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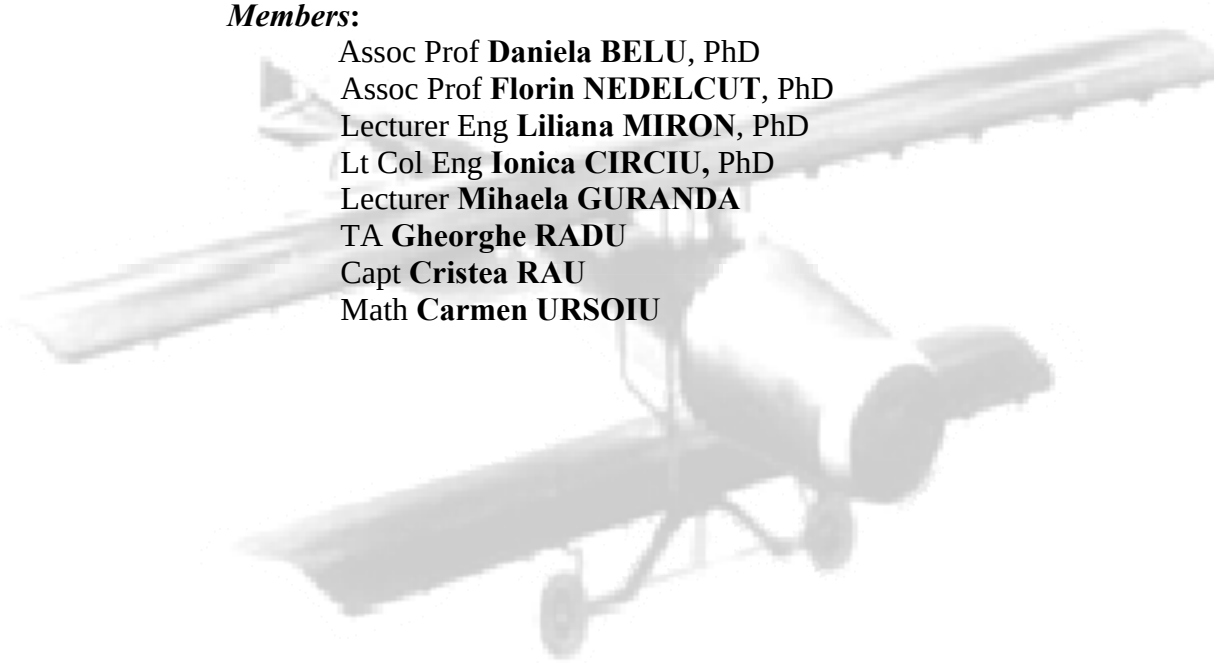

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GLOBALIZATION. SECURITY CRISES

Iustin ACHIRECESEI, Vasile NODIŞ

Introduction

This report examines the implications of this strategy in recent years; following the emergence of a New Cold War, as well as analyzing the war in Georgia, the attempts and methods of regime change in Iran, , the expansion of he Afghan-Pakistan war theatre, and spread of conflict in Central Africa. These processes of a New Cold War and major regional wars and conflicts take the world closer to a New World War.

Peace is only be possible if the tools and engines of empires are dismantled.

Eastern Europe: Forefront of the New Cold War

In 2002, the Guardian reported that, "The US military build-up in the former Soviet republics of central Asia is raising fears in Moscow that Washington is exploiting the Afghan war to establish a permanent, armed foothold in the region.

In 2004, it was reported that US strategy "is to position U.S. forces along an "arc of instability" that runs through the Caribbean, Africa, the Middle East, the Caucasus, Central Asia and southern Asia. It is in these parts of the world -generally poor, insular and unstable --that military planners see the major future threats to U.S. interests.

In 2005, it was reported that talks had been going on between the US and Poland since 2002, along with various other countries, over the possibility of setting up a European base to intercept long-range missiles. It was further reported that, such a base would not have been conceivable before Poland joined Nato in 1999.

In November of 2007 it was reported that, Russia threatened to site short-range nuclear missiles in a second location on the European Union's border yesterday if the United States refuses to abandon plans to erect a missile defence shield. A senior Russian army general said that Iskander missiles could be deployed in Belarus if US proposals to place 10 interceptor missiles and a radar in Poland and the Czech Republic go ahead. Putin also threatened to retrain Russia's nuclear arsenal on targets within Europe. However, Washington claims that the shield is aimed not at Russia but at states such as Iran which it accuses of seeking to develop nuclear weapons that could one day strike the West.

This is a patently absurd claim, as in May 2009, Russian and American scientists released a report saying "that it would take Iran at least another six to eight years to produce a missile with enough range to reach Southern Europe and that only illicit foreign assistance or a concerted and highly visible, decade-long effort might produce the breakthroughs needed for a nuclear-tipped missile to threaten the United States." Even in December of 2007, the National Intelligence Estimate (NIE) released by all 16 US intelligence agencies reported that, "Iran halted its nuclear weapons program in 2003 and that the program remains frozen."

Russia has concerns not only about missile interceptors in Poland, which it claims are aimed at Russia, but is also concerned

about an advanced missile-tracking radar that the Pentagon wants to place in the Czech Republic. Further, in 2007, the Guardian reported that, Russia is preparing its own military response to the US's controversial plans to build a new missile defence system in eastern Europe, according to Kremlin officials,in a move likely to increase fears of a cold war-style arms race. A Kremlin spokesman said of the Polish missile defenses and the Czech radar system, that, "We were extremely concerned and disappointed.We were never informed in advance about these plans. It brings tremendous change to the strategic balance in Europe, and to the world's strategic stability."

In May of 2008, it was reported that, "President Dmitri A. Medvedev of Russia and President Hu Jintao of China met ... to conclude a deal on nuclear cooperation and together condemn American proposals for a missile shield in Europe. Both countries called the plan a setback to international trust that was likely to upset the balance of power.

In July of 2008, the Russian Foreign Ministry said that it "will be forced to make a military response if the U.S.-Czech missile defense agreement is ratified," and that, "we will be forced to react not with diplomatic, but with military-technical methods." In August of 2008, the US and Poland reached a deal "to place an American missile defense base on Polish territory. Russia responded by "saying that the move would worsen relations with the United States."

Russia further said "the US had shown that Russia was the true target of the defensive shield, as tension between the two powers continued to rise over the conflict in Georgia." The Deputy Head of Russia's general staff "warned that Poland was making itself a target for Russia's military."

It was further reported that, "General Anatoly Nogovitsyn said that any new US assets in Europe could come under Russian nuclear attack with his forces targeting 'the allies of countries having nuclear weapons'," and that,"Such targets are destroyed as a first priority."

In April of 2009, Obama said, "that the U.S. missile defense system in the Czech Republic and Poland will go forward." In May of 2009, Russia said that it "could deploy its latest Iskander missiles close to Poland if plans to install U.S. Patriots on Polish soil go ahead."In July of 2009, Russian President Medvedev said that, "Russia will still deploy missiles near Poland if the US pushes ahead with a missile shield in Eastern Europe."

Iran and the China-Russia Alliance

The Bush regime used hostile rhetoric against Iran, threatening possible war against the country. However, Iran will not be in any way similar to the military adventurism seen in Iraq. A war against Iran will bring China and Russia to war with the west. Chinese and Russian investments with Iran, both in terms of military cooperation as well as nuclear proliferation and energy ties, have driven the interests of Iran together with those of China and Russia.

In 2007, both Russia and China warned against any attack on Iran by the west. From 2004 onwards, China became Iran's top oil export market, and Iran is China's third largest supplier of oil, following Angola and Saudi Arabia. China and Iran signed a gas deal in 2008 worth 100 billion dollars. Further, Beijing is helping Tehran to build dams, shipyards and many other projects. More than 100 Chinese state companies are operating in Iran to develop ports and airports in the major Iranian cities, mine-development projects and oil and gas infrastructures. Also, China, Iran and Russia maintain identical foreign policy positions regarding Taiwan and Chechnya, which only further strengthens their alliance.

In August of 2008, a senior Iranian defense official warned that any attack against Iran would trigger a world war In February of 2009, Iran and Russia announced that, "Iran and Russia are to boost military cooperation." Russia has also been selling arms and advanced weapons systems to both Iran and Venezuela.In 2008, OPEC warned against an attack on Iran, saying that, "oil prices would see an 'unlimited' increase in the case of a

military conflict involving Iran, because the group's members would be unable to make up the lost production."

The Georgian War: Spreading Conflict in the Caucasus

After the break-up of the Soviet Union in 1991, Georgia's northern province of South Ossetia declared independence but failed to be internationally recognized. South Ossetia as well as Georgia's other largely autonomous province, Abkhazia, had traditionally been allied with Russia. There had been long-standing tensions between South Ossetia and Georgia and a shaky ceasefire.

On August 1, 2008, six people were killed in South Ossetia when fighting broke out between Georgian and South Ossetian forces. Both sides blamed each other for opening fire first, with Russian peacekeepers blaming Georgia and the Georgians blaming Russian peacekeepers.

On August 5, Russia announced that it would "defend its citizens living in the conflict zone" if a conflict were to erupt in Georgia, and the South Ossetian President said Georgia was "attempting to spark a full-scale war."

Further, South Ossetian children were being evacuated out of the conflict zone, an act that was "condemned" by Georgia, saying that the separatists were "using their youngsters as political propaganda."

On August 7, a ceasefire was announced between Georgia and South Ossetia, with Russia acting as a mediator between the two. On the night of August 7, five hours after the declared ceasefire, Georgian President Mikheil Saakashvili began a military operation against the capital city of South Ossetia, Tskhinvali. The Georgian attack targeted hospitals, the university and left the city without food, water, electricity and gas.

Georgian forces surrounded the city and their troops and tanks continued to assault the civilian targets. On the 8th of August, Russia called for an end to the military offensive. Reportedly, 2,000 civilians were killed by this point in South Ossetia, so Russia sent troops into the area. Russian Prime Minister Putin referred to Georgian actions as "genocide" and Russia also reportedly bombed a Georgian town. Immediately, the US called for "an
end to the Russian bombings." The Georgian President called it an "unprovoked brutal Russian invasion." Much of Tskhinvali was left in ruins after the Georgian offensive, with 34,000 South Ossetian refugees in Russia. Georgia, which had 2,000 troops deployed in Iraq, announced on August 9th that they would be pulling 1,000 troops out of Iraq to be deployed into South Ossetia, with the US providing the transportation for Georgian troops to get back to Georgia. However, the Russian advance pushed the Georgian troops back, recapturing
the city and damaging much of Georgia's military infrastructure. The Russian troops also entered the other breakaway province of Abkhazia and even occupied the Georgian city of Gori.

On August 12, the Russians announced an end to their military operations in Georgia and on August 13th, the last remaining Georgian troops pulled out of South Ossetia.

However, there is much more to this story than simply a conflict between a small Central Asian nation and Russia. It is important to remember the role played by American NGOs in putting the Georgian President Mikhail Saakashvili into power through the Rose Revolution in 2003.

The US then developed closer ties with Georgia. Even before the Rose Revolution, in 2002, US military advisers were in Georgia in an effort to open up a "new front" in the war on terror, with Americans there to "train the Georgian army in how to counter militant activity." Also in 2002, hundreds of US Green Berets and 200 Special Forces arrived in Georgia to train Georgian forces "for anti-terrorism and counterinsurgency operations." Russia warned against US involvement in Georgia, saying that it could "complicate" the situation.

US and Georgian troops even conducted war games and military exercises together. In July of 2008, it was reported that 1,000 US troops in Georgia began a military training exercise with Georgian troops called "Immediate Response 2008." The same report stated that "Georgia and the Pentagon [cooperated] closely." The training exercise came amidst growing tensions between Russia and Georgia, while the US was simultaneously supporting Georgia's bid to become a NATO member.

Further, 1,200 US servicemen and 800 Georgians were to train for three weeks at a military base near the Georgian capital of Tbilisi.The exercise was being run in cooperation with NATO and was preceded by a visit to Georgia by US Secretary of State Condoleezza Rice, where she met with the President and stated that, "the future of Georgia is in NATO."

However, these exercises and increased military cooperation between the US and Georgia did not go unnoticed by Russia, which simultaneously began military exercises on the other side of the Caucasus mountains, involving up to 8,000 Russian servicemen. Clearly, Russia itself was aware of the potential for a military conflict in the region.

When the conflict with Russia began, there were US military instructors in Georgia, and Russia's envoy to NATO also accused NATO of encouraging Georgia to take the offensive against South Ossetia. The US was not the only western nation to aid Georgia, as the unofficial NATO member, Israel, also played a part in arming Georgia. The Georgian tanks and artillery that captured the South Ossetian capital were aided by Israeli military advisers. Further, for up to a year leading up to the conflict, the Georgian President had commissioned upwards of 1,000 military advisers from private Israeli security firms to train the Georgian armed forces, as well as offer instruction on military intelligence and security. Georgia also purchased military equipment from Israel.

The War in Georgia was designed to escalate tensions between NATO and Russia, using the region as a means to create a wider conflict. However, Russia's decision to end the combat operations quickly worked to its benefit and had the effect of diminishing the international tensions. The issue of NATO membership for Georgia is very important, because had it been a NATO member, the Russian attack on Georgia would have been viewed as an attack on all NATO members. The war in Afghanistan was launched by NATO on the premises of 'an attack against one is an attack against all.

It also was significant that there was a large pipeline deal in the works, with Georgia sitting in a key strategic position. Georgia lies between Russia and Turkey, between the Caspian Sea and the Black Sea, and above Iran and Iraq. The significance of Georgia as a strategic outpost cannot be underestimated. This is true, particularly when it comes to pipelines.

The Baku Tblisi Ceyhan (BTC) Pipeline, the second largest pipeline in the world, travels from Baku, the capital of Azerbaijan, through Tbilisi, the capital of Georgia, to Ceyhan, a Mediterranean port city in Turkey. This pipeline creates a route that bypasses both Iran and Russia, to bring Caspian Basin oil resources "to the United States, Israel and Western European markets." The US company Bechtel, was the main contractor for construction,
procurement and engineering, while British Petroleum (BP), is the leading shareholder in the project. Israel gets much of its oil via Turkey through the BTC pipeline route, which likely played a large part in Israel's support for Georgia in the conflict,as a continual standoff between the West and the East

(Russia/China) takes place for control of the world's resources.

Zbigniew Brzezinski, co-founder, with David Rockefeller, of the Trilateral Commission, and Jimmy Carter's National Security Adviser who played a key role in the creation of the Afghan Mujahideen, which became known as Al-Qaeda, wrote an op-ed for Time Magazine at the outbreak of the Russia-Georgia conflict. Brzezinski, being a Cold War kingpin of geopolitical strategy, naturally blamed Russia for the conflict. However, he also revealed the true nature of the conflict. He started by blaming Russia's "invasion of Georgia" on its "imperial aims." Brzezinski blamed much of this on the "intense nationalistic mood that now permeates Russia's political elite." Brzezinski went on to explain Georgia's strategic significance; stating that, "an independent Georgia is critical to the international flow of oil," since the BTC pipeline "provides the West access to the energy resources of central Asia." Brzezinski warned Russia of being "ostracized internationally," in particular its business elite, calling them "vulnerable" because "Russia's powerful oligarchs have hundreds of billions of dollars in Western bank accounts," which would be subject to a possible "freezing" by the West in the event of a "Cold War-style standoff."

The West Sponsors Terrorists in Iran

In 2005, Scott Ritter, former UN weapons inspector, reported that, "the Mujahadeen el-Khalq, or MEK, an Iranian opposition group, once run by Saddam Hussein's dreaded intelligence services," was now working for the CIA in terror bombings inside Iran. In February of 2007, the Telegraph reported that, "America is secretly funding militant ethnic separatist groups in Iran in an attempt to pile pressure on the Islamic regime to give up its nuclear programme."

The CIA operations "involve dealing with movements that resort to terrorist methods," and the article noted that, "there has been a wave of unrest in ethnic minority border areas of Iran, with bombing and assassination campaigns against soldiers and government officials," and interestingly, the CIA operations are focused on "helping opposition militias among the numerous ethnic minority groups clustered in Iran's border regions." A former State Department counter-terrorism agent was quoted as saying, "The latest attacks inside Iran fall in line with US efforts to supply and train Iran's ethnic minorities to destabilise the Iranian regime."

ABC News reported in April of 2007 that, "A Pakistani tribal militant group responsible for a series of deadly guerrilla raids inside Iran has been secretly encouraged and advised by American officials since 2005." The group, named Jundullah, operates out of the Baluchistan province in Pakistan, on the boarder of Iran, and "has taken responsibility for the deaths and kidnappings of more than a dozen Iranian soldiers and officials."

In 2008, Pakistan's former Army Chief said that, "the US is supporting the outlawed Jundullah group to destabilize Iran," and that, "the US is providing training facilities to Jundullah fighters--located in eastern areas of Iran--to create unrest in the area and affect the cordial ties between Iran and its neighbor Pakistan."

The Afghanistan-Pakistan War Theatre

Within days of getting into office, President Obama authorized a missile strike in Pakistan, which killed several civilians. Obama continued with this strategy, after

Bush, in July of 2008, “authorized the C.I.A. and the Joint Special Operations Command to make ground incursions into Pakistan.” This was to set the pace for US strategy in the region, particularly in relation to Afghanistan and Pakistan.

In late March, Obama announced his plan for a new Afghanistan and Pakistan strategy, which are to be a combined strategy. As part of the strategy, known as the AfPak strategy, “More U.S. troops, civilian officials and money will be needed,” and “Obama pledged to tighten U.S. focus on Pakistan.” Further, Obama announced in late March that, “he would send 4,000 U.S. troops -- beyond the additional 17,000 he authorized” in February,

“to work as trainers and advisers to the Afghan army, and hundreds more civilian officials and diplomats to help improve governance and the country's economy,” bringing the total number of US troops up to 60,000.

In May, a major event took place in military circles, as one of the few times in over 50 years an American wartime general was fired in the field. In May of 2009, Defense Secretary Robert Gates fired the top general in Afghanistan saying that what was needed was “fresh thinking” and “fresh eyes” on Afghanistan. Gates “recommended that President Obama replace McKiernan with a veteran Special Operations commander, Lt. Gen. Stanley A. McChrystal.” As the Washington Post reported, McKiernan, the general whom Gates fired, “was viewed as somewhat cautious and conventionally minded.” Could it be that McKiernan did not see the AfPak strategy as a viable option; that it went against “caution”?

His replacement, General McChrystal, was “the director of the Pentagon's Joint Staff. From 2006 to August 2008, he was the forward commander of the U.S. military's secretive Joint Special Operations Command, responsible for capturing or killing high-level leaders of the Sunni insurgent group al-Qaeda in Iraq.” One expert summed up the new General as such: “McChrystal kills people.” One senior military official at the Pentagon asked; “what message are we sending when our high-value-target hunter is sent to lead in Afghanistan?”

However, there is another twist to this story. As Pulitzer Prize winning journalist, Seymour Hersh revealed,Cheney created a special unit called the Joint Special Operations Command (JSOC), which was to carry out high-level assassinations. This unit was kept a secret for many years, and Hersh referred to it as an “Executive assassination ring.” Hersh reported that they carried out many assassinations, “not just in Iraq and Afghanistan,

it's in a lot of other countries, in the Middle East and in South Asia and North Africa and even central America.”

The new General of the AfPak war theatre, Stanley McChrystal, used to run Cheney’s assassination squad.

At the end of November 2009, Obama announced a surge of an additional 30,000 troops to Afghanistan, “bringing the total American force to about 100,000.”[115] Further, in early December, it was reported that Obama “authorized an expansion of the C.I.A.’s drone program in Pakistan’s lawless tribal areas, officials said this week, to parallel the president’s decision, announced Tuesday, to send 30,000 more troops to Afghanistan.”

Clearly, the Afghanistan-Pakistan strategy will only further inflame the region in conflict and turmoil. Expanding the Afghan war into Pakistan is akin to playing with matches around a stick of dynamite. Perhaps this was the clarity of the previous general, McKiernan, in seeing this strategic insanity, and thus, the reason for his removal.

The destabilization of this region threatens all of the neighboring countries, including India, China, Russia,Turkey and Iran. The possibility of creating a much wider war in the region, and even between the greatpowers, is ever increasing.

Conclusion

The continuation of the Cold War stances of the West versus the East remain and are exacerbated, in what can be referred to as a “New Cold War.” At the same time, global regional conflicts continue to be waged and

expanded, be it in the Middle East, Central Africa or Central Asia, with coups and regime change being furthered in Eastern Europe, South America and across the globe. However, these two major global issues: regional wars
and conflict and the New Cold War, are not separate, but inherently linked. An exacerbation of conflict, in any and all regions, will only serve to strengthen the political-strategic conflict between the US-NATO alliance and the Russia-China alliance.

All that is required for a new major world war is just one spark: whether it comes in the form of a war between Pakistan and India, or a military strike on Iran, in which case China and Russia would not sit idly by as they did with Iraq. A strike on Iran, particularly with nuclear missiles, as is proposed, would result in World War III. So why does strategy on the part of the US and NATO continue to push in this direction?
As George Orwell once wrote:

The war is not meant to be won, it is meant to be continuous. Hierarchical society is only possible on the basis of poverty and ignorance. This new version is the past and no different past can ever have existed. In principle the war effort is always planned to keep society on the brink of starvation. The war is waged by the ruling group against its own subjects and its object is not the victory over either Eurasia or East Asia, but to keep the very structure of society intact.

A New World War would be a global war waged by a global ruling class against the citizens of the world, with the aim of maintaining and reshaping hierarchical society to serve their own interests. It would indeed symbolize a New World War for a New World Order. In a globalized world, all conflict has global implications; the task at hand is whether the people can realize that war is not waged against a "distant" or "foreign" enemy, but against
all people of the world.

Herman Goering, Hitler's second in command, explained the concept of war when he was standing trial at the Nuremberg Trials for war crimes, when he stated, "Why, of course, the people don't want war," and that, "Naturally, the common people don't want war; neither in Russia nor in England nor in America, nor for that matter in Germany. That is understood. But, after all, it is the leaders of the country who determine the policy and it is always a simple matter to drag the people along, whether it is a democracy or a fascist dictatorship or
a Parliament or a Communist dictatorship." When Goering was corrected that in a democracy, "the people have some say in the matter through their elected representatives," Goering responded:

Oh, that is all well and good, but, voice or no voice, the people can always be brought to the bidding of the leaders. That is easy. All you have to do is tell them they are being attacked and denounce the pacifists for lack of patriotism and exposing the country to danger. It works the same way in any country.

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CONSIDERATIONS IN ROMANIA FOR ESTIMATING POTENTIAL GDP

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Abstract. *In this paper we present the methodology used for estimating NAIRU using filters and we also consider the posibility of a convex Phillips curve that captures an asymmetric relationship between inflation and unemployment and discuss some problems of estimates. Asymetry in Phillips curve (which is represented by the convexity of the curve) means that high unemployment has relatively limited effects in pulling inflation down, whereas low unemployment can be much more effective.*

Keywords: *output gap, Kalman filter, NAIRU, asymmetric Phillips curve*

Clasificare JEL: *JEL*: C02, C51, C24, E24, E20

Clasificare REL: 8E

1. Introduction

There is no consensus among economists about the precise sharp of the Phillips curve as studies on US data lead to different results:

- convex sharp: Turner (1995); Clark et al. (1996); Debelle and Laxton, (1997);
- concave sharp: Eisner (1997) and Stiglitz (1997);
- linear: Gordon (1997).

The difference of opinion on the empirical evidence may imply high costs regarding economical results of political decisions.

The meaning of asymmetry is that the response of unemployment to output growth is different when the economy is expanding from that when the economy is contracting. The conventional specification, which encompasses symmetry, would let us believe that expansions and contractions in output have the same absolute effect on unemployment. This focus came at a time when economists started to be interested in asymmetry in business cycles in general, an idea that can be traced back to Keynes (1936), who suggested that downturns may be sharper than upturns.

Asymmetry in Okun's law is related to asymmetry in the Phillips curve, because the latter is a combination of Okun's relationship and the aggregate supply curve. While asymmetry in Okun's law means that downturns in the economy are more rapid and sustained in driving unemployment up than recoveries in bringing it down, asymmetry in the Phillips curve (which is represented by the convexity of the curve) means that high unemployment has relatively limited effect in pulling inflation down, whereas low unemployment can be much more effective. In other words, the Phillips curve is asymmetric if unemployment below NAIRU tends to result in increasing and eventually explosive inflation, whereas excess unemployment will

have a diminishing effect, tailing away into insignificance.

2 Mehodology for NAIRU estimation using filters

HP filter for NAIRU

The statistical approach can be unifactorial or multifactorial. For a unifactorial approach we can use Hodrick-Prescott (HP) filter. In order to use this method to determine the unemployment deviation we first have to determine the long term trend component of unemployment U_t^* by minimising the problem defined in ecuation (5):

$$\underset{U_t^*}{\text{Min}} \left\{ \sum_{t=1}^{T} (U_t - U_t^*)^2 + \lambda \sum_{t=2}^{T-1} (\Delta U_{t+1}^* - \Delta U_t^*)^2 \right\} \quad (5)$$

The adjustment of trend component depends on the selection of parameter λ .

In general, U_t^* determined by this approach is known as an estimate of NAIRU because it does not explicitly incorporate information on the structural variables that determine the natural rate of unemployment.

Empirical analysis revealed that the NAIRU obtained with HP filter (based only on current unemployment) is significantly correlated with changes in inflation, suggesting that even this simple approach leads to significant results.

A possible disadvantage of the HP approach is that estimates the deviation of unemployment, without appealing to information about inflation. Multifactorial statistical approach such as Kalman filter has the advantage that estimates NAIRU (or potential output) as variable in time, in close correlation with the Phillips curve. The reason for using multifactorial techniques is that it employs more information in determining the NAIRU and potential output.

Kalman filter for determining the NAIRU

Below we present the method for determining the Kalman filter NAIRU:

$$\Delta\pi_t = \alpha(L)\Delta\pi_{t-1} - \theta(U_t - U_t^*) - \gamma(L)\Delta U_t + \xi_t \qquad \xi_t \sim N(0, H)$$

$$U_t^* = U_{t-1}^* + \eta_t \qquad \eta_t \sim N(0, Q) \text{ and } \text{cov}(\xi_t, \eta_t) = 0$$

where: Δ is the first difference operator, π_t is the annual inflation rate, U_t is the unemployment rate, U_t^* is NAIRU, η_t and ξ_t are the error termns.

Equation (2) is the generalised Phillips curve. Expectations are implicitely assumed in inflation dymanics. The second equation (3) specifies NAIRU, U_t^*, as a random walk process and the unknown terms are θ si U^*.

From equation (2) conclude that inflation increases when unemployment falls below NAIRU, influenced by additional effects from the unemployment rate changes due to past changes of inflation.

There are two sources of change in inflation in this model. The first source can be an inflationary shock due to exogenous events. The second can be the change of NAIRU itself. Kalman filter extracts the noise signal (the observed changes in inflation and unemployment) providing an estimate of the NAIRU.

Since the NAIRU is determined by structural factors that evolve gradually over time, some restrictions on the variation of the error terms (Q and H) are required, which are considered in the context of Kalman filter method. For simplicity, usually in practice, H is normalized to unity, leaving Q which is restricted (Gordon 1997).

Univariate Kalman Filter

The output equation is:

$$y_t = za_t + e_t$$

$$e_t \sim N(0, H)$$

where y_t is the observable output variable, a_t is the unobservable state variable.

$$a_t = Ta_{t-1} + u_t$$

$$u_t \sim N(0, Q)$$

The matrix H and Q are matrix of variations for the observable and unobservable variables. The error terms e_t and u_t sare assumed to be serially independent.

The model for estimating the output deviation is:

- actual output identity:

$$y_t = y_t^* + gap_t \quad (4)$$

- potential output equation:

$$y_t^* = y_{t-1}^* + \eta_t \quad (5)$$

Output gap equation:

$$gap_t = \phi_1 gap_{t-1} + \varepsilon_t \quad (6)$$

y_t is the log of real GDP, seasonally adjusted, y_t^* is the output potential, gap_t is the output gap, η_t and ε_t represents shocks that are assumed to be independent and identically distributed (iid) with average zero and constant variation.

Equation (4) is an identity that shows the actual output as the sum of potential output and output gap. Equation (5) represents the potential output as a random walk process. Equation (6) defines the output gap as a AR(1) process.

We consider the dynamic system:

$$x_t = Za_t + e_t$$

$$a_t = Ta_{t-1} + u_t$$

in which we assume the observable output vector x_t observabil and the unobservable state vector a_t . We can rewrite equations (4) and (6) as:

$$[y_t] = [1 \quad 1]\begin{bmatrix} y_t^* \\ gap_t \end{bmatrix}$$

$$\begin{bmatrix} y_t^* \\ gap_t \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & \phi \end{bmatrix}\begin{bmatrix} y_{t-1}^* \\ gap_{t-1} \end{bmatrix} + \begin{bmatrix} \eta_t \\ \varepsilon_t \end{bmatrix}$$

where:

$x_t = [y_t]$, $Z = [1 \quad 1]$, $a_t = \begin{bmatrix} y_t^* \\ gap_t \end{bmatrix}$, $T = \begin{bmatrix} 1 & 0 \\ 0 & \phi \end{bmatrix}$ and $u_t = \begin{bmatrix} \eta_t \\ \varepsilon_t \end{bmatrix}$.

We can estimate the system using Kalman filter with the maximum likelihood method.

3. Estimating output gap using production function method

Production function method is a standard multivariate method used for estimating potential output as a function of total factor productivity, capital and labor, all employed at their potential level.

Unlike HP filter, the production function method has the main advantage of providing usefull information regarding input

contribution to potential output but the estimates depend on the techniques employed for input smoothening and requires longer time series.

For estimating potential output and output gap we consider the following Cobb-Douglas production function with constant returns to scale:

$$Y_t = A_t (K_t)^{\alpha} (L_t)^{1-\alpha}$$

(3)

where Y_t represents real output, $A_t = e^{\delta+\eta t+\varepsilon_{yt}} = A_0 e^{\eta t+\varepsilon_{yt}}$ is total factor productivity (TFP), K_t represents capital stock, L_t is labor force, α and $(1-\alpha)$ represents capital and labor contributions to output[1].

Liniarizing (3) yields:

$$\ln Y_t = \ln A_t + \alpha \ln K_t + (1-\alpha) L_t$$

(4)

For a given α, the log value of total factor productivity $(tfp_t = \ln A_t)$ is derived from:

$$tfp_t = y_t - [\alpha k_t + (1-\alpha) l_t] = a + \beta t + \varepsilon_{y_t}$$

(5)

in which small letters denote log values for Y, K, L and $a = \ln A_0$.

The production function for potential output is:

$$Y_t^{pot} = A_t^{pot} \left(K_t^{pot}\right)^{\alpha} \left(L_t^{pot}\right)^{1-\alpha}$$

(6)

where $A_t^{pot} = e^{\gamma+\theta t} = e^{\gamma} e^{\theta t} = A e^{\theta t}$ represents the HP filtered total factor productivity and $K_t^{pot} = K_t c_t^{NAICU}$ is the potential capital stock corresponding to the capacity utilization rate that does not accelerate inflation (NAICU- Non Accelerating Inflation Capacity Utilization Rate) that is derived by HP filtering capital stock.

For potential labor we employ the equation that was proposed by Giorno etal (1995):

$$L_t^{pot} = L_t^S \left(1 - u_t^{NAWRU}\right)$$

(7)

where L_t^S represents civil active population at time t filtered with HP filter and u_t^{NAWRU} is the unemployment NAWRU rate (Non Accelerating Wage Inflation Rate of Unemployment) that is also HP filtered. Therefore, L_t^{pot} corresponds to the number of people that could be employed if the unemployment rate would equal its natural rate given by NAWRU.

Considering the above mentioned notations, potential output can be written as:

$$Y_t^{pot} = A e^{\theta t} \left(K_t^{NAICU}\right)^{\alpha} \left(L_t^S \left(1 - u_t^{NAWRU}\right)\right)^{1-\alpha}$$

(8)

and the output gap is defined as the difference between real output and its potential divided by potential output:

$$output \quad gap\_FP = \frac{Y_t - Y_t^{pot}}{Y_t^{pot}} * 100$$

(9)

The output gap can take positive values (when real output>potential output) and in this case the aggregate demand growth exceedes the aggregate suply growth. This could lead to inflation, thus we call it inflationary gap. If output gap values are negative, then we have a recessionary gap that could lead to deflation.

For estimating potential GDP and output gap we used STATA. Total factor productivity was calculated based on the value 0.65 for labor contribution to output acoording to the estimations provided by Dobrescu (2006: pp. 71).

The production function is:

$$Y_t = 1.97 e^{0.02t} (K_t)^{0.35} (L_t)^{0.65}$$

(13)

and potential output is calculated with:

$$Y_t^{pot} = 1.97 e^{0.02t} \left(K_t^{NAICU}\right)^{0.35} \left(L_t^S \left(1 - u_t^{NAWRU}\right)\right)^{0.65}$$

(14)

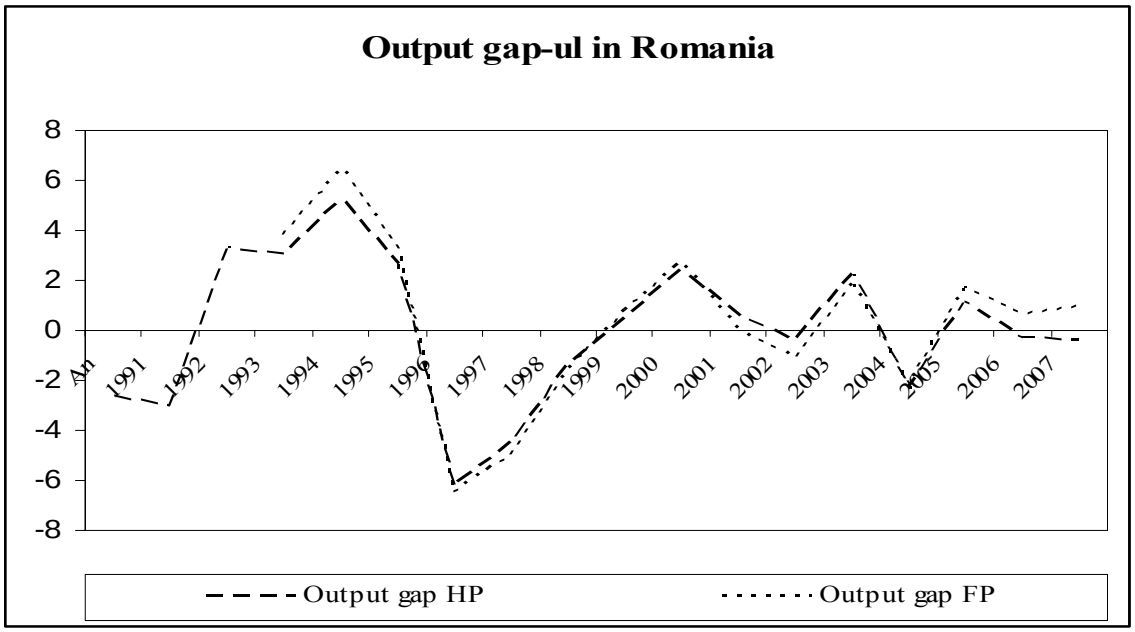

Figure. 1. Output gap with HP filter and production function method

In this paper we were interested in estimating potential output and output gap in Romania between 1991-2008 using an univariate method- HP filter and a multivariate method- the production function method. The production function is Cob-Douglas type and potential labor is determined based on NAWRU that is obtained with the method suggested by Elmeskov (1993).

Both methods provide similar results indicating variations within the range of -0.36% and 2% for potential output between 1994-2000 but beginning 2001 it will start to increase towards 5%-6.7%, between 2004-2008.

As for the evolution of output gap, we notice the existence of stronger gaps for the first years (expansionary between 1993-1996 and recessionis between 1997-1999) that are decreasing starting 1999 varying between -2.3% and +2.7% in 1999-2008.

3. The asymmetry of Phillips curves

The convex shape Phillips curve in terms of unemployment means that as the unemployment falls below its sustainable level, the upward pressure of inflation rises increasingly, on the margin. In this case, it is proven that the stabilization policies matters.

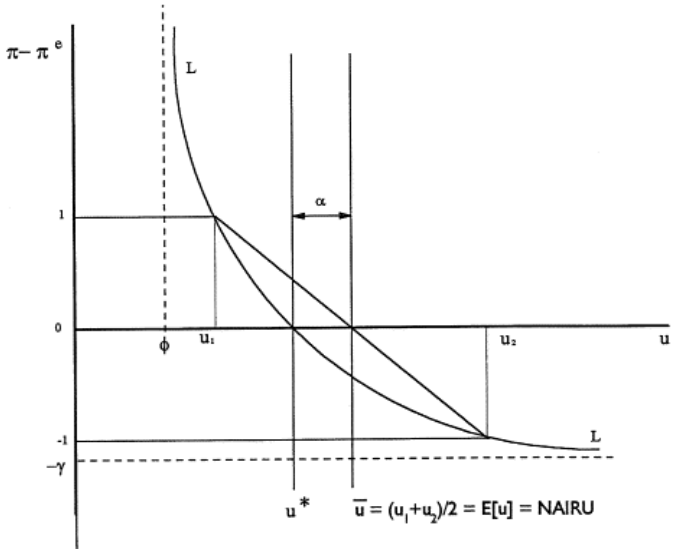

Figure 2: The implications of convexity on Phillips curve

In figure 2, the vertical axis shows the inflation, the horizontal axis shows the role of unemployment, *u*. Convexity means that the cyclical trade-off between inflation and unemployment worse on the margin as the latter is pushed below the point u^* where u^* is the deterministic NAIRU or DNAIRU.

DNAIRU is the level of *u* at which there is no systematic pressure for inflation to rise or fall, relative to expectations, in absence of shocks (hence deterministic).

$\bar{u}$ is average level of *u*, called "*the natural rate*", it is consistent with expectation equilibrium, usually named NAIRU, or the stochastic equilibrium rate. NAIRU is the level of *u* where there will be no acceleration (or deceleration) of inflation in the stochastic setting.

$$\bar{u};\ E[u] = \frac{1}{2}(u_1 + u_2) \tag{7}$$

α is the difference between the NAIRU and the DNAIRU. The size of α depends on the degree of convexity and the dispersion of *u*. In the convex case, the stabilisation policy has effects because could reduce the variability of *u* and lower its mean value.

The convex Phillips curve proposed by *Debelle and Laxton (1997), Laxton ed al (2000) is:*

$$\pi_t = \lambda \bar{\pi}_t^e + (1-\lambda)\pi_{t-1} + \gamma(u_t^* - u_t)/(u_t - \phi_t) + \varepsilon_t^{\pi} \tag{8}$$

where:

u^*_t is the DNAIRU;

$$\bar{\pi}_t^e = \left(\sum_{i=0}^{12} \pi_{t-i}^e\right)/12 \tag{9}$$

π^e_j is the one-year-ahead expectation of inflation, held at *j*.

Parameter ϕ defines a lower bound on *u*, reflecting short-run constraints on how far rising aggregate demand can lower unemployment before capacity constraints become absolutely binding and inflationary pressure becomes unbounded. One can allow ϕ being time-varying:

$$\phi_t = MAX(0, \bar{u}_t - 4) \tag{10}$$

where $\bar{u}_t$ is a measure of trend unemployment..

ϕ_t is constrained to be zero when the trend unemployment rate is at or below 4%.

Using data from different articles: Cornelia Scutaru, Cristian Stanica (2004); Ciprian Turtureanu (2007); Elisabeta Jaba et al (2008) and from www.insse.ro , as well, we obtained the following (*Debelle and Laxton (1997), Laxton ed al (2000)* estimated function:

Estimated convex Phillips curve for Romania

$$\pi_t = 0{,}305679\bar{\pi}_t^e - 0{,}203130\pi_{t-1} - 79{,}7840(u_t^* - u_t)/(u_t - \phi_t) + \varepsilon_t \tag{11}$$

Hyeon-seung Huh (2002) considers a standard Phillips curve augmented with an LSTAR (Logistic Smooth Transition Autoregression) component:

$$\Delta\pi_t = \sum_{i=1}^{p}\theta_i\Delta\pi_{t-i} + \sum_{i=1}^{q}\eta_i\Delta u_{t-j} + \left[\sum_{i=1}^{p}\theta^*{}_i\Delta\pi_{t-i} + \sum_{i=1}^{q}\eta^*{}_i\Delta u_{t-j}\right]F(z_{t-k}) + \varepsilon_t \tag{12}$$

where:

Δ is the first order difference operator, $\pi_t = 1/4\ln(CPI_t / CPI_{t-1})$ is a quarterly inflation at an annual rate; u_t is the unemployment rate, and ε_t is a disturbance term.

The logistic function is assumed to have the following form:

$$F(z_{t-k}) = (1 + \exp(-\lambda(z_{t-k} - c)/\sigma_z))^{-1} \tag{13}$$

where $F(z_{t-k})$ lies in the range between 0 and 1. The variable z_{t-k} is switching indicator that represents the state of the economy, and the parameter ***c*** represents the threshold around

which the dynamics of the model change. The parameter λ is the smoothness parameter measuring how rapidly the transition between the regimes is processed. The parameter σ_t is the standard deviation of switching variable z_{t-k}.

For estimation we used the function:

$$\Delta\pi_t = \theta_1\Delta\pi_{t-1} + \theta_2\Delta\pi_{t-2} + \eta_1\Delta u_{t-1} + \mu_2\Delta u_{t-2} + (\alpha_1\Delta\pi_{t-1} + \alpha_2\pi_{t-2})(1 + \\ + \exp(-\lambda\bar{u}_t / 2{,}305)))^{-1} + \varepsilon_t \quad (14)$$

where $\bar{u}_t$ is NAIRU trend, $\sigma_u = 2{,}305$ is standard deviation of $\bar{u}_t$, π_t and u_t having the signification above.

The estimated Phillips curve in that case is:

$$\Delta\pi_t = 0{,}329409\Delta\pi_{t-1} - 0.465129\Delta\pi_{t-2} + (0{,}036110\Delta\pi_{t-1} - 0{,}121287\pi_{t-2})(1 + \\ + \exp(-0.932652\bar{u}_t / 2{,}305)))^{-1} + \varepsilon_t \quad (15)$$

Conclusions:

The first objective of this paper was to produce an estimate for potential output and output gap in Romania between 1991-2008 using a multivariate method- the production function method. The production function is Cob-Douglas type and potential labor is determined based on NAWRU that is obtained with the method suggested by Elmeskov (1993).

For the evolution of output gap, we notice the existence of stronger gaps for the first years (expansionary between 1993-1996 and recessionis between 1997-1999) that are decreasing starting 1999 varying between -2.3% and +2.7% in 1999-2008.

The second objective was to estimate a Phillips curve for Romania. Since the linear function did not produce a good estimate for Phillips curve, we used an assymetric analitical form of Phillips curve. We preffered the assymetric form because it yields better estimations and there were theoretical and empirical evidence that suggests nonlinearities in the Phillips curve also apply for Romanian data. We intend to use the estimated assymetric function for determining the optimal monetary policy rule.

[1] Assuming that the price of capital reflects its marginal productivity and wages reflect labor marginal productivity.

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ADVANTAGES OF THE NEW ROMANIAN ECONOMIC SPACE. DEVELOPMENTS OF THE ROMANIAN ECONOMIC DIMENSION ON NATIONAL SECURITY

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Preface
The new Romanian economic area integrates external Romanian potential and provides highly evolved component of action in the spirit of Romanian values and efficient use of our resources.
The new work approach requires adapting political view by changing the economic legislation environment and by setting up flexible laws; therefore, changing the legislative system.
Change of attitude implies political change, then legislative change, followed by the change within economic field. We develop much pressure for dynamic change and acceptance of early development models. Changes are the logic consequence of European evolution. We expect that this positive competition in the European countries, that country that will soon understand the role and rhythm of changes will be favorably positioned for the sale of products.
Romanian people, making reference to external Romanian potential.
Positive changes which can be dynamised within the country as a consequence of applying this new system, are :

- *changing business people mentality;*
- *development of positive role models for businessmen in the country;*
- *economic growth through creativity ;*
- *economic and financial stability;*
- *credibility from the inside, as well as from outside for all the businessmen involved in the application of the new system.*

We have the necessary tools for the achievement of a large project, which worth to mark on history, that of a Global Romania.

The onset of the third millennium is finding us, humans, experiencing yet another time of reorganization and re-crystallization. Humankind has undoubtedly been through perpetual changes since the beginning of time, however the rate of change has sped more and more concurrently with its evolution and particularly with the huge amount of information now being processed.
We can safely argue that the dynamics of the surge of today's information volume and its conveyance via fast communication capabilities involves a perpetual dynamics of change in any given individual.
We are experiencing an overwhelming information bombardment. These days a person receives more information in a couple of seconds than a fellowman in a lifetime some hundreds of years ago.
What really counts is that the information being now received is mostly common and involves expected reactions, albeit slightly different, to one same kind of stimulus-type information. Such feedback involves a global analysis

resulting in a global decision-making process further leading to globally impacting outcomes, but still identical for each individual.

A case in point would be those commercials acting as inputs and triggering an identical kind of feedback from consumers to the products exhibited.

However, similar economic news will elicit similar reactions from people worldwide. Any news on price hikes in any product will cause the same reaction in individuals, irrespective of the country they live in. Any political news announcing conflicts will worry the people in any communities or countries where such conflicts occur.

In such context, the economic dimension of the national security has to be judged in terms of the dynamics of the development of a country, and its society and values considered by the countries tacitly negotiating the future architecture of the planet.

In such circumstances, our country has to think out working plans for an advantageous integration in the future international architecture.

The newly proposed working plan aimed at the integration of the Romanian value and potential in a dynamics relying on the current day's values is obviously a good opportunity for Romania.

We have taken into account the arguments expounded in this work, as well as the particulars that define both the industrial society and the information society.

Having an economy-based approach on a national society, we are hereby counterpoising the old-time, Cold War practices, and state-led protection in international competition, with a new approach, involving the interdependence and economic cooperation between countries.

The current economic security does not preclude the state's capacity to properly manage nationally challenges such as:

(a) inflation, unemployment, life quality, balance of payments, shortage of business opportunities, excessive protectionism, heavy reliance on foreign material resources;

(b) state's capacity of maintaining the economic independence of its military output;

(c) problems related to poverty and a people's purchase power, the security of daily livelihood;

(d) challenges posed by illegal business involving weapons, drugs, and economic crime;

(e) matters related to the manipulation of specific sectors of the national economy to pursue the interests of particular countries or foreign groups of interests.

The demonstration of the benefits to be brought about by the new working system also involves an analysis here of the specifics that define the economic space, the capabilities and the political, social and economic system of the state that manages the interests of the Romanian people in Romania.

Therefore, it must be noted that the sole assessment of the Romanian potential, and of the Romanian tangible and intangible valuables of our countries is now conducted by the Institute of Statistics, the intelligence services, leading companies (however for particular lines of business), polling institutes and political parties. We should also remind you that Romania's admission in NATO and the EU also involved an extensive audit by such bodies.

However, the most comprehensive analysis must be surely conducted by the currently ruling political parties, as they need such knowledge to make the best decisions for the country.

The ruling parties are able to ensure a more successful government if they properly know the resources of the prevailing international trends and how they should act in the given circumstances.

The design of virtual models using simulations and economic scenarios is most assuredly related to an effective, discerning government pursuing the values that define success and prosperity and, last but not least, due consideration for the economic dimension of the national security.

The system ensuring the integration of the Romanian potential abroad provides a high-minded component of action in the spirit of the Romanian values and of the effective use of our national resources.

Having researched Alvin Töffler's "Third Wave", we must conclude that the values that define the Romanian society in 2010-2011 are mostly specific to the second wave, i.e. the industrial wave, which has been devoted to the same principles over the last three hundred years.

The current economic, social and political organization, and the care for and responsibility towards the environment are specific to an era that tends to be supplanted. The third wave is the succinct definition of the post-industrial era, and of the information era. A society adhering to the industrial values is a society that is committed to forcible industrialization, and to the consumption of such concentrated resources as oil, gas, metal, and power.

Such society type has developed the pursuit of such values as towering industrial chimneys and expansive manufacturing combines, standardization and good timing, high output volumes disregarding the environment protection. Moreover, is has emphasized the use of repetitive works producing deliverables that were supposed to satisfy markets that were already shaped for the products to be supplied. The industrial mode of the second wave society described by Alvin Töffler also informed the school education overloaded with classes where students saw their spirit flattened into uniformity, and conscience prepared for standardized work. Nonetheless, it is the political system, i.e. is the very resource of a successful change-oriented decision-making process that has been most severely affected, which means that we should have been consequently the victim of a vicious circle. However, the huge amount of information and technological advances has resulted into unexpected relations and changes. Humans substituted by robots in the industrial facilities have headed to the service sector and so a new-fangled type of relatedness between companies, i.e. based on new products and new responsibilities, has appeared.

Diversity, information, communications and continuous and diverse education have helped crystallize the relations that tend to define the third wave, of information society. The new emphasis on the influential points to the detriment of the new capabilities has meant a tremendous step towards the new model society that will replace the industrial society for good.

Our system ensuring the integration of the Romanian potential points is consistent with the information society and demonstrates a number of conveniences such as:

a. Advantage of time and attitude

Such edge helps Romania act as a partner state for the countries that strive to promote progress and strengthen a new type of worldwide organization in the post-industrial, i.e. information, society. Therefore, we shift from a passive, ever-satisfied player to a pro-active player that decides its future by itself.

Our national resources are protected under a policy that pursues an active positioning in the dynamics of the global developments.

So, we are now in a position to witness Romania's efforts in 2010 to achieve accession to the Schengen Area. Such efforts are partly accounted for by the fact that our foreign policy is only regionally relevant.

The platform that helps integrate the Romanian resources abroad earns Romania a global player role with all swaying powers deriving therefrom. The economic relations consolidated in multiple hubs all over the world can obviously materialize into a political lobby inside the European Union inclusively. We need to also acknowledge that Romania's economic security should be looked upon as an inductive characteristic involving multi-vectorial influences from all directions.

b. "Position while act" advantage

Just as the countries that failed to quickly understand the purpose of industrialization three hundred years ago lost their political supremacy (e.g. Portugal, Spain, Turkey) to the benefit of other countries that comprehended change and shifted from the agricultural society to the industrial society (e.g. England, France, Prussia), now any country that fails to be aware of the need to move from the industrial society to the information society will face stagnation or even throw-back.

The new working system for the integration of the Romanian potential provides the components required to create an edge for the immediate positioning among the movers and shakers acting towards the new global architecture. We are now in a position to reconsider the profitable activities involving intangible products specific to quick-paced transactions in the world's communities where we have fellow citizens and relating power. We have intelligence that can and must be used intelligently after a due analysis in the hub-type center in Romania.

The system's nerve enter integrating such spots of potential is located in Romania.

c. Advantage of access to economic, cultural, and educational information

Such mechanism enables a proper relationing in a many-sided universe with quick access to the wisdom heritage of many peoples, which involves large-scale cultural changes, so Romania will be able to act as a catalyst in the cultural relations between various spaces.

At the same time, we should also acknowledge a regularization of information that will rid us of what may be called informational smog. The accessibility of culture for the people will set into motion a mechanism enabling perpetual education and continuous knowledge.

It is obvious that, as far as direct transactions are concerned, such commercial changes in the field of culture and education may occur. Romania is bound to become an education-fostering space.

All commercial bureaus set up to operate in support of the spots of Romanian potential in various countries will promote and liaise for the Romanian education. We must place a capital emphasis on education. We promote the mercantile side of education. We can become a spearheading space of education if we provide education to large masses of youths in various countries. Such advantage contributed by the new working system explains the future power that the system and Romania are to enjoy.

d. Earning new markets for all Romanian products

In the current period 2010 - 2011, Romania has admittedly a deficitary balance of payments. Romanian products are mostly intended for the European area. However, supplying of more plain products to the markets of other non-European countries would enable Romania to right its trade balance and even make it achieve some degree of excess. That would have outstanding economic, social and political consequences. Such essential element is characteristic of the economic security paradigm and consistent with the values of the information era.

We must put to good use the influences located in the countries where we have Romanian potential that would allow us to achieve successful relationing and bring to fruition commercial transactions.

A system employing intangible values of the relations between commercial areas in the form of relations between banks, companies, institutions will help direct financial influxes to Romania. Such novel working system is first and foremost a system that ensures that the Romanian values are promoted in a well-organized and intelligent manner. We acknowledge the Romanian State's efforts promoting the country brand.

This working system analyses and acts on previously reviewed segments, on the areas where economic power is concentrated in each country.

Therefore, we would have a working tool behind each spot of potential, a work bureau acting operating in close cooperation with its hub in Romania. Such mechanism uses science, intelligence, information, communication and relations, all of which are intangible.

e. Development of markets

The implied development of a sizeable Romanian, or Romanian-influenced market, requires participation in the global decisions of the international associations that regulate markets, products, or in other words participation as active players. Now, in 2010, China stands as conclusive proof for the potential of a market during a crisis time. China's relations with markets covering the needs of billions of consumers have enabled it to be a player that has not been affected by the ongoing world crisis.

The new working system provides a space which cannot be easily affected by any downturn as it operates on markets to a mutually-offsetting effect geographically; if it spreads on all continents and operates on multiple ranges of products, the system will again achieve a self-balancing effect.

The migration of capital from a line of business to another also helps muffle a crisis. It is vitally important that the new working system can absorb some of the crisis shocks as a result of the current globality and diversity.

f. Advantage of European area

As a European country situated in a space secured by stability and organizational culture, Romania has an edge compared to other areas, which provides it with an easier, and perhaps more suitably negotiated, access.

Many EU countries manufacture products that can penetrate the European market and do not achieve an actual access because they do not have the required intermediary. Using a platform that integrates the spots of Romanian potential, we are in a position to resurrect this type of joint-venture to achieve sales together on a secure, but exacting market.

Also, by using such brokering products integrated in the new working system, many non-EU Countries will be enabled to invest in or place their investment in the safety of the European area.

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A QUANTITATIVE STOCHASTIC MODEL FOR AVIATION SECURITY

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Abstract: *This paper provides a quantitative analysis of the risks of terrorism in aviation security system using mathematical device. The aim of analysis is to support effective the underlying decision process in conflict situations that may occur due to terrorist threats in aviation system. To obtain a model more suitable and real of the phenomenon, it were adopted the instruments offered by the mathematical theory of discrete Markov processes and game theory, the results constitute a systematic risk assessment effectively against such attacks. To demonstrate de approach, a simple example of a terrorist attack against a passengers aircraft is modelled and analyzed.*

Keywords: *aviation security, game theory, Markov chain, conflict situations*

1. INTRODUCTION

The security of aviation system has traditionally been expressed in a qualitative manner. Qualitative risk analysis involves considering each risk in a purely descriptive way, to imagine various characteristics of the risk and the effects that these could have on the aviation system.

In the aftermath of the 9/11/2001, it has been considered that the threats against the aviation system are real and multiple, and in this context the civil aircraft could be the target of terrorist attacks conducted with air defence systems.

In contrast to failure, attack may not always be well characterized by models of a random nature. Thus, the probabilistic methods for quantifying the operational security of aviation systems provide a more accurate model of the terrorists' expected behaviour, which can be used to assign more realistic transitions probabilities in the stochastic models.

In this paper, a game theoretic method is used for analyzing the aviation security, where the interactions between a terrorist and the aircraft are modelled as a two-player stochastic game.

Also, for the mathematical description of the attack, viewed as a phenomenon that takes place in stages and determines the system passing through several states, Markov chain theory is used.

2. THE STOCHASTIC MODEL

2.1 Related work

System failure is a concept that denotes the system's inability to deliver its services, in the security community it calls *security breach.* A

security breach might be caused by normal usage operation, but more likely by *intentional attack* upon the system.

Considered physical system can only be found in a multitude of states S and can change state at discrete moments $t_1, t_2, \ldots, t_n$.

$$S=\{S_1, S_2, \ldots, S_m\} \quad (1)$$

If the probability of moving to a state when a state θ ($t_k<\theta<t_{k+1}$) to a state S_i depends on S_j in which the system is at a time t ($t_{k-1}< t<t_k$), then the system evolution is described by a discrete – time Markov chain [1].

Exemplifying every intermediate point of attack, depending on the success (A_{i+1}) or failure (A_{i-1}), the attacker has the opportunity either to cancel the attack (safety system), or continue it (A_i).

On the other hand, the system has the ability to detect the attack and change to safety system, which would lead to the attackers impossibility to continue the attack (figure 1).

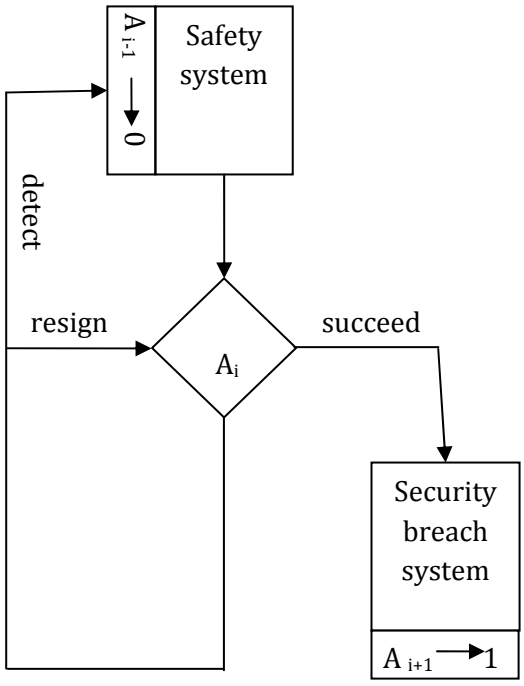

Fig.1 Terrorist attack against aviation system described as state changes

For each of the states of the associated crowd A crossing probabilities $P_{ij}(t, \theta)$ can be arranged in the shape of a square matrix:

$$P_{ij} = \| P_{ij}(t, \theta) \| \quad (2)$$

where each element satisfies the relations:

$$\begin{cases} \sum_{A_j \in A} P_{ij}(t,\theta) = 1, A_i \in A, \ \forall \ (t,\theta), t \prec \theta \\ 0 \le P_{ij}(t,\theta) \le 1, \ A_i, A_j \in A, \ \forall \ (t,\theta) \end{cases} \quad (3)$$

Also, the likehood of passage in any state of the system can be calculated if the initial distribution is known and also the transition probabilities at different times [2].

$$P_{rs} = P_{rk} \times P_{ks} = \left\| \sum_{A_j \in A} P_{ij}(r,k) \times P_{jl}(k,s) \right\| \ \forall \ A_i, A_j \in A \quad (4)$$

If the evolution of the system was developed by the moments 1, 2,..., n, then the relation (4) becomes:

$$P_n = P_0 \times P_{0,1} \times P_{1,2} \times \ldots \times P_{n-1,n} \quad (5)$$

where P_0 is the initial distribution [3].

2.2 Quantification of an attack

This is a simple example to illustrate the possible use of the theory previously presented.

Suppose that a passenger plane enters the path to large landing area with a low risk of terrorist attack. The aircraft has both active countermeasures system (DIRCM), as well as passive (chaff & flares) against attacks with portable surface to air missiles (MANPADS).

A terrorist cell is ready to attack aircraft with such a system, once the aircraft will enter the complex possibilities of antiaircraft action. The number of missiles available is 3.

The attacker considers that in order to predict the outcome of his attack (figure 2), the aircraft can be found after the attack in one of the possible states [4,5].

- S_1 – the aircraft lands safely (the rocket did not reach target due to limited knowledge of terrorist missile operating system);
- S_2 –the aircraft is damaged but can land in emergency terms;
- S_3 – the aircraft was destroyed.

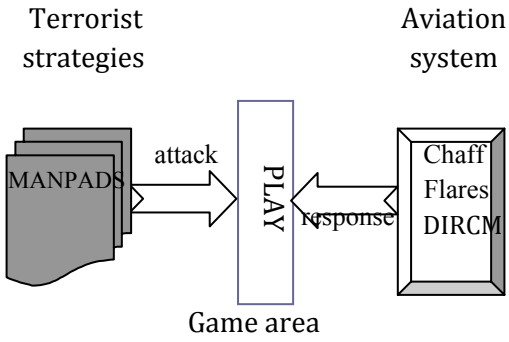

Fig. 2 The interactions between a terrorist and the aircraft modeled as a two-player game

We consider the initial state of the aircraft (before the first missile launch) with the distribution:

$$P_0 = (1,0,0) \qquad (6)$$

The probabilities of transition from one state to another are expressed by the values

$$P_{0,1} = \begin{array}{c} \begin{matrix} S_1 & S_2 & S_3 \end{matrix} \\ \left|\begin{matrix} 0,2 & 0,5 & 0,3 \\ 0 & 0,6 & 0,4 \\ 0 & 0 & 1 \end{matrix}\right| \end{array} \begin{matrix} S_1 \\ S_2 \\ S_3 \end{matrix} \qquad (7)$$

Stochastic matrix P can be interpreted as representing the aircraft's chances of moving from one state to another, and these transitions are irreversible.

The evolution of the system changes with the times depending on which rockets are launched. So, it must calculate the vector P_3 which will consist of probabilities that the system (aircraft) is in the three states after missile launch:

$$P_1 = (1 \;\; 0 \;\; 0) \bullet \begin{pmatrix} 0,2 & 0,5 & 0,3 \\ 0 & 0,6 & 0,4 \\ 0 & 0 & 1 \end{pmatrix} = (0,2 \;\; 0,5 \;\; 0,3) \qquad (8)$$

P_1 shows that after the first missile launch system has a good chance to be in state S_2.

For P_2 we obtain:

$$P_2 = (0,2 \;\; 0,5 \;\; 0,3) \bullet \begin{pmatrix} 0,2 & 0,5 & 0,3 \\ 0 & 0,6 & 0,4 \\ 0 & 0 & 1 \end{pmatrix} = (0,04 \;\; 0,4 \;\; 0,56) \qquad (9)$$

In this case, the system will most likely find in the state S_3, therefore, the terrorist attack can be successful using only two missiles in total.

Finally, for P_3 we get:

$$P_3 = (0,008 \quad 0,242 \quad 0,732) \qquad (10)$$

This calculation shows that the determination of terrorists to attack aircraft with three missiles is established, although it can get close to accomplishing the mission at a rate of 60% using only 2 missiles.

3. THE GAME MODEL

Game theory is not a new concept in the field of aviation security system. The gain of using a game theoretic approach is that it may help stakeholders from aviation (airliners, industries, government, and so on) to find the optimal solution (technical and strategical) for the aircraft to become more secure, to ensure best possible protection against advanced air defense devices, and a higher survival rate as in the case of a terrorist attack.

Regard each terrorist attack, which may cause a transition in the stochastic model as an

action in a game, then the interactions between the attacker and the system can be modeled as a two-player game, as illustrated in figure 2 [6].

The game consists of:

- the two players: N={1,2}={attacker, system};
- the strategy spaces of players: S_k,k=1,2,…,n, where S_k is the set of all available strategies to player k;
- the payoff function of player: V_k:S→R, k=1,2,…,n.

Let X and Y crowds pure strategies of the two players (A, B), where $X \in S_1$, $Y \in S_2$, and be $x \in X$ and $y \in Y$ pure strategies chosen by two players [7,8].

If each player has a finite number of pure strategies, meaning $X = (x_1,\ldots,x_m)$ and $Y = (y_1,\ldots,y_n)$, than the game can be represented by the matrix:

$$V = \begin{Vmatrix} v_{11} & v_{12} & .. & v_{1n} \\ v_{21} & v_{22} & .. & v_{2n} \\ .. & .. & .. & .. \\ v_{m1} & v_{m2} & .. & v_{mn} \end{Vmatrix} \quad (11)$$

In most cases the terrorist does not know exactly the possibility that the attack is countered by the system, game theory says that he should assume that his opponent is aware of the game that tries to minimize the gain expected by the attacker [9].

If player A chooses strategy x_i, must expect the player to respond to that strategy B which corresponds to the lowest gain, y_j strategy that is determined by:

$$\alpha_i = \min v_{ij} \quad (12)$$

Armed with m pure strategies, player A will seek to maximize earnings:

$$\alpha = \max \alpha_i = \max_i \min_j v_{ij} \quad (13)$$

After a similar reasoning, player B will apply one of the strategies that did not lose more than β, where:

$$\beta = \min \beta_j = \min_j \max_i v_{ij} \quad (14)$$

Using the example from the previous chapter, the gain matrix may be made depending on shooting conditions (training drawer, weather, etc.) and use of protective measures (assets, liabilities, none) of the aircraft:

V=

	y_1	y_2	y_3
x_1	v_{11}	v_{12}	v_{13}
x_2	v_{21}	v_{22}	v_{23}
x_3	v_{31}	v_{32}	v_{33}

=

	act.	*pass.*	*no*
1R	**0,1**	**0,2**	**0,3**
2R	**0,2**	**0,4**	**0,5**
3R	**0,3**	**0,5**	**0,7**

(15)

Lower values of α and superior β of the game are:

$$\alpha = V = \beta = 0{,}3 \quad (16)$$

meaning the strategy x_3 for the A player and the y_1 strategy for the B player are optimal strategies.

Thus, the conflicting parties must understand that if you do not meet up maxmin strategies, namely minmax they may lose more.

In the example shown, player A must necessarily choose x_3 strategy, any strategy chosen in the hope of winning more can be prevented by player B.

It is assumed that both players know the game matrix and that they choose a certain strategy, based on the premise that their opponent is at least as good at it and will do everything to prevent him from achieving his goal.

4. CONCLUSIONS AND FURTHER WORK

Even if the model presented is quite simple, it could be a start for extended approach that includes more than one type of attack and there are more than two possible ways to reach the safety system state.

In drawing up the mathematical model of the game does not always stand out as not optimal strategies. Even if both players know

the rules, they do not know the consequences of selected strategies.

Also, game theory shows that in cases where the attacker does not know the probability of being countered by the system, abandoning the strategy would result in loss of warranty minmax expected earnings, which would be contrary to the logical behavior. A "one-shot game" with a minmax solution in such cases may be more appropriate for modeling the expected behavior of attackers.

The theoretical model presented in this paper offers a realistic scenario of what could happen today in the aviation security system, even if they require further research, including validation of the used data.

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A GAME THEORY MODEL OF STOCK EXCHANGE MARKET MANIPULATION

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Abstract: *The role of the stock exchange market is to finance the national economy, therefore anti-crisis measures must be taken by the state to support and encourage the investments on the financial markets. An important measure which can be taken by the National Securities Commission is to charge higher fines on market abuse which should lead to fewer cases of abuses by discouraging manipulators, leading to a higher level of trust from behalf of the local and foreign investors, due to higher protection imposed by the authorities. The hereto paper develops a static game of complete information, between the National Securities Commission (the stock exchange market regulator) and an investor which tries to manipulate the stock exchange market. The model presents an investor which chooses between two trategies: to manipulate the market or not to manipulate the market, and the National Securities Commission which chooses between two strategies: to investigate the market abuse or not to investigate it.*

Keywords: *stock market manipulation, market regulation, mixed strategies*

1. INTRODUCTION

The role of the stock exchange market is to finance the national economy, therefore anti-crisis measures must be taken by the state to support and encourage the investments on the financial markets. An important measure which can be taken by the representative of the state on the stock exchange market, namely the market regulator or "watchdog" called the National Securities Commission, is to charge higher fines on market abuse which should lead to fewer cases of abuses, leading to a higher level of trust from behalf of the local and foreign investors, due to higher protection imposed by the authorities, thus attracting more and more investors and funds on the local stock market.

One of the anti-crisis measures taken by the state during the global crisis in 2009, in order to support the investments on the financial markets, was to completely cutt off the tax on capital gain for the 2009 fiscal year. On the other hand, the Bucharest Stock Market decided to reduce trading commissions, especially commissions on buying transactions, and, based on the positive trend of global stock exchange markets' indices, the local stock market showed a strong recovery, at least in the first four months of 2009.

At the end of 2010, the National Securities Commission's (CNVM) representatives stated that the institution is preparing legislative changes in order to raise the value of fines charged for market abuse, by calculating them as a percentage of the turnover.

On the other hand, the fiscal legislation regarding the tax on capital gains for 2010 fiscal year was verry confusing, as in the third quarter the Government has modified taxation starting with July 1st, leading to a steap dropp in the number of deals on the Bucharest Stock Exchange market, to around 45,000 in September, from 91,000 in June and 130,000

in May. Fiscal legislation issues have a great impact upon investors' decisions, therefore the state must choose verry carefully among different strategies, because the final purpose of the state is the social welfare which can be also obtained by encouraging investments.

Lately, there has been a constant development of the theoretical literature on market manipulation, starting with Hart and Kreps (1986) [1], Vila (1987, 1989) [2], Allen and Gale (1992) [3], Benabou and Laroque (1992) [4], and Jarrow (1992, 1994) [5, 6] who were among the first researcher to study market manipulation. Subsequent contributions include Bagnoli and Lipman (1996) [7], Chakraborty and Yilmaz (2004) [8]. Vitale (2000) [9] considers manipulation in foreign exchange markets, while Van Bommel (2003) [10] shows the impact of rumors in price manipulation.

Allen and Gale (1992) [3] propose a classification scheme for models of manipulation.

The hereto paper develops a static game model of complete information, between the National Securities Commission (the stock exchange market regulator) and an investor which is tempted to manipulate the stock exchange market. The players of the game are: an investor who chooses between two strategies: to manipulate the market or not to manipulate it, and the National Securities Commission which also chooses between two strategies: to investigate the market abuse on the market or not to investigate it.

Section 2 describes the stock market manipulative strategies which are taken into consideration in this paper, while Section 3 introduces the static game model in complete information. In order to describe the game model, we define a normal-form representation of the game, and try to find a strictly dominated strategy and a mixed strategy, which will be interpreted in terms of a player's uncertainty about what the other player will do.

2. STOCK MARKET MANIPULATIVE STRATEGIES

Manipulation can occur through actions taken by insiders that influence the stock price (accounting and earnings manipulation), or by the release of false information or rumors in press or on the Internet, which influence stock prices. Also large block trades can influence prices, therefore by purchasing a large amount of stock, a trader can drive the price up, and profit on the back of the price increase [11]. Note that in this paper, we reffer only to the regulated stock exchange market, which is supervised by the National Securities Commission.

Potentially informed parties are corporate insiders, brokers, large shareholders and market makers, which are likely to be manipulators, while illiquid stocks are more likely to be manipulated and manipulation increases stock volatility [12]. An investor, especially an informed trader, has to balance the short term profit from the trade with the long term effect his trade has on the beliefs of the market and on future profits, thus a strategy is manipulative if it involves the informed trader undertaking a trade in any period which gives him strictly negative short term profit in order to manipulate the beliefs of the market regarding his private information, enabling him to recoup the short term losses and more in the future [8]. In our model, the investor's payoff in case he does not manipulate the market is considered to be $\pi \in \Re$, while the additional payoff generated by manipulating the market is $r \in \Re, r > 0$, called informational rent.

The manipulation described above implies the following elements, for a successful market manipulation [13]:

a) Access to a large number of potential investors, ideally at low cost.

b) Anonymity, or market manipulators might otherwise be revealed.

c) Scalability, meaning the ability of the manipulator to duplicate rumors on a large scale.

d) Time to accomplish a manipulation quickly because the danger of exposure increases with the period of time a scheme takes.

e) Impact, meaning that the people who hear the rumor should be motivated to act by trading on the false information.

3. STATIC GAME MODEL OF COMPLETE INFORMATION

3.1 Description of the model. The description of the game is best ilustrated by the normal-form representation of the game, in which each player simultaneously chooses a strategy, and the combination of strategies chosen by the players determines a payoff for each player. The problem analysed by this paper refers to an investor (INV) (any investor on the stock exchange market, often an insider) who has the possibility and the means to manipulate the market. The only one who can stop the investor from manipulating the market is the National Securities Commission (NSC), which can investigate the cases of market abuse and the investors' trading strategies.

We assume that the game is of complete information, because the players of the game know the strategies and the gains obtained by the other player, as the NSC can easily find out the profit of any investor on the stock exchange market, with the help of the institutions which operate the trades and by interogating the intermediaries on the stock exchange markets, regarding their clients, as all the trades operated on the regulated stock exchange market are introduced by the intermediaries autorized and supervised by the National Securities Commission. On the other hand, the investors on the market know the level of fines which the National Securities Commission is allowed to charge, because it is provisioned by the capital market laws and regulations. We also assume the correctiveness of the NSC, therefore in case the NSC investigates and the investor manipulates the market, he will be caught and fined, while if the investor is inocent and the NSC investigates the market, he will not be fined. Also, we do not take into consideration the corruption cases, in which the employees or management of the NSC are payed by the investor not to investigate the market.

We consider a market for one asset, and we assume not only that the players are rational, but also that both players know about the other that he is rational, and that both players know that the other player knows that he is rational.

In our model, the investor's payoff in case he does not manipulate the market is considered to be $\pi \in \Re$, while the additional payoff generated by manipulating the market is $r \in \Re, r > 0$, called informational rent, his gain being affected by the fine charged by the NSC in case it investigates the market. The NSC's gain comes from commissions charged from the participants on the capital market noted as $com \in \Re, com > 0$ which is tightly related to the number of transactions operated by the investors, and from fines charged on market manipulation, $\alpha \in \Re$. In case the investor manipulates the market and the NSC does not investigate, the gain obtained by the NSC will be reduced with a weight $\alpha \in (0,1)$ due to the loss of trust from behalf of other investors on the market, which leave the market not properly controled and supervised. The investigation process implies an expense $c > 0$.

Although in a normal-form game the players choose their strategies simultaneously, this does not imply that the players necessarily act simultaneously, but each player chooses his acton without knowledge of the others'choices.

The game can be represented in the following bi-matrix, Fig. 1:

Probabilities	**NSC**	**p**	**1-p**
INV	Strategy	I	NI
q	M	$\pi + r - a$ $com + a - c$	$\pi + r$ $\alpha \cdot com$
1-q	NM	π $com - c$	π com

Fig. 1 Players'payoff bi-matrix

3.2. Solving the model. In order to eliminate the temtation of the investor to manipulate the market, we must see if the strategy can be dominated by the strategy of non manipulating the market. This happens when for each feasible combination of the other players' strategies the payoff from manipulating the market is strictly less than the payoff from not manipulating the market.

The payoff of the investor according with the strictly dominated strategy will be:

$$U_{INV}(M,\cdot) = (\pi + r - a, \pi + r) \quad (1)$$

$$U_{INV}(NM,\cdot) = (\pi, \pi) \quad (2)$$

After comparing the payoffs, we can state that in order for the investor not to manipulate the market, it is necessary for the variables to meet the following conditions:

$$\begin{cases} \pi > \pi + r - a \\ \pi > \pi + r \end{cases} \Rightarrow \begin{cases} a > r \\ r < 0 \end{cases} \quad (3)$$

Due to the fact that $r > 0$ was set at the beginning to be positive, because the informational rent derived from manipulating the market is supposed to be positive, there is no dominated strategy in the model.

In order to solve the problem, the mixed strategy will be used, which implies one player's uncertainty about what the other player will do, by assigning a probability distribution to it. Therefore, a mixed strategy for the investor is the probability distribution *(q, 1-q)*, where *q* is the probability for which the NSC beliefs that the investor will manipulate the market, and *1-q* is the probability for which the NSC beliefs that the investor will not manipulate the market. A mixed strategy for the NSC is the probability distribution *(p, 1-p)*, where *p* is the probability for which the investor beliefs that the NSC will investigate the market abuse, and *1-p* is the probability for which the investor beliefs that the NSC will not investigate the market.

The expected payoffs for each strategy will be computed, taking into consideration the pobability distribution attached, as follows:

$$E(U_{INV}(M,\cdot)) = p \cdot (\pi + r - a) + (1 - p) \cdot (\pi + r) = -p \cdot a + \pi + r \quad (4)$$

$$E(U_{INV}(NM,\cdot)) = p \cdot \pi + (1 - p) \cdot \pi = \pi \quad (5)$$

In order to find out the value of the probability distribution for which the investor is indifferent between the two strategies, the expected payoffs must be equalized:

$$-p \cdot a + \pi + r = \pi \Rightarrow p = \frac{r}{a} \quad (6)$$

According with the investor's beliefs, the best response of the investor is not to manipulate the market in case $p < \frac{r}{a}$, and the best response of the investor is to manipulate the market in case $p > \frac{r}{a}$, where *p* represents the belief of the investor that the NSC will investigate.

In order to find out the value of the probability distribution for which the NSC is indifferent between the two strategies, we compute the value of q:

$$E(U_{NSC}(\cdot, I)) = q \cdot (com + a - c) + (1 - q) \cdot (com - c) = q \cdot a + com - c \quad (7)$$

$$E(U_{NSC}(\cdot, NI)) = q \cdot a \cdot com + (1 - q) \cdot com = com + q \cdot com \cdot (\alpha - 1) \quad (8)$$

In order to find out the value of the probability distribution for which the NSC is indifferent between the two strategies, the expected payoffs must be equalized as follows:

$$q \cdot a + com - c = com + q \cdot com \cdot (\alpha - 1) \Rightarrow q = \frac{c}{a + com \cdot (1 - \alpha)} \quad (9)$$

According with the NSC's beliefs, the best response of the NSC is not to investigate the market abuse in case $q < \frac{c}{a + com \cdot (1 - \alpha)}$, and the best response of the NSC is to investigate

the market in case $q > \frac{c}{a + com \cdot (1-\alpha)}$, where q represents the beliefs of the NSC that the investor will manipulate the market price.

Therefore, the mixed strategy is the following:

$$\left(\left(\frac{c}{a + com \cdot (1-\alpha)}, \frac{a + com \cdot (1-\alpha) - c}{a + com \cdot (1-\alpha)} \right), \left(\frac{r}{a}, \frac{a-r}{a} \right) \right)$$

3.3. Results. By analysing the senzitivity of the model to the variables, we can conclude that when the fine (a) set by the NSC is very high compared to the informational rent which the investor should receive by manipulating the market, $a \to \infty$ the probability $p \to 0$, therefore the NSC in tempted not to investigate the market abuse. On the other hand, in case the informational rent is close to the fine charged by the NSC for manipulating the market, $r \to a$ the probability $p \to 1$, therefore the NSC will be tempted to investigate the market abuse. We can observe that r must always be smaller than a in order to have a mixed strategy.

If we look at the variables which influence the probability for the investor to manipulate the market, we can state that the investor will be tempted to manipulate the market in case that $c \to a + com \cdot (1-\alpha), q \to 1$, but if $a + com \cdot (1-\alpha) \to \infty$ the investor will not manipulate, $q \to 0$ the market due to either high fines, or low trust from the other investors on the market which would determine the NSC to look for incomes derived from fines, instead of commissions from the market participants.

4. CONCLUSIONS & ACKNOWLEDGMENT

4.1. Conclusions. The National Securities Commission plays an important role on the stock exchange market and therefore on the local economy, because its decisions to sustain investments by protecting the investors interests and to assure a fair and healthy capital market can boost economy growth by attracting higher investments. An important measure which can be taken by the National Securities Commission is to charge higher fines on market abuse which should lead to fewer cases of market manipulation, leading to a higher level of trust from behalf of the local and foreign investors, due to higher protection imposed by the authorities.

The hereto paper develops a static game of complete information between the National Securities Commission and an investor which tries to manipulate the stock exchange market. The model presents an investor which chooses between two trategies: to manipulate the market or not to manipulate the market, and the National Securities Commission which chooses between two strategies: to investigate the market abuse or not to investigate it. The result is a set of probability distributions and restrictions which lead to indifferent reactions showed by the players, from which we can start to analyse the players' reactions to the other player's strategie. The main problem of the model is that the informational rent obtained by the investor who manipulates the market is very hard to compute by the NSC, because it represents the additional value which the investor obtains by manipulating the market, compared to the payoff that he should have gained in case he would have not manipulated the market, therefore the stock prices history would have been another, one unknown.

4.2. Future work. Further studies should be performed by adapting the model to a dynamic game in incomplete information, and computing the Bayesian equilibrium, and to compare the results with the ones in the present paper. Furthermore, study cases should be performed in order to establish how much close to the reality is the model presented in this paper.

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INSURANCE MARKET EVOLUTION IN ROMANIA IN TERMS OF GLOBAL ECONOMIC CRISIS

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Abstract:*This paper aims to present the evolution of general insurance business in Romania during 2005-2010.*

The insurance market in our country, risk underwriting activity takes place within the insurance companies. They have general insurance underwriting and life insurance activity. There are companies whose activity is mixed. On 31.12.2010 activates on the Romanian market a number of 45 insurers. They have achieved in 2010 a volume of insurance gross premiums in the amount of 1.989 billion euros. With reference to the European currency EURO, we find that the insurance market in Romania has dropped by 5% compared with 2009. If we look at actual developments in national currency and keep inflation rate for 2010 which was 6.09%, then we find that the decrease was actually of 11%. The penetration gradeof insurance in GDP has declined, reaching a value of 1.63% for 2010, and the previous year was 1.81%. Insurance products reach the insurance consumer by employees and / or insurance companies agents and through the insurance brokerage representatives.

The insurance brokerage market has been the only one that has achieved in 2010 an increase of gross premiums brokered volulului for insurers. The increase was 5% compared to 2009. These achievements show that the insurance brokerage was able to adapt to the new economic conditions caused from the second year of economic crisis. Business volume of insurance brokers increased in the retail zone, more and more clients appeal to the broker consultancy services to obtain efficient, economical and less costly insurance offers.

KEYWORDS: *insurance companies, gross written premiums, ris, insurance broker.*

1. INTRODUCTION

Natural disaster risks and technical risks of exploitation are more and more frequently throughout the Earth's surface and atmosphere, regardless of geographic areas and stage of economic development. They negatively affects people's lives and their economic activity. Knowing the circumstances under which various phenomena occur, associated with natural disasters they allow people to take reasonable steps to avoid such phenomena, to prevent them, limit their destructive action [4Văcărel, Bercea, 2007, page19] or find alternative sources of funding, to cover economic losses that could not be avoided. Risk transfer instruments are diversified. One source of funding which is utilized worldwide is the insurance policy [5 Zelinschi, 2009, page 460].

Conclusion of insurance policies is done through the insurance companies by underwriting the risk. The classification of

risks that are underwritten through insurance generated a split into two policies main insurance policies classes: life insurance and general insurance. Regarding our paper, we will deal in further with the evolution of general insurance underwriting policies in the past five years.

2. THE EVOLUTION OF UNDERWRITING GENERAL INSURANCE POLICIES IN THE INSURANCE MARKET IN ROMANIA DURING 2006-2010

In this article we intend to analyze the development of indicators of the Romanian insurance market. In the classifications for risks and insurance premiums reporting, the Insurance Supervisory Commission established by the classification rules of insurance policies , the framing into 18 classes of general insurance. These contain: accident and sickness insurance; health insurance; land transport, rail, air and water insurance; in separate classes; insurance of goods in transit, fire and natural disasters insurance, other damages to the property insurance , liability insurance for motor vehicles, air and sea transportation, general liability insurance, credit insurance, guarantee insurance, financial loss insurance, legal expenses insurance, tourist assistance insurance [6 Primary legislation in insurance, page 89]. To analyze the evolution of Romanian insurance market we have chosen subscription period between the years 2006 and 2010.

In Table 1 we have presented the evolution of Romanian insurance market in terms of gross premiums underwritten by insurance companies which are performing general insurance. Regarding the fact that catastrophic risks in recent years have occurred with increasing severity we believe it is important to show their share in total subscriptions of Romanian insurance market. In the synthetic information provided by the Insurance Supervisory Commission, underwriting of catastrophic risks insurance are reported by the insurance companies in the insurance class 8, which are called "Fire and natural disasters". The synthesis of information and reports submitted by insurance companies to the Insurance Supervisory Commission, during the period 2006-2010 shows that they have a share ranging between 11.3% and 14.5% of all subscriptions registered for general insurance policies.

During the economic growth period in 2006-2008, the value of general insurance underwriting has increased significantly. Insurance premiums written were 23.4% higher in 2008 than in 2007. In the same, the total insurance premiums of fire and natural disasters had increased by over 31%.

From the data analysis presented in the table below, we can see that in the period 2008-2009, although there were early signs of economic crisis, the insurance value of subscriptions continued to increase but the percentage increase is less significant . Insurance written premiums were 2.45% higher in 2009 than in 2008. For the same period of time, the total insurance premiums of fire and natural disasters had increased by 9.34%. Evolution of the value of claims paid by insurers for Class 8 - Fire and natural disasters in 2009 compared to 2008 registered a high growth. This increase in claims ratio is due to the large floods produced in this period in several river basins in Romania. The increase of insurance claims ratio for these policies was 87.4%.

Year of 2010 is the year in which are felt more and strongly the effects of economic crisis in the insurance market. Lending activity of banks decreases, lowering the number of insurance policies for both general insurance (buildings and property purchased with bank loans) and for life insurance which in most cases contracts are insurance contracts mortgage accessories. The same thing happens with the reduced leasing activity to produce reductions in insurance underwriting both classes of vehicles and other property acquired in leasing, insured for fire and catastrophic risks. Value in life insurance underwriting fell. Insurance written premiums were 7.5% lower in 2010 than in 2009. For the same period, the total insurance premiums of fire and natural disasters, had a 3.9% increase. If the value of insurance premiums for fire and natural

calamities we subtract the value of the PAD type underwriting insurance policies to cover catastrophic risks, we can conclude that there would be no increase in subscriptions registered by insurance companies in 2010 compared to the previous year.

Table 1

Dynamics of main indicators of underwriting policies that cover catastrophic risks on insurance market in Romania during 2006-2010

Indicator / Year	**2006**	**2007**	**2008**	**2009**	**2010***
Total gross written premiums – thousands lei	4.591.003	5.726.752	7.068.173	7.241.584	6.698.510
Of which of 8th class - thousands lei	534.071	648.324	849.670	934.738	971.200
Weight of Total Subscriptions for 8th class	11,63%	11,30%	12,02 %	12,91%	14,50%
Gross premiums "PAD" - thousands					35.863

Source: Authors' processing of the CSA's annual reports for the period 2006-2009. For 2010, there were reports of insurers used by CSA and Media 31/12/2010 XPRIMM, unaudited data from 28/02/2011
* To 2010, estimates based on reports by insurers 31.12.2010 CSA and Media XPRIMM,

3 THE ACTORS OF THE ROMANIAN INSURANCE MARKET

The subscription analysis of risks in insurance is both directly by the insurers and with the help of insurance intermediates. According to legislation the insurance intermediates are: the insurance broker, the insurance agent, the insurance subagent and the subordinate insurance agent. Insurance agents generally work for one insurance company and represent the insurers interests. Brokers intermediate products for different insurance companies and represent the clients' interests who needs to be offered a complete protection with as lower costs as possible. Insurance brokers compare different companies' products and recommend to the clients the most suitable offer for their needs[1.Badea, 2008, pag 57-58] It is important to underline the role that the broker can have in educating the population with regard to the protection of heritage through insurance. As we can see from the infromation in the previous chapter, the population reacts better to the sanctions that a bill can produce and less to the daily increes in natural catastrophies all over the world. The role of the insurance broker is that of a consultant for the client when it comes to insuring homes and personal belongings not only when it comes to the risks, limites and alues stated through a bill.

Below we presented the evolution of the number of insurers and insurance brokers when it comes to catasthrophical risk subscriptions. From the total number of insurance companies – reinsurance companies some are specialized only on general insurance, whereas others only on life insurance and others have a composite activitie. Form the total number of insurance brokers authorized by the Insurance Supervisory Commission, a procentage of 90% intermediate general insurance and life insurance.

Table 2
Evolution of the number of insurers and insurance brokers in the market Romania during 2006-2010

Year	**2006**	**2007**	**2008**	**2009**	**2010**
Number of authorized insurance companies	41	42	44	46	44
Number of authorized insurance companies that subscribe catastrophic risks	28	33	37	31	32
Number of insurance companies issuing the insurance policy type PAD	0	0	0	0	13
Number of authorized insurance brokers and active	313	348	403	482	565

Source: Authors' processing of the CSA's annual reports for the period 2006-2009. For 2010, there were reports of insurance brokers used to 31.12.2010, by the CSA and Media XPRIMM.

* To 2010, estimates based on reports by insurers 31.12.2010 CSA and Media XPRIMM

Table 3

Dynamics of main indicators of brokers who intermediates general insurance policies during 2006-2010

Indicator / Year	**2006**	**2007**	**2008**	**2009**	**2010***
Total gross premiums brokered – thousand lei	1.105.340	1.568530	2.704.593	3.211.369	2.056.704
From insurance to 8th Class - thousand	142.610	111.350	149.960	138.088	201.807
Proportion of 8th Class in the total insurance brokerage brokers	12,90%	7,1 %	5,5 %	4,3%	9,8 %

Source: Authors' processing of the CSA's annual reports for the period 2006-2009. For 2010, there were reports of insurance brokers used to 31.12.2010, by the CSA and Media XPRIMM.
* To 2010, estimates based on reports by insurers 31.12.2010 CSA and Media XPRIMM, .

From the data analyzed in the above table, we can note that in the analyzed period although the volume of insurance premiums intermediate by insurance brokers has grown in 2009, the insurance policies related to the class of insurance in witch catastrophically risks are subscribed has decreased year by year. These intermediates have oriented their attention to insurance classes such as that of automobiles and liability. In 2010, with the application of law no. 260/2008 with regard to the mandatory insurance of homes, the percentage of these subscriptions has began to grow.

We consider that it is of interest to also analyze the importance that of geographical zones in Romania have in the total of brute insurance premiums subscribed to the overall insurance during the 5 years of analyzing the insurance market. During the analysis we can observe that the area of Romania's capital is first the subscription of insurance premiums having ,in average, values representing almost half the total of the brute insurance premiums subscribed nationwide. The area of Romania's capital is followed during the whole analysis by the North-west of Romania where the subscriptions of insurance premiums do not pas 10 percent from the total overall insurance subscriptions nationwide (table 4).

In what concerns the subscription of mandatory insurance policies for homes we analyzed the volume of subscription in geographical areas. (table 5).

So we considered that the subscription of the tree types of catastrophes through PAD

insurance policies does not belong to the general trend of subscribing risks in general insurance. We can remark significant deviations , so we can note:

- The north-western zone of Romania had in 2010, 9,12% total brute subscribed primes of the whole national subscriptions and 8,6% PAD policies

-The north- eastern zone of Romania had in 2010, 7,36% total brute subscribed primes of the whole national subscriptions and 12,61% PAD policies

- the south-eastern zone of Romania had in 2010, 8,07% total brute subscribed primes of the whole national subscriptions and 19,14% PAD policies

- the southern zone of Romania had in 2010, 8,90% total brute subscribed primes of the whole national subscriptions and 14,58% PAD policies

-South-Western zone of Romania had in 2010, 4.30% total brute subscribed primes of the whole national subscriptions and 6.17% PAD policies

- the western zone of Romania had in 2010 6.46% total brute subscribed primes of the national total and 10,17% PAD policies

- central Romania had in 2010, 8,47% total brute subscribed primes of the whole national subscriptions and 11,60% PAD policies

- the municipality of Bucharest had in 2010, 46,38% total brute subscribed primes in general insurance of the whole national subscriptions and 26,30% PAD policies

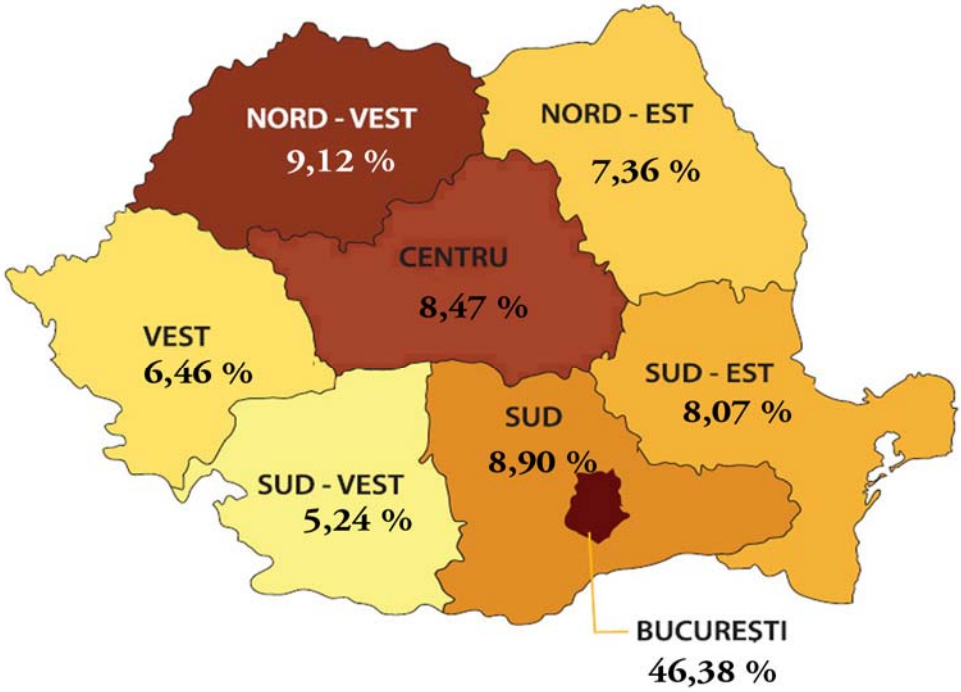
Table 4

Distribution of general insurance gross written premiums in the geographical areas in Romania during 2006-2010

Year / geographical area	2006	2007	2008	2009	2010*	% PAD policyes
North - West	9,02	9,60	8,52	8,86	9,12	8,60
North - Est	6,84	7,12	6,24	6,65	7,36	12,61
South - East	7,81	8,29	7,45	7,44	8,07	19,14
South	8,26	8,47	7,66	8,01	8,90	14,58
South - West	4,74	4,93	4,25	4,54	5,24	6,17
West	6,15	6,69	5,76	5,72	6,46	10,17
Center	8,20	8,64	8,04	7,87	8,47	11,60
Bucharest	48,98	46,26	52,08	50,91	46,38	26, 30

Source: Authors' processing of the ISC's annual reports 2006-2009,
* To 2010, estimates based on reports by insurers 31.12.2010 CSA and Media XPRIMM, .

Distribution of general insurance gross written premiums



4.CONCUSIONS

The data analyzed in Chapters precedentel us to conclude that in 2010 they felt more and preganant economic crisis in the insurance companies and insurance brokers. In 2010 to offer diversified general insurance policy with a new product PAD. If MTPL is mandatory for vehicle owners, insurance policy becomes the second pad required insurance product. This time the PAD insurance is mandatory for owners of buildings used for housing. Found that although it is a compulsory insurance policy has not generated significant volumes in insurance premiums to the insurance market indicators change very much. Companies in the insurance brokering, like other industries, is a great deal of work that was conducted in electronic commerce. Obligation to issue in early 2010, insurance policies against civil liability to electronic trained insurance brokers to issue policies PAD type the same conditions. If in the future will be considered valid electronic document for more insurance policies, this will reduce the costs of issuing and management for both insurers and brokers asigurare.Economia resources in times of crisis will be significant. Access and electronic underwriting insurance policies will lead to changes in the areas of insurance density geografice.Cresterea gross value of any class of insurance premiums will create new financial resources and risk hedging.

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MONTHLY SEASONALITY IN THE BUCHAREST STOCK EXCHANGE

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ABSTRACT:*This paper investigates the existence of the monthly effects on the Romanian Stock Exchange. We employ the returns of the main indices and the trading volume and the trading values from the main components of the Bucharest Stock Exchange. We find different forms of monthly seasonality explainable by some characteristics of the stocks.*

Keywords *Seasonality, Bucharest Stock Exchange, Efficient Market Hypothesis, Stock Market Anomalies*

1. INTRODUCTION

The Efficient Market Hypothesis (EMH) of Fama (1970) stated that past prices of stocks couldn't be used to predict the future prices [1]. However, various studies contested the validity of EMH, giving the argument of stock market anomalies, such seasonal patterns of the returns. Knowing such anomalies the investors could predict the future prices and they could elaborate strategies that could beat the market. Later, Fama (1998) admitted the existence of the stock market anomalies and their implications on EMH [2].

One of the most studied stock market anomalies is the month of the year effect which is materialized in the change of return stocks from month to month. Several studies proved the existence of such anomaly [3,4]. Many of them found that, in general, the returns for January are higher than those from the other months. January effect has many explanations, such as the Tax Loss Selling Hypothesis (in order to obtain tax losses, many investors sell declining stocks at the end of a year and they repurchase them at the beginning of the new year) and Window Dressing Hypothesis (many institutions buy winner stocks and sell loser stocks at the end of a year in order to get a favorable portfolio holding) [5,6,7]. There are also studies that found other forms of monthly effects [8,9].

Some researches revealed the particularities of investors' behaviors for the emerging capital markets which influenced monthly effects [10,11,12]. Other studies identified some differences regarding monthly effects for the small firms stocks in comparison with the big corporations stocks. Such particularities were related to the impact of firm size on the investors' behavior [13,14,15].

In this paper we analyze the potential monthly effects from the Bucharest Stock Exchange (BSE). We take into consideration two main components of BSE: BET, where there are listed some of the biggest Romanian corporations, and RASDAQ, where there are listed, in general, smaller firms. We study the seasonality not only for the returns but also for the trading volume and for the trading values.

The rest of the paper is organized as follows. The second part describes the data and the methodology. The third part presents the empirical results and the fourth part

concludes.

2. DATA AND METHODOLOGY

We use monthly values about the two main components of BSE: BET market and RASDAQ market. Our sample of data is provided by BSE and covers the period January 2000 – March 2011. For both markets we employ the main indices (BET-C, for BET market and RAQ-C, for RASDAQ market), trading volume and trading values.

The monthly returns (R), trading volume measures (Vol) and trading values measures (Val) are computed using the following equations:

$R_t = \ln P_t - \ln P_{t-1}$ (1)

$Vol_t = \ln Vo_t - \ln Vo_{t-1}$ (2)

$Val_t = \ln Va_t - \ln Va_{t-1}$ (3)

In these equations, P_t, Vo_t and Va_t stand for the closing market index price on the day t, the trading volume on the day t and the trading values on the day t, respectively.

We analyze the stationarity of the time series by employing the Augmented Dickey Fuller Test. We establish the deterministic component based on a graphical representation. The number of lags is chosen based on the Schwarz Bayesian Criterion.

The seasonality of time series will be tested using OLS regressions with dummy monthly variables and autoregressive components:

$$y_t = \sum_{i=1}^{12} a_i dm_{it} + \sum_{k=1}^{m} c_k y_{t-k} + u_t \quad (4)$$

A monthly dummy variable dm_{it} takes the value one for the month i and zero otherwise. The k number of lagged values of the variable y is chosen based on the Schwarz Bayesian Criterion. An a_i coefficient associated with a dummy variable dm_{it} could be interpreted as the average returns in the month i. The seasonality is confirmed if at least one dummy variable is statistically significant.

3. EMPIRICAL RESULTS

We analyzed the stationarity of the variables. The results of ADF tests, presented in the Table 1, indicate the stationarity of all the six time series.

We performed a regression between the returns of BET-C and the dummy monthly variables. The results, presented in the Table 2, indicate that no dummy variable is statistically significant.

In the Table 3 there are presented the results of the regression between the trading volume of BET market and the dummy monthly variables. We found statistical significance for two dummy variables corresponding to January and February. Coefficients for these variables are positive.

The results of a regression between the trading values of BET market and the dummy monthly variables are presented in the Table 4. We found two dummy variables which are statistically significant: for January and for May. Both variables have positive coefficients.

In the Table 5 there are presented the results of the regression between the returns of RAQ-C and the dummy monthly variables. We found no dummy variable statistically significant.

The results of the regression between the trading volume of RASDAQ market and the dummy monthly variables are presented in the Table 6. We identified two dummy variables statistically significant: for January and for October. The coefficient for the first dummy variable is negative while for the second is positive.

In the Table 7 there are presented the results of the regression between the trading values of RASDAQ market and the dummy monthly variables. We identified a single dummy variable statistically significant, corresponding to September. Its coefficient is positive.

4. CONCLUSIONS

In this paper we analyzed the monthly effects for two main components of BSE: the BET market and the RASDAQ market. We found no monthly seasonality for the returns but this fact could be related to the significant changes that occurred in the Romanian economy between 2000 and 2011: the industry reorganization, the adhesion to the European

Union, the global crisis a.s.o.

We found seasonalities for the trading volume and for the trading values. Such seasonalities are different for BET market and for RASDAQ market, reflecting the differences between the big companies and the small firms.

For BET market higher trading volume in January and February and higher trading values in January and May resulted. The monthly effects for the first months of a year could be explained by the significant changes occurred in comparison with the previous year. A higher trading volume in May could be caused by the uncertainty about the activity in summer.

For RASDAQ market a lower trading volume in January, a higher trading volume in October and higher trading values in September resulted. The seasonality in autumn months could be explained by the changes in the activity in comparison with summer.

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APPENDIX

Table 1 - Results of Augmented Dickey-Fuller Tests for the six time series

Variable	Lagged Differences	Test statistics	Asymptotic p-value
Return of BET-C	3	-4.11126	0.0009258
Trading Volume of BET market	7	-6.47575	7.906e-009
Trading Value of BET market	2	-10.566	4.951e-021
Return of RAQ-C	5	-4.40116	0.0001
Trading Volume of RASDAQ market	7	-6.18883	4.153e-008
Trading Value of RASDAQ market	2	-10.5325	6.354e-021

Table 2 - OLS Regression for Returns of BET-C

Variable	Coefficient	Std. Error	t-ratio	p-value
dm1	0.0369905	0.0290147	1.2749	0.20481
dm2	0.00119409	0.0292071	0.0409	0.96746
dm3	-0.00976262	0.0277681	-0.3516	0.72577
dm4	0.0471112	0.0289941	1.6249	0.10682
dm5	-0.00507727	0.0292442	-0.1736	0.86246
dm6	0.00635045	0.0289866	0.2191	0.82696
dm7	0.0322628	0.0289894	1.1129	0.26797
dm8	0.00314183	0.0291387	0.1078	0.91432
dm9	0.000268128	0.0290006	0.0092	0.99264
dm10	-0.00896266	0.0289822	-0.3092	0.75767
dm11	0.003838	0.0289893	0.1324	0.89489
dm12	0.0155017	0.028981	0.5349	0.59372
R_1	0.263972	0.0881141	2.9958	0.00333***

Notes: Adjusted R-squared = 0.007583; F (12, 120) = 1.084054; P-value (F) = 0.379588; *** denotes significance at 1% level.

Table 3 - OLS Regression for Trading Volume of BET market

Variable	Coefficient	Std. Error	t-ratio	p-value
dm1	0.284845	0.167695	1.6986	0.09217*
dm2	0.293955	0.168967	1.7397	0.08466*
dm3	0.0820543	0.169121	0.4852	0.62850
dm4	-0.204681	0.175744	-1.1647	0.24663
dm5	0.0664493	0.175328	0.3790	0.70541
dm6	-0.0614773	0.175203	-0.3509	0.72633
dm7	-0.204749	0.165567	-1.2367	0.21880
dm8	-0.0813527	0.166511	-0.4886	0.62610
dm9	0.135345	0.165969	0.8155	0.41653
dm10	0.257799	0.16589	1.5540	0.12300

dm11	-0.0480836	0.166896	-0.2881	0.77380
dm12	-0.214129	0.166993	-1.2823	0.20240
Vol_1	-0.527257	0.0897453	-5.8750	<0.00001***
Vol_2	-0.3561	0.0985386	-3.6138	0.00045***
Vol_3	-0.34762	0.101696	-3.4182	0.00088***
Vol_4	-0.292679	0.101636	-2.8797	0.00477***
Vol_5	-0.223662	0.0924234	-2.4200	0.01713**

Notes: Adjusted R-squared = 0.228189; F(17, 120) = 3.167271; P-value(F) = 0.000132; *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

Table 4 - OLS Regression for Trading Values of BET market

Variable	Coefficient	Std. Error	t-ratio	p-value
dm1	0.290076	0.157496	1.8418	0.06806*
dm2	0.252089	0.158582	1.5896	0.11464
dm3	-0.0286038	0.160293	-0.1784	0.85868
dm4	-0.0143621	0.166606	-0.0862	0.93145
dm5	0.270011	0.157175	1.7179	0.08848*
dm6	0.0463335	0.158598	0.2921	0.77070
dm7	-0.138088	0.158345	-0.8721	0.38497
dm8	0.0507429	0.158875	0.3194	0.75001
dm9	-0.016304	0.15704	-0.1038	0.91749
dm10	0.174053	0.156949	1.1090	0.26973
dm11	-0.0018212	0.157365	-0.0116	0.99079
dm12	-0.115846	0.157155	-0.7371	0.46252
Val_1	-0.379167	0.089657	-4.2291	0.00005***
Val_2	-0.276703	0.0928688	-2.9795	0.00352***
Val_3	-0.25883	0.0901229	-2.8720	0.00485***

Notes: Adjusted R-squared = 0.158742; F(14, 120) = 2.752178; P-value(F) = 0.001506; * and *** denote significance at 10% and 1% levels, respectively.

Table 5 - OLS Regression for Returns of RAQ-C

Variable	Coefficient	Std. Error	t-ratio	p-value
dm1	0.0195384	0.0222308	0.8789	0.38122
dm2	0.00518344	0.022285	0.2326	0.81647
dm3	-0.0198435	0.0212971	-0.9317	0.35334
dm4	0.0201236	0.0222667	0.9038	0.36794
dm5	0.0236965	0.0222708	1.0640	0.28946
dm6	-0.000918468	0.022364	-0.0411	0.96731
dm7	0.0191628	0.0222359	0.8618	0.39052
dm8	0.00788829	0.0223044	0.3537	0.72421

dm9	-0.00969621	0.0222605	-0.4356	0.66392
dm10	0.00254952	0.0222331	0.1147	0.90890
dm11	-0.0089364	0.0222275	-0.4020	0.68837
dm12	-0.00200792	0.0222404	-0.0903	0.92821
R_1	0.282046	0.0876122	3.2193	0.00165***

Notes: Adjusted R-squared = 0.019777; F(12, 120) = 1.221931; P-value(F) = 0.275916; *** denotes significance at 1% level.

Table 6 - OLS Regression for Trading Volume of RASDAQ market

Variable	Coefficient	Std. Error	t-ratio	p-value
dm1	-0.33319	0.18079	-1.8430	0.06789*
dm2	0.047352	0.183334	0.2583	0.79665
dm3	0.234486	0.178159	1.3162	0.19072
dm4	-0.196784	0.187299	-1.0506	0.29561
dm5	0.16978	0.179984	0.9433	0.34749
dm6	-0.0213194	0.177386	-0.1202	0.90454
dm7	-0.0704796	0.177314	-0.3975	0.69174
dm8	-0.115669	0.175701	-0.6583	0.51163
dm9	0.192555	0.175798	1.0953	0.27565
dm10	0.375482	0.176702	2.1250	0.03571**
dm11	-0.191654	0.17977	-1.0661	0.28859
dm12	-0.234189	0.180641	-1.2964	0.19740
Vol_1	-0.541396	0.0880646	-6.1477	<0.00001***
Vol_2	-0.37796	0.0948372	-3.9854	0.00012***
Vol_3	-0.31961	0.0881202	-3.6270	0.00043***

Notes: Adjusted R-squared = 0.286497; F(15, 120) = 4.413303; P-value(F) = 1.67e-06; *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

Table 7 - OLS regression for Trading Values of RASDAQ market

Variable	Coefficient	Std. Error	t-ratio	p-value
dm1	-0.0826961	0.172136	-0.4804	0.63184
dm2	-0.151798	0.171706	-0.8841	0.37850
dm3	0.223299	0.171024	1.3057	0.19425
dm4	-0.157581	0.180636	-0.8724	0.38481
dm5	0.19355	0.173303	1.1168	0.26638
dm6	-0.209423	0.174225	-1.2020	0.23180
dm7	0.0341965	0.17438	0.1961	0.84487
dm8	-0.115149	0.17286	-0.6661	0.50664
dm9	0.29251	0.172749	1.6933	0.09309*
dm10	0.121562	0.173992	0.6987	0.48616
dm11	-0.0884012	0.17329	-0.5101	0.61093
dm12	-0.1039	0.17348	-0.5989	0.55040
Val_1	-0.514541	0.0909426	-5.6579	<0.00001***
Val_2	-0.387397	0.0962249	-4.0260	0.00010***
Val_3	-0.198614	0.0909278	-2.1843	0.03095**

Notes: Adjusted R-squared = 0.227713; F(15, 120) = 3.488749 ; P-value(F) = 0.000064; *, ** and *** denote significance at 10%, 5% and 1% levels, respectively.

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COMMUNICATION STRATEGY OF THE MINISTRY OF DEFENCE OF THE SLOVAK REPUBLIC

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Abstract: *The article deals with marketing communication issues of the Ministry of Defence of the Slovak Republic. The main author's attention is focused on the analysis of current approaches of MoD to the implementation of marketing communication. Marketing Communication of the Ministry based on carefully thought out and sophisticated communication strategy could be the means that can effectively assist to the achievement of its objectives. The communication strategy of the Ministry should first of all contribute to maximize its communication efforts exerted to achieve the support of key subjects and a better understanding between the department and its target audience at home and also abroad. The primary long-term goal of the communication strategy can be considered a systematic effort to improve the reputation or image of the armed forces, respectively to strengthen their goodwill in the public eye. In this context, the author set attention to the clarification of the place and role of public opinion in developing a communication strategy of the Ministry.*

Keywords: *Marketing communication. Communication Strategy. Ministry of Defence. Image*

1. COMMUNICATION AS A SIGNIFICANT TOOL OF MARKETING MANAGEMENT OF THE PUBLIC SECTOR SUBJECTS

Marketing concept of management and a set of activities known as marketing are the basic attribute and means of existence of enterprise subjects in market-oriented economic conditions, typical for democratic society. Althought such situation definitely is not common for public sector subjects, conversely it is very often rejected by the managers, practical experience indicates, that applying marketing management in this sector seems inevitable in the increasingly competitory environment.

The fact that marketing helps create, maintain and develop ties between the goals of the given subject based on its mission and the strategies chosen to achieve these goals following assigned sources in the framework of constantly changing conditions, is an important argument in favour of incorporation and utilization of strategic marketing management.

An important and inseparable part of marketing management of every modern organization or institution is marketing instrumentarium forming the so-called marketing mix. The composition of the marketing mix in case of public sector subjects has to respect not just the particularities of this sector, but also the mission and tasks these subjects are performing. That indicates, that traditional marketing tools require a certain modification or adjustment to fulfilling new tasks.

The most dominant tool of marketing mix of public sector subjects can be considered communication, which performs several tasks. It provides information, building communication ties with target audiences (citizens, partners, providers etc.), it affects the behaviour and public opinion (external as well as internal), it helps create a positive image etc. It indicates that also in public sector we can notice informing communication, communication acquiring support and that might be the reason for its attribute „marketing" communication.
Empirical knowledge suggests that using new approaches, methods, tools, means and forms of marketing communication especially in the business practice is a natural and sufficiently qualified basis also for the public sector subjects, when respecting the particularities of the given subject as well as its sphere of action, of course.

Practice findings confirm that commercially-oriented subjects as well as public sector subjects increasingly deal with the issue of marketing communication. The Ministry of Defence of Slovak Republic (MoD of SR) is not an exception. It aims to perform its communication activities systematically and purposefully following their own communication strategy primarily focused on the public and media.

In the next chapter of the article we are trying to define the current methods of MoD of SR of solving the issue.

2. CURRENT METHODS OF MINISTRY OF DEFENCE OF PERFORMING MARKETING COMMUNICATION

Activities of the ministry in the scope of marketing communication are supervised by the Communication department of the Office of the Minister of Defence of the Slovak Republic. The main task of the department is to deliver current information from various areas of the ministry. „The reorganized communication department is based on professional staff, effective structure and manager rules of administration." [3]. It consists of two sections – Press section and Marketing and public affairs section. This structuring indicates that the department acts as a contact organ of the ministry not only for the press, but also for the public (expert as well as laical). The Communication department has the biggest contribution to preparing and performing activities presenting the army to the public. In addition, it is the contact place for all natural persons and legal persons that ask for information about the department available for the public according to the Act No. 211/2000 Coll. on free access to information.
This task is performed in line with the valid Directive No.5 from the year 2000 of the Ministry of Defence of the Slovak Republic on free access to information.

The Ministry of Defence of the Slovak Republic in its efforts to secure a unified method of communication with the public follows the Directives of the Ministry of Defence of the Slovak Republic No. 60/2008 on communication with the public. The directives are designed for the ministry, offices and facilities under the ministry, for the General Staff of the Armed Forces of the Slovak Republic (AF of SR), Military Police, contributory organizations, budget organizations, state companies as well as stock companies. The purpose of the directives is to [7]:

- define tasks, methods and activities of performing communication with the public,
- define the system of coordination of providing information,
- provide a more detailed and more effective informing about the activities of the ministry and about the Armed Forces of the Slovak Republic (AF of SR),
- provide a positive influence on the public opinion.

Communication with the public is provided in line with the mentioned directives by several subjects. The subjects are [7]:

- Minister´s Advisor – spokesman of the ministry,
- General Staff Officer for the public affairs,
- public affairs officer,
- Head of the organization branch of the ministry,
- Head of the Office,
- Chief of Military Police,
- Chief of organization branch of the general staff,
- Commanders of ground forces, air force, training and support force, Medical Corps Commander, unit commander, head (Officer Commanding) of the office and facilities of the Armed Forces of SR,
- statutory assistant of legal person,
- professsional soldier assigned to perform given activities in line with the mentioned directives.

The tasks of these subjects related to communication with the public are defined in the directives.

From the typology perspective presented in homeland and foreign literature we can say that marketing communication of the ministry takes different shapes and forms. The point of view is the determining factor. From the pyramid perspective it is the group or interpersonal level of communication. According to the time and content context it is the primary or secondary communication. According to the environment the communication is performed in, it is either the internal communication, let us say communication with the internal environment that can further be divided into formal, informal, vertical, horizontal, personally oriented (subject), non-personally oriented (object), goal or process oriented [4], or it is the external communication, let us say the communication of the subjekt with the outer environment (public).

According to the tasks the marketing communication is supposed to perform we can differentiate between informing communication, acquiring communication, persuading communication, supporting communication etc.

The ministry is striving to enforce the goal method which is typical for the communication focused on the complexity of goals. From the theoretical point of view the marketing communication goals of the ministry can be generally defined as „specific communication task, which the communication has to perform in relation to the defined target market or audience[1] during a certain period of time"[5]. It is necessary to emphasize that the marketing communication tasks of the MoD of SR are significantly determined by their specific mission and tasks, which are performed by the ministry in favour of our country and citizens. In comparison

[1] Note: According to Štefka, R. and collective, the audience becomes market just in case a specific subject (organization, institution) decides they want to acquire some sources from this audience (not just financial sources), while they offer some advantages in exchange.

with enterprise-oriented or commercially-oriented subjects, which strive to achieve especially economic goals such as increasing the profit, sales or the market share, the goals of the ministry are different. They have the features of non-economic or communication goals, such as providing current information about the activities of the ministry, specifying negative or incomplete news, as well as reacting to negative news related to the ministry – satisfying the information needs of the public. Other goals are: earning the public´s trust, creating good relations with the public through favourable publicity and building „corporate image", creating or improving the image of the armed forces, improving their credit etc. that means influencing the public opinion with the desired direction.

Since the condition of implementation of successful marketing communication in the ministry is systematic and long-term building and maintaining the effective communication of the ministry with its target markets, groups or audiences, it is necessary to define these subjects first and then find out about their needs, requirements and expectations and finally try to achieve the given communication goals with each of them by means of tailor-made communication strategy.

The target audiences of the MoD can be considered multicomponent. In the broadest sense they are represented by the public, expert as well as laical (citizens), eventually external and internal (professional soldiers and civil employees) public.

The goal of the communication activities of the ministry oriented on the public is the effort to achieve a real or constant change of attitudes, opinions and activities of various target groups. This requires knowledge of the audience, circumstances of the communication, good strategy, its performing and adequate evaluation, eventually correction, i.e. performing the so-called strategic communication process.

The first-rate communication activity or the connection between the ministry and the public is the existence and effect of an adequate image. The ministry has the PR (public relations) and publicity for the communication with the public. An important part of the activities of the ministry focused on the public is primarily oriented on young people, who represent the potential for complementing human resources depending on the needs of the ministry. Especially the communication activities performed within the marketing form of recruitment and central recruitment of the ministry are purposefully oriented on young people.

In the narrower sense the audiences of the ministry can be considered the cooperating home partners (e.g. organs of civil service and regional self-government, interest unions and associations, lobbying groups, companies, organizations and institutions with any connection to the department), as well as foreign partners or allies (especially from the states of the Alliance). Enterprise subjects working in the position of suppliers and providers of various services for the ministry (performed by means of outsourcing) have a significant position among the homeland partners.

Since defence is financed from the state budget and big amounts of financial means are spent on it, the ministry of finance of the Slovak Republic is also the audience that the representatives of the ministry of defence communicate with.

Communication activities of the ministry are focused also on buiding correct relations with those who inform about it. Therefore there are also media among the target audiences of the ministry (including the press organs of the Alliance). The analysis results have shown that the main attention is focused on the journalists.

Based on other findings, we can say that the marketing communication of the ministry is typical for the constant expansion of elements of traditionally presented communication mix – which is especially advertisement, public affairs and publicity[2], by new tools – especially event marketing and direct marketing. We can also notice the usage of new communication media, multimedia and modern technologies (CD-ROM, DVD internet, e-mail, cell phone etc.), thanks to which the ministry does not significantly lag behind the comercially-oriented subjects in the marketing communication. We can also notice a great effort to build a strong „corporate identity" that supposes unification or integration of all tools, means and forms of communication by means of which the ministry strives to affect the target groups. „Corporate culture is shown in all communication outcomes and visual elements of the ministry and gives a certain signal of unification and order in it" [3].

2. 1 COMMUNICATION STRATEGY FOCUSED ON THE IMAGE

The common decision about marketing communication includes deciding about what to say, whom to say it and how to say it while these decisions are included in the communication strategy [4]. Communication strategy of the ministry is supposed to make sure that the information they deliver will impress, will be heard, underwood and they will finally stimulate the target audiences to a desired reaction or behaviour. By means of communication strategy the ministry wants to maximize the effect of the exerted communication effort, that means to achieve the support of the key subjects and improve the sympathy between the ministry and its target audiences at home and abroad.

Adequatly chosen communication strategy of the ministry should answer the following questions: Why should we communicate – what is the link between the marketing communication goals and the total goals of the ministry, its capacities and knowledge about the target groups or audiences? What should be the topic of the communication – what information do the target audiences absorb the most effectively? How to communicate – by means of what channels, when and where? What should the communication be oriented on – who can be influenced by adequatly chosen information?

From the theoretical point of view processing the communication strategy must be considered an examination and consideration of market risks, systematic work, constant revaluating of weak sides and disadvantages in comparison with the competitors and finally systematic determination of goals and direction of the future development of the company, organization or institution [5].

The ministry of defence when creating the communication strategy does not rely just on the experience and knowledge of the qualified

[2] Note: Regarding the specific position of the ministry, its objectives and mission, we can say that other tools of the communication mix – sales support and direct sales, have just a low utilization in the marketing communication of the ministry, if ever.

employees, but it also uses the servises of experts – specialists in the individual fields of marketing communication (e.g. services of advertisement or research agencies). In the field of implementation of communication strategy the Communication department cooperates with organs of Civil service, regional self-government as well as the representatives of non-governmental organizations.

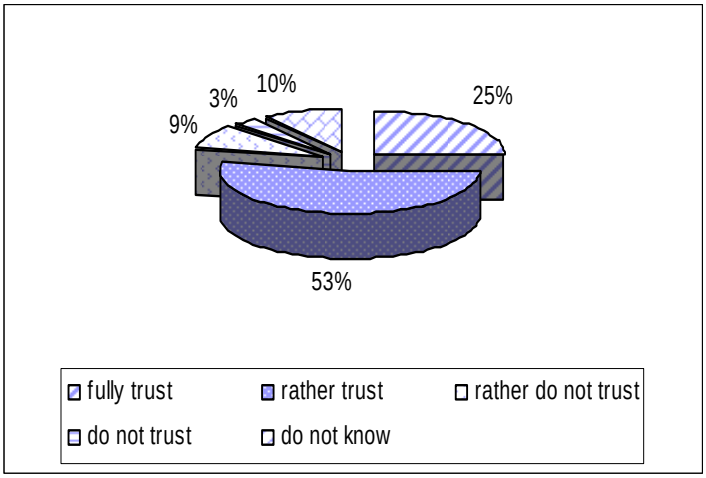
One of the most important objectives of the communication strategy is to improve the credit (image) of the Armed Forces, let us say to strengthen their reputation. Positive opinion about the Armed Forces plays an important role in the increasing pressure on the efficient use of public finances in the present day. Since the public opinion about the department is significantly influenced by the quality of the available information, the primary condition of meeting the objectives of the communication strategy of the MoD is presenting true information by trustworthy and convincing means. The credit of the Armed Forces can be harmed by negative phenomena occuring in the security environment and in the society whatsoever. Therefore the ministry within its communication policy has to strive to present clear and coherent ideas of its goals and methods in the field of defence and security policy of the state.

2. 2 PUBLIC OPINION RESEARCH

Researching the public opinion is an important tool of the communication strategy of the Ministry of Defence of SR. „Public opinion is not just the guarantee of conclusiveness of democracy, but also a factor that co-determinates the success of each operation we involve our forces in" [2]. Knowledge about the manifestations and content of the public opinion helps when choosing and applying the intentions related to recruitment of new military staff, or eventually other activities of the ministry in relation to the public.

The current opinion on the Armed Forces (AF of SR) can be presented following the public opinion research performed by the Public opinion research agency Ltd. in the year 2010. The research included 1 128 respondents older than 18 and it was representative in the features such as sex, age, education, address and nationality. The results of the research are shown in figure 1.

Fig. 1 Credit of the Armed Forces of SR



Source: ČUKAN, K. Dôveryhodnosť Ozbrojených síl SR. In Obrana. roč. 18, č. 8, 2010, p. 33.

The question: „Do you trust our army" was positively answered by 78% of respondents, 25,4% of them answered that they fully trust the army, 52,7% answered they rather trust our army. Only 12% of the respondents answered that they do not trust our army, the rest 10,5 % could not answer. Other research results indicate that the armed forces are an institution that has the trust of all layers of citizens. Younf people as well as middle-aged and old people trust our army. There were also no

significant differences in the political nor religious perspectives. Our army is trustworthy for Slovaks as well as members of national minorities living in Slovakia. The respondents valued the skills of the Armed Forces. The agreement rate with the statement „the army is able to perform the tasks on missions abroad, help citizens in case of natural disasters, fulfil their obligations within NATO, participate in defending the public order, meet their objectives when fighting terrorism and provide defence and security of the state" is between 74% to 96% [1].

The results of recently performed empirical researches point out the fact that in spite of the relatively stable and strong trust of the public in the AF of SR, we have lately noticed a decreasing trend of people interested in joining the professional army. Joining the army and working for them has become the last choice for even unemployed people. Defining the reasons of this situation, adequate communication strategies along with other measures can temporarily improve this situation and help increase the attractivity of this profession in comparison to other jobs again.

One of the options of increasing the attractivity of the Armed Forces of SR for the public is a properly chosen advertisement representing the professional armed forces as a „modern institution with a human face, offering an interesting and adventurous job" [3]. When processing individual advertisement products, the ministry relies on the help of sociologists from the MoD of SR as well as civil media agencies [2].

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IMPLEMENTATION OF AN ECONOMIC-MATHEMATICAL MODEL IN ORDER TO DETERMINE THE EFFECTIVENESS OF INVESTMENTS IN THE CHANGES FROM THE DEFENSE INDUSTRY

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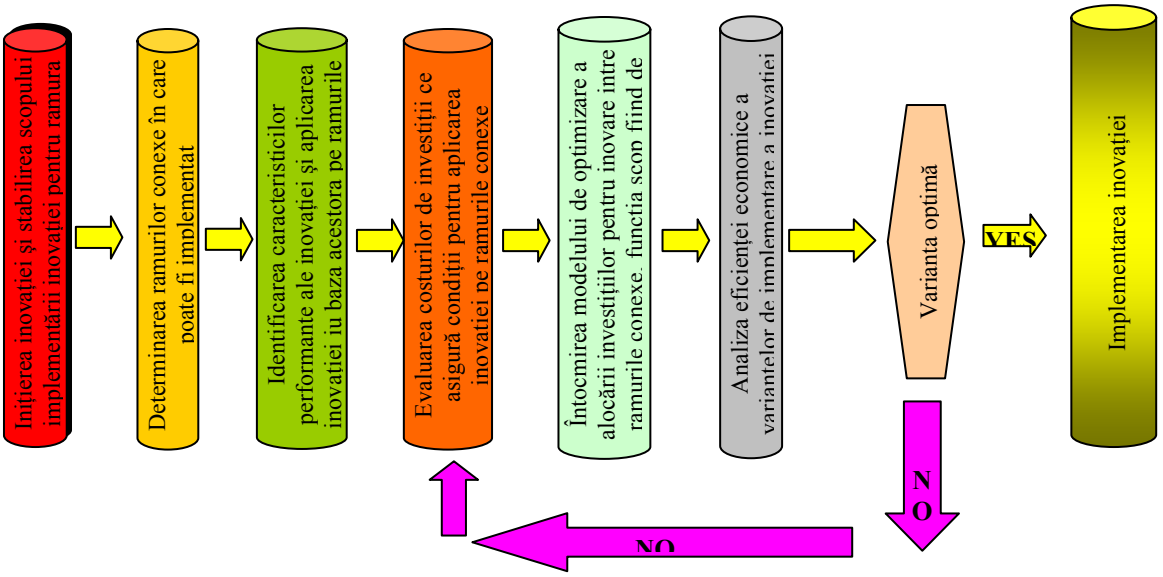
Abstract: *Technically, this method is a systemic process of analysis and economic management, resulting from the foundation of the method for determining the effectiveness of industry innovation through technological interdependence, but also from the content and time frame for achieving it. It is mainly based on taking decisions on the application and integration of innovation in the economic activity of the companies for estimating the costs necessary for the implementation of innovations, ie, placing the capital needed to create and integrate new products or technologies and of the economic consequences resulted in other branches, different from the basic use of the innovation.*

Since the control and maintaining of the problem in the imposed limits is only possible in the hypothesis that the implementation is targeting a small number of sectors, it is imperative to state that according to a specific legislation adapted to the defense industry (GEO nr.95/2002 with additions and amendments), of the many objectives set for the distribution of investments in this area, we believe that the design, implementation and development of technologies and advanced munitions, the development and acquisition of new equipment, including information, represent priorities.

Keywords: *economic mathematical model, innovations, arms industry, integration.*

Solving the systemic problem and increasing the studies on the evolution of economic processes is obtained by using the economic and mathematical methods. In this regard, in order to obtain an effective and comprehensive estimate of innovation, based on the drawing method for assessing the effectiveness of innovation that has been discussed previously, it is recommended an economic-mathematical algorithm used for the assessment of economic efficiency that is built as follows (Figure 1).



Source: Developed by author

Figure 1. Steps taken in assessing the effectiveness of innovations in the national economy

Under assessment of efficiency in each stage of the review before taking final decision, there is a permanent identification of all the ways to find the optimum solution to make the most suitable decision on the application of innovations within the national economy.

From the brief method of technological interdependence between branches there can be outlined the organization of the algorithm of efficacy innovation [1] which is structured on the choice and application of optimal investment costs, including the solution adopted for the use of innovation. This is structured in three stages, as follows:

a. The stage of introducing technical improvement to the new field of activity - it includes selecting it and initiating the design decisions that specify the meaning of the expression of the areas of use for this innovation, but is closely following the finding and applying of the most suitable decision. Also at the start of the creation of the effectiveness management system, an important point is the basis for decision on the application of innovation, by specifying the goals for the main industry.

Exemplifying, they can be: the improvement of the production and services organization, the increase of productivity, limiting all the costs and guaranteing the superior value of the products, reducing the raw material and electricity consumption, etc.

b. The evaluation stage, focuses on studying the best parameters of innovation, because after that, the main directions of application set by the original decision will be included in the innovation. In this phase the are investigated and highlighted the important technical parameters of innovation, the investment costs necessary to use innovation are determined as well as the circumstances that set the stage with the highest value of innovative product effectiveness. The high quality technical parameters of innovation and their adequate support on the market should constitute the essential starting point for accomplishing economic efficiency increase.

c. The synthesis stage, involves the development of the rational processes that produce the desired effect, namely the distribution of stock investment to achieve innovation in various sectors of the economy. In this stage, the designated possibilities can become applicable in practical solutions. There are also being searched the most suitable ways for checking and for the practical application of innovation and compliant project implementation activities, these being accomplished under conditions of return in terms of investment efforts. Hence, the decisions regarding the application of innovation are based in a high percentage on

the quantity of goods allocated that are indispensable for the application to economic news in all the other branches. In such circumstances, to ensure an appropriate relationship between costs that are needed for ensuring the use of innovation and all the results obtained, it seems appropriate to express the guidelines for the implementation of innovations, which depend on the development of the application innovation.

Likewise, the manner in which the investment envisaged for the implementation of innovations are designed specifically by industry and innovation that can be integrated, is, along with identifying the circumstances and benefits of various options for implementation, the first and essential aspect in assessing the economic efficiency of innovation, having intense implications on the effectiveness of future innovations. Thus, we find that the economic efficiency of investment plans in innovation is subject to a large extent to the availability of resources and to the manner in which these are distributed. Being a part of economic efficiency, we consider that the distribution of investment resources that can be divided on sectors must be focused on the growth of those which raise the most concern for economic and social development and whose general assessment to justify all expenditure incurred in the final. Usually, the variety of problems relating to investment supports several possible solutions, which causes to the same extent also many different results.

For the vast variety of solutions, there is always one, sometimes more, which is chosen as the most useful, because of the better result expected and achieved and that essentially represents the level of obtaining the objective associated with the most effective solution, ie the optimal solution. Today, with the economic agents the most sensitive issues arising in the international management process are those related to optimization [2]. Obtaining and solving optimal solutions for resource allocation can be performed through various mathematical processes. The set of specific economic systems and the management of their many problems have created a variety of economic-mathematical representations, called models [3].

The study of these problems with the help of a mathematical model allows determining the appropriate variations, participating directly to the increase of economic efficiency and hence the efficiency of economic branches of the existing operators. In the most appropriate distribution of the needed resources, an important role plays the optimization calculations of the allocation of investment that administer the linear mathematical programming [4]. Therefore, linear programming plays an extremely important part both in the theory and in economic practice. The economic theory has gained from the interdisciplinary approach that allowed deep research examining the maximum efficiency of complex systems, it accepted the intrusion of new concepts of the economic optimum, improved the methods of learning and knowledge and the economic practice has gained a very useful tool of economic analysis and strengthening decisions.

All mathematical programming models and especially their subclass, linear programming models are also dealing with issues of prediction, in which both the optimized objective and the requirements imposed by the problem are expressed by linear functions. Thus, the implementation of linear programming can be also used in our case, that of the appropriate distribution of investments by which we attempt to address the problem effectively. Their variety is

determined mainly by the structure of the "subject" studied, by the examination purpose and information available. Often, due to the large proportions, the diversity of processes and events taking place in the industry and the management of their offices, due to the fact that they are carried out gradually in stages specific to the production process, solving by traditional means the various problems that the trader faces becomes insufficient, for which it is resorted constantly to their solving by reformulation as linear programming problems.

In these circumstances, various mathematical linear programming problems, recognized as issues of improvement, occurr in the setting of variables that have the role to check a specific algebraic restrictions system and thus positively or negatively affect an initial function called objective. It is the goal toward which the system tends to be improved to reach the highest possible standard. Only in this way it will positively and really influence the specific social and economic reality.

Restrictions to which we have referred and which are controlled by predetermined variables, mean, in fact, limits imposed by the issues of optimizing the initial situation and the improvement of these variables.

Therefore, the mathematical programming in the field is to determine the costs necessary for the introduction and transfer of technological innovation in both basic and the complementary branches [5]. Assessment of total costs includes both direct and the subsequent costs necessary for the efficient generalized implementation of innovation, because this relationship is reciprocal: the existing costs for introducing innovation in the key field generates a series of new costs to transfer the same technology in complementary fields dependent or determined by field basis.

Programming will have to undergo several stages. The first stage aims at the basic field. The problem will be designed by setting the determinant terms related to the basic field, respectively the costs and benefits resulting from the implementation of innovation, only then being settled the costs for technology transfer in complementary areas. Next there follows the most difficult stage, that of designing mathematically the problem that will translate into a computer model. All these efforts aim at implementing a computer program to allow the assessment of all the costs and benefits arising from the introduction of innovation, thereby achieving, by saving time and labor, the optimal variant of investment [6].

In the following we will exemplify this by designing a problem aimed at introducing new technological processes. This aims to streamline production units belonging to different areas, but which influence each other. We establish that the amounts allocated to innovation in all areas of industry k, branches R1, R2 ,...., RK is the Sum.

Consider true costs of the basic fields

$$R_i, i = \overline{1,k} \quad (1)$$

as known and equal, each with s_i, and the benefit obtained from 1 u.m. investment, each of the branches, from the application and use of innovations, equals *pi*. As a result of the creation of other products or the start of operating the technology used for the first time, there arises the need for additional investment, aiming to ensure conditions for spreading the innovations. In order to supplement this, there is required an amount of investment to ensure the implementation of s_c related innovations in the activities of other sectors (industry) *A1, A2, ..., An*. When the expected benefits for 1 u.m. related investment in the industry *Aj* is worth *PIJ* um, and *xij* is related investment allocated in the industry

$$j, (j = \overline{1,n}), \quad (2)$$

product *pij xij*, expresses the benefit in the industry

$$A_i (i = \overline{1,n}), \quad (3)$$

from the investments related to implementation of the distributed new technology.

Therefore, the total benefit of innovation applied will represent the result of adding the product

$$\sum_{i=1}^{k} p_i s_i , \quad (4)$$

which is benefit in the main branches of application of the innovations and product

$$\sum_{i=1}^{k}\sum_{j=1}^{n} p_{ij}x_{ij} \quad (5)$$

and which is the benefit achieved from the implementation of the innovations in the branches attached to each main branch. Thus,

$$P_{total} = \sum_{i=1}^{k} p_i s_i + \sum_{i=1}^{k}\sum_{j=1}^{n} p_{ij}x_{ij} . \quad (6)$$

What emerges, issues discussions on how to ensure the greatest efficiency of the related investments in industries in which the new technology is to be implemented, so that the resulting benefit from this active participation is very high. The circumstances determine the fact that the direct investments specified in the application of the new technology in the main branch and their effectiveness are known independent of the innovative application.

In these circumstances, you know the constitutive element

$$\sum_{i=1}^{k} p_i s_i \quad (7)$$

of the total income (*Ptotal*), the problem analyzed being limited to the calculation

$$\max Z = \sum_{i=1}^{k}\sum_{j=1}^{n} p_{ij}x_{ij} \quad (8)$$

which constitutes the target destination expression that depends on the innovative plan, which determines the highest benefit.

The set of limitations on which the implementation of innovation depends, is limited to the investment stocks that are available and are established in order to carry out these activities. In order not to overlook the limitations we have to consider the investment costs necessary to implement innovation in every branch. These imposed limitations are:

a. Determining all costs necessary for the application of innovation:

$$\sum_{i=1}^{k}\sum_{j=1}^{n} x_{ij} \le S_c \quad (9)$$

b. Restrictions on the total amount allocated to the related investments established for the implementation of the new technology in the neighboring branches of the basic industry R_i, in such a way that the investment does not go over the limit that was established prior to the implementation of the new technology in the basic industry:

$$\sum_{j=1}^{n} x_{ij} \le s_i (i = \overline{1,k}) \quad (10)$$

c. The planning of the minimum related investments required for the related branches to ensure the use of the innovations that have already been integrated into the main branches:

$$\sum_{j=1}^{n} x_{ij} \ge x_{ij\min} (i = \overline{1,k}; j = \overline{1,n}) \quad (11)$$

d. This condition implies that the fundamental variables can not be negative, as it is necessary to fulfill the requirement in the previous paragraph, ie to meet the minimum investment, as follows:

$$x_{ij} \ge 0, (i = \overline{1,k}; j = \overline{1,n}) \quad (12)$$

Obviously, what is sought both by introducing the new technology in the primary sector and the secondary sectors is achieving as large profits as possible with minimum investments, meaning the efficient use of the sectors to be modernized. That this is the very goal of the programming based on the analyzed mathematical problem, namely achieving an optimal investment, as we show below:

$$\max \quad Z = \sum_{i=1}^{k} \sum_{j=1}^{n} p_{ij} x_{ij}$$

$$\begin{cases} (1) \sum_{i=1}^{k} \sum_{j=1}^{n} x_{ij} \le S_c; \\ (2) \sum_{j=1}^{n} x_{ij} \le s_i \, (i = \overline{1,k}); \\ (3) \sum_{j=1}^{n} x_{ij} \ge x_{ij} \, (i = \overline{1,k}; \; j = \overline{1,n}); \\ (4) \, x_{ij} \ge 0, (i = \overline{1,k}; \; j = \overline{1,n}) \end{cases} \qquad (13)$$

Given the general rules for linear programming, the formula that will reflect the proposed efficient mathematical problem is given of the below:

As a result of these formulas we find the factors affecting the investments required for introducing the new technology process in the related sectors and which determine a maximum value for z, so that

$$P_{total} = \sum_{i=1}^{k} p_i s_i + \sum_{i=1}^{k} \sum_{j=1}^{n} p_{ij} x_{ij} \, . \qquad (14)$$

The problem exposed took into consideration all the economic consequences determined by the way in which investments were made, except for the length of time in which they take place and then they are covered.

Concluding, we consider that in this mathematical model, the primary investment is instantaneous and the implementation of the latest technology in the related sectors is subsequent to its full implementation. When the period in which the investment in related sectors is higher, the limitations also change and the original function must be recalculated and updated. Updates are made by the coefficient a^{t-1}, where the update factor $a = (1 + i)^{-1}$.

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IMPACT OF GLOBALIZATION ON AIRPORT INDUSTRY

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Abstract: *Globalization is, at its most literal sense, the process of creating, transforming things or phenomena into global ones and it is synonymous with expansion rush of international capital, in various forms to all over the world. Air industry is playing an important role in this expansion. Both airlines and air travel infrastructure must respond to the always changing demands for its services. Demand for air transportation is derived from international transport requirements for high quality, speed, reliability and safety.*

Keywords: *globalization, air transportation, airport industry*

1. INTRODUCTION

Globalization has become a fashionable concept in the social sciences, the main dictum of the management specialists, journalists and politicians of any kind. It says that we live in an era where most of the social life is determined by global processes, where cultures, economies and national borders are disappearing. Evolution of the airlines is a very intuitive example for developing alliances and globalization strategies for the coming years. For airlines there are several advantages of such a development, like strengthening market position, network extension, product integration, brand loyalty and costs reduction.

2. THE IMPACT OF GLOBALIZATION ON AIR TRAVEL

Air transport is a major industry in itself, with a significant contribution to economic, political and social processes. As it is in case of other types of transportation, demand for air transport services is a derived one and it is based on the need and the desire to achieve more final objectives. Air transport contributes, for example, to the economic development of a region or a particular industry such as tourism. Lack of air transport, like in case of the absence of any other economic component, can prevent an effective growth. On the other hand, an excessive or inadequate transportation is a waste.

3. DEVELOPMENTS AND STRATEGIES IN THE AIRPORT INDUSTRY

Major theme of the literature on the aviation industry is focused on the unprecedented changes taking place in this field. After liberalization of air transport activities, which took place first in the U.S., then Europe and then even in Asia, with serious repercussions in airport operations, we are witnessing today a great tournament held under the sign of globalization. In the airport industry, first signs of globalization have emerged as new market availability: facing the limited possibilities of expansion at home, companies involved in airport management are willing to seek business expansion outside. There also appeared a number of organizations, from outside of the aiport business, interested in using these

opportunities to become "global players" in the airport industry. They have achieved notable successes as they had the ability and understanding to become themselves international companies.

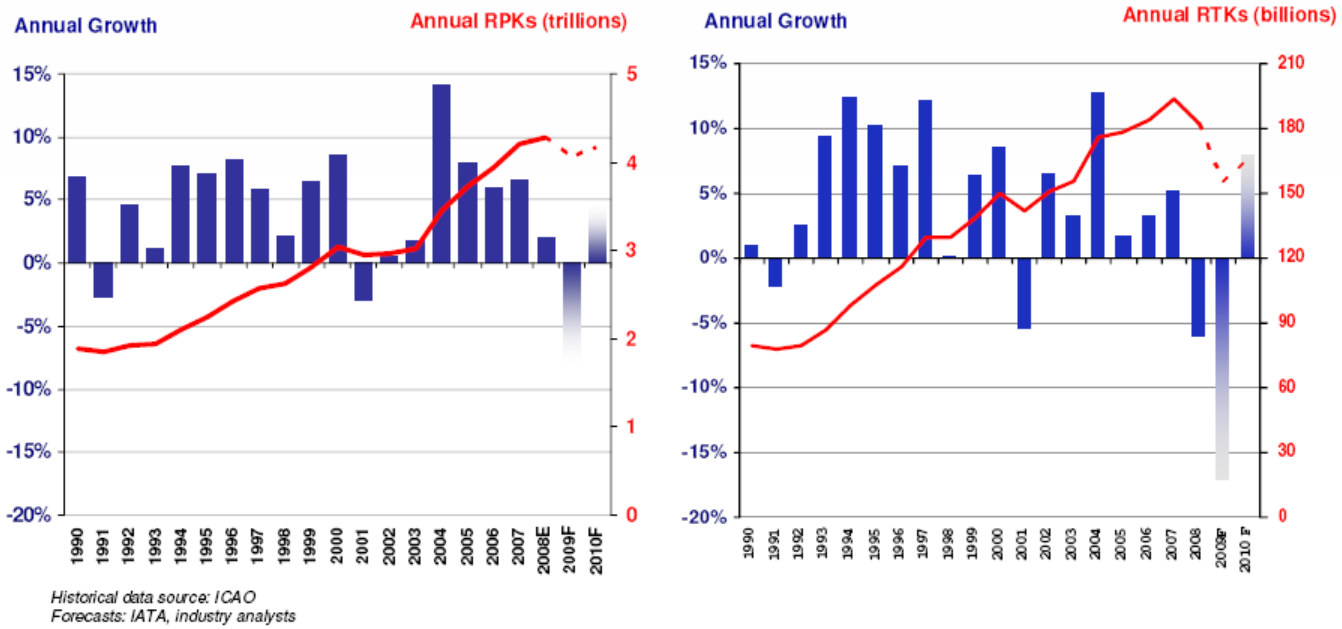

Fig. 1: Evolution of passenger traffic (left) and of the cargo traffic (right). The chart shows the annual percent increase in blue and red with the number of paying passengers x km (left, in billions) and freight tonne x km (right, in millions).
Source: Boeing's Global Strategy Summit 2009

Development of air transport has experienced a dramatic increase until the '90s, experiencing doubling of the traffic values at every 10 years. Since the 90s, the air transport market is approaching maturity, increased traffic, gradually decreasing by 5% per year, except that in some markets such as Asia - Pacific, growth remained at a rate of more than 7% (ICAO, 2001).

Despite declines in traffic in 2001, 2002 respectively, due to the September 11 terrorist attacks, the general trend was to increase the values of both passenger traffic and cargo traffic. A new challenge is the economic crisis we are going through, which has dramatically affected the airline industry.

In total, traffic values are expected to decrease by 6.8% for passengers' transportation and by 19.3% for cargo, being visible a return of demand in the second half of the year (decreases reported for July was 2.9 % for passengers traffic and 11.3% for cargo). While market values of the traffic have declined a lot, the physical (actual reduction in the number of aircraft that have made racing) are -3.8% in passenger traffic and -10.2 in cargo traffic. Figure 2 summarizes the statistical figures on the evolution of air traffic in 2010 compared to 2009.

Year on Year Comparison	Jan 10 vs. Jan 09						2009 vs. 2008					
	RPK	ASK	PLF	FTK	AFTK	FLF	RPK	ASK	PLF	FTK	AFTK	FLF
Africa	6.3%	5.5%	66.1	30.4%	9.2%	21.8	-2.0%	1.5%	66.7	-9.2%	2.0%	24.0
Asia/Pacific	6.5%	-1.4%	77.8	38.4%	10.3%	61.9	-4.6%	-5.3%	73.7	-9.1%	-11.1%	60.8
Europe	3.1%	-0.2%	74.5	11.6%	-6.9%	48.5	-3.3%	-2.9%	77.5	-16.1%	-10.8%	47.3
Latin America	11.0%	3.4%	80.3	30.9%	20.7%	37.3	0.0%	1.4%	72.9	-4.0%	1.2%	38.6
Middle East	23.6%	17.2%	75.3	33.0%	19.3%	42.6	11.2%	13.6%	73.0	3.9%	6.8%	42.7
North America	2.1%	-2.2%	77.6	27.3%	-4.3%	39.6	-5.2%	-5.0%	79.6	-10.8%	-9.7%	37.7
Industry	6.4%	1.2%	75.9	28.3%	3.7%	49.6	-2.5%	-2.1%	75.7	-10.1%	-8.3%	48.6%

Fig. 2: The evolution of air traffic in 2010 compared to 2009. Source: IATA 2010.

Projections on the rate of development of air transport are optimistic, despite a decline in the market in 2009 generated by the global financial crisis. It is estimated that after passing this point, air traffic growth to continue with the 4-6% per year.

IATA Global Traffic Forecast

	International and Domestic		International	
	RPK	FTK	RPK	FTK
2007	7.4%	4.7%	7.9%	5.1%
2008	1.3%	-1.3%	3.4%	-0.9%
2009 F	-4.0%	-14.0%	-4.6%	-14.5%
2010 F	3.2%	5.0%	4.1%	5.5%
2011 F	4.8%	7.6%	5.7%	8.1%
2012 F	6.4%	6.2%	7.3%	6.7%
2013 F	6.1%	5.7%	7.0%	6.2%
2009-13 CAGR	**5.1%**	**6.1%**	**6.0%**	**6.6%**

Note: The figures are average annual growth rates taken from IATA's Financial Forecast.
Updated: 9/2009 Next 12/2009
Source: Industry Financial Forecast Table (Econ)

Fig. 3: IATA air traffic forecasts by 2013

Increasing traffic also generates troubles. Air traffic control units are overloaded, airways are increasingly crowded, and some airports are facing major traffic congestion.

Airports, operating in a commercial environment, must change to meet new customers demands, like low cost carriers, which are holding now an important share of the market. As the aviation industry is developing and other disorders may show up in the future, airports must constantly adapt to new requirements.

One of the most important changes that will take place at the airport industry will be the gradual transition to privatization, beginning with various forms of public-private partnership, until reaching the final stage of full privatization. Although a significant number of airports have been privatized, private sector involvement in the airport industry remains small comparing to the case of airlines. Despite the popularity of the airports and even on investment and business opportunity, there remains some uncertainty about the constraints on expansion, environmental, political and social right, and, in the European Union, the suppression of tax systems and tax-free.

There are currently controversial discussions whether traditional airports, with a long tradition and experience in airport operations, may work better as individual units or quasi-monopolistic companies such as TBI or AGI.

TBI is a financial institution that purchased in 1995 Cardiff International Airport, Belfast International Airport in 1996, Orlando Sanford International in 1997 and in 1998 bought 98% stake in Stockholm Skavsta Airport, and in 1999 acquired 82% stake AGI, which had almost total interests in airports in Canada, Bolivia, U.S., Australia and Central America. It was discussed whether the airports are more, from technical and operational point of view, a special problem, different from other businesses, or can be purchased like any other commodity, by the powerful multi-national financial companies. It seems that airports can be incorporated into the global financial management of big corporations by providing technical and operational management of premium quality.

All fundamental change in the airport industry cannot be separated from the parallel development of the airlines, after disturbances produced by the tragic events of 11 September 2001. On the one hand, there was a decrease in the number of passengers, which airlines imposed a strict control on costs, and secondly there has been a move towards forming alliances of airlines. Despite the shock of the terrorist attacks on New York, long-term prognosis rate indicates a notable increase in passenger traffic. In Table 1 presents this forecast, prognosis being issued by both the aircraft manufacturers and the international civil aviation bodies.

Organization	*Time period*	*Traffic measure*	*Annual growth rate %*
Boeing	2000-2019	Passengers / mile	4,8
Airbus	2000-2019	Passengers / kilometer	4,9
Rolls- Royce	2000-2019	Passengers / kilometer	5,0
ICAO	1997 - 2021	Passengers / kilometer	5,5
AICI	1997-2010	Passengers	4,0

Table 1. Passenger traffic long term forecast

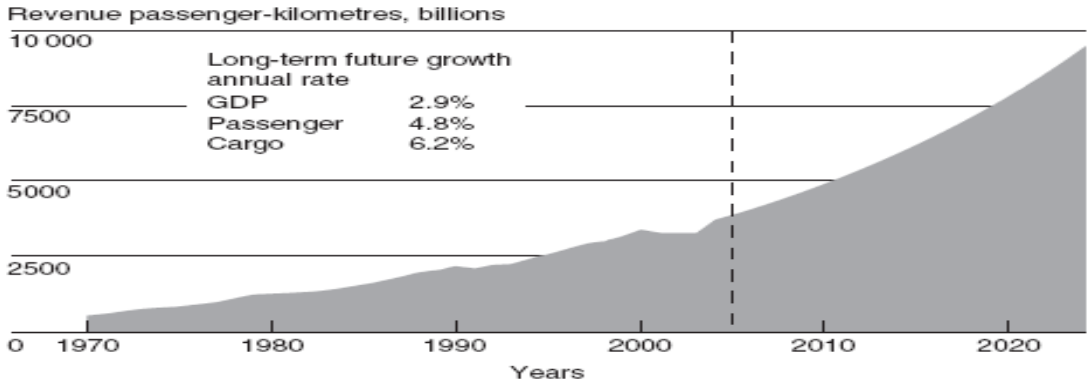

Fig. 4: Passengers traffic evolution. Source: Boeing

General economic growth reflected in increased activity of businesses and mobility of the people, along with increasing affordability of the air transportation will increase demand for traffic, but development of telecommunications links and the emergence of teleconferencing could reduce demand for business travel. But development, overall global trade business and will encourage additional air traffic needs to arise.

At the same time it is expected an increase in air cargo traffic, with an even higher ratio than annual rate than passenger traffic. Table 2 is depicted a long-term forecast of development.

Organization	*Time period*	*Traffic measure*	*Annual growth rate %*
Boeing	2000-2019	Tones / mile	6,4
Airbus	2000-2019	Tones / kilometer	5,7
Rolls- Royce	2000-2019	Tones / kilometer	6,5
ACI	1997-2010	Tones	6,4

Table 2. Cargo traffic long term forecast

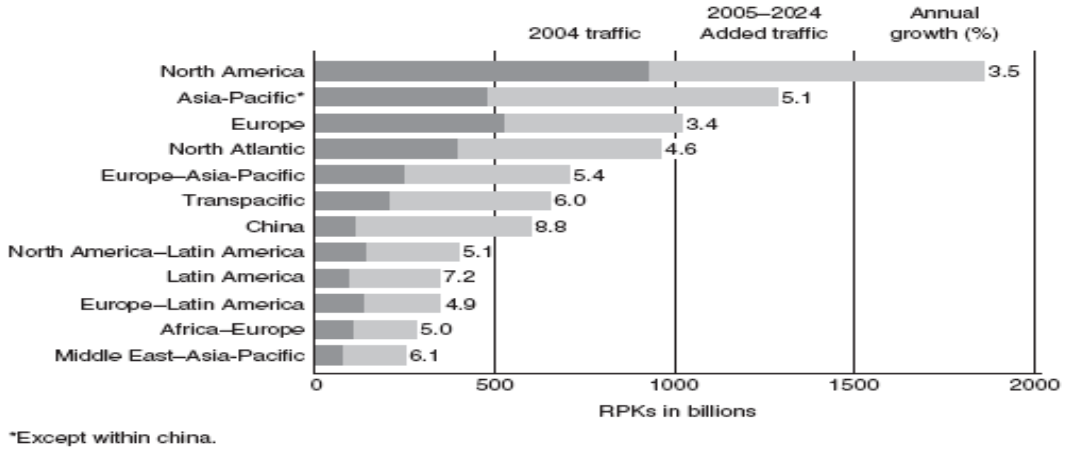

Fig. 5: Cargo traffic evolution. Source: Boeing

Projected growth in freight traffic is obviously strictly related to economic growth, cost of operation and speed. But this growth, substantially higher than for passenger traffic, has other explanations. First, the electronics industry (computers, communication and multimedia) and the pharmaceutical industry is in continuous development and high value products distributed have small weights (low weight high-value). Secondly, it was found that passengers' baggage does not occupy the whole capacity of planes cargo deck, so this aircrafts were used for the transport of light cargo, containers properly. Thirdly, cargo transport does not require a particular schedule, and could be made at any time at night, if there are environmental restrictions.

The main cause of the growth of the freight traffic is globalization. Big retailers like Metro, Billa, Selgros, Carrefour wants to have the same goods at the same time, in various parts of the world, and this requires rapid transport, that can be performed only using air transport.

4. CONCLUSIONS

Globalization has stimulated and will continue to stimulate technology transfer and employment, development of new technologies and processes that will improve

the overall economic condition. Air transport is an important factor in the evolution of globalization, and according to statistical data presented, there will be a prosperous period in both passenger traffic and in trade.

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PERCEPTIONS OF THE CURRENT ECONOMIC CRISIS DIMENSIONS IN A RURAL COMMUNITY

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This paper treats the main aspects of specific symptoms of economic crisis and how it is felt in rural areas, analyzing the situation of a certain local community.

Keywords: economic crisis, price, market, unemployment

1. Introduction

For us, who recently came back to the capitalist society, the appearance of the economic crisis meant a new unique experience.

A proverb says that "the poor man is in trouble because he has no money, but the rich man is as well in trouble because he is rich." Some of them miss money and the others have to take care of their money.

Assuming this approach, we may consider that where there is almost nothing, there is nothing to lose.

This is how we expect the economic crisis effects to occur and be perceived differently depending on the level of economic and social development of a population group:

-From a developed country and from a poor one,

-From an urban or a rural group,

-In a trance of rich or poor people etc.

In fact, we can even predict that different people would have different perceptions both in terms of the wealth or living standards, and of the economic crisis. In one way we can perceive the imminent miss of our mansions, luxury cars and holidays and in a different way we accept to confine ours expenses, which are already modest.

Of course, the poorer you get, there is less you can lose. But what can we do, when the loss makes you unable to provide at least your minimum requirements?

2. Features of the economic crisis

The economic and financial crisis is the economic stagnation for a period of time, disturbing the economic and financial activity. It is considered that the appearance of economic crises is cyclical. The interval, duration, area and intensity of economic crises vary.

The general phenomena which are characteristic to the economic crisis are: the reduced sales of goods and supplying services, the increasing or decreasing prices, lower wages, unemployment, the decreasing of the stock transactions, the stagnation of the credits, and the reducing investments.

In a cross-border economy the effects of the crisis can not be limited to a small area or a certain region. They import and spread quickly, so they affect in various forms the entire world.

The more a country is depending on the world market it is natural that many crisis events occur. Also, the adoption of solutions in order to resolve the crisis is more difficult in the absence of a concerted action of many national economies.

The damage of the market generates insolvency in chain for many operators.

The decrease in revenues of the population modified the structure of the consumption of goods and services. Depending on their education and material possibilities, consumers have taken on new guidelines and they adapted their needs to the new conditions.

Many enterprises, manufacturers have been hit by tougher competition conditions, the crisis came under the conditions of the relatively new EU membership status.

The population was forced to postpone the purchase of properties and that of the durable goods or at last to reduce their consumption expanses in general, in the order of the difficulty of the access to those goods.

In the few years before the crisis, the acquisition of properties was considered in Romania to be a convenient way to invest. That way property sales were higher than in the case that there would be sold only buildings / land that are really necessary to their buyers for living or for their economic activity. It is interesting that in the accounting of economic agents the choice to make real estate investment is not obvious yet as long as they are not used any separate accounts to those we generally use for tangible assets.

The prices of the Romanian vegetable production have been sensitive in the recent years, not only on the annual amount and the costs of their production, but the also on the price of the imported similar products.

It is also interesting what happened to the zootechnic activity. In the periods in which they could buy cheap feed, people have decided to raise lots of animals. This increased the local meat offer and so the selling price did not motivate the producers for more efforts in the next period.

That decrease of production generated a price increase, which made the domestic offer uncompetitive against imports.

The banks have suffered the effects of the non-efficient loans and of the declining of the savings of their customers. The appetite for the credit has fallen because of the uncertainty of the future revenue and wages and because of the interest rate instability.

Being aware of the continuous presence of these systematic risks, lots of the small local producers pay attention and caution and avoid exposing themselves, so they rarely seek bank financing support to expand, develop and modernize their bussiness.

Impoverishment of people and the lack of perspective for the young people to find a job generate their lower interest for education. On the other hand those who can finance their studies try to complete them in order to become more competitive in the labor market.

3. Specific aspects in the studied case

We got used to the idea that the countryside is disadvantaged compared to the urban, in various aspects, and not only economically.

Even between different rural areas, serious gaps occur due to the action of many factors. These are: the distance from the city and the difficult access to the labor market, the area, the destination and the quality of land, the soil type, the climate, the access to the utilities, the pollution, the access to education and culture.

The analyzed case is a village located in the Carpathian region in Prahova County with a population of round 1000 inhabi-tants.

In the table below we present the dimensions of the living standards of the villagers in terms of suitable indicators.

The study took into account a group of 50 families of the village.

Table 1 ***Data on living standards***

%

INDICATORS	2008	2010
Household features		
Bathroom	20	24
Central heating	4	8
Hot water supply system	20	26
Community Services		
Local health care services (medical clinic)	90	90
Local Pharmacy	60	80
Garbage collecting (the late 3 years)	80	84
Local post services	100	100
Telephone	86	94
Television	94	96
Internet	20	24

Cultural/entertainment center	80	80
Durable goods		
Car	40	50
Oven	94	96
Refrigerator	90	92
Washing machines,	76	78
of which automated	8	12
Diswasher	-	4
Infrastructure		
Methane gas	-	-
Running water	34	38
Direct access to paved road	68	82
Sewerage	-	-
Running Electricity	100	100

Source: interview, compilations

In a village where residents have average or poor living conditions, the crisis was felt later. It attacked the wealthy people more perceptible when their wages decreased or when they remained as unemployed people.

The decrease of wages reduces the access to durable goods, the construction or renovation of buildings etc. Even if in the table before we saw the apparent stability, we must know that many young people postpone their plans for marriage due to the lack of perspectives. They do not have their own place to live and they do not have enough money to buy a house. We also observed that the young families live together with their parents, helping eachother.

Our subjects were questioned about the investments they made in the last 3 years.

The table below presents the situation.

Table 2 ***Data on living standards***

Investments	Number
New home	1
House renovation / house improving	2
A new car	2
A used car	8

Source: interview, compilations

The villagers bought more used cars because their price was lower and some people felt the need to spend their money. In else way this maney was insufficient for a serious investment in land or house or even for a new car.

Regarding the daily food and clothing shopping, along with the lower incomes the prices fell as well. In addition, the subjects have adapted their shopping to the new lower possibilities.

They continue to have a priviledged access to healthy food, either from their own production, or by purchasing it on the local market. The price is still relatively cheap, comparing to the supermarket.

Unfortunately, cheap and poor quality food invaded the market and entered the shopping cart since 20 years ago. The economic crisis has increased their share.

However, the reduction of the number of animals in the village is obvious especially that of the cattle. If 5-6 years ago, the villagers grew about thirty cattle, they have no more than five today.

The cattle breeders are not stimulated by the low price and especially by the recently imposed regulations on the sale market.

Those variables, which normally entitles them to hope they could sell their production convenient, now they do not offer to the villagers any financial security. So they waste a lot of their important available resources of non-polluted food for animals.

We observed an unequal distribution of the poverty through the villagers. There is an area in the villege more crowded and poorer then the other areas. The access to a convenient workplace and their different enharitage of land created these differences.

4. Conclusions

Apparently in this community there are not felt any significant effects on the living standards yet. This fact is visible through the image of data concerning the owner-ship on household features and those concerning the access to major services and infrastructure.

The real situation is that they live in the same old houses, some of them being maybe even more crowded then other times. They bought cars, but mainly used cars.

They postponed their plans, waiting for a better time.

The saddest image we could think about this village is that of a quiet place, too quiet to be real, or so we thought. Where are the noisy parties, where is the joy? Even in the holiday it is still silence.

The village is not out of a better future. There are smart and intelligent children in that community. Lots of them understood the meaning of school. Their families made efforts and tried to keep them in good schools.

Some young people proved they love their place and chose to commute to the city. They are still creating new families having children. The oldies say that what commes arround goes arround. They did not lose their hope.

Despite the poverty, this world is a modernized one: they have telephones, cable television, hot water and especially the computers which are access points to knowledge.

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EVOLUTION OF CURRENT INCOME AND CONSUMPTION OF POPULATION IN A RURAL COMMUNITY

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This paper referes to the recent evolution of income and consumption in a rural village.

Keywords: income, consumption, expenses

1. REVIEW

What was the economic and social status of the village on the verge of major change in the end of 1989?

The people in the rural areas searched within a period of 40 years, during the decades of industrialization, to migrate toward the city.

What have been the causes of this migration?

In a brief list of those we could include the following:

-The village was considered a pole of the poverty, because the country life is lacking some features of employment and wages, but also because of the comfort that the city could offer;

-In the rural areas the population density is lower compared to the urban areas, which led to a reduced both the interest for infrastructure investment and their speed;

-In consequence the rural residents have had some difficulties with the gas and water supply (in the past even the electricity could miss), sewerage system rarely entered into the discussion, thus the country houses usually assured a little comfort;

- The transport was difficult because the roads were in poor conditions, the fuel was lately rationalized and for many localities the roads were the only access way;

- Public transportation, although less expensive than the private one, was inconvenient, both because of the schedule, in which the races were being rarely programmed and because of the crowded buses;

- The low density of rural population, especially of the school age has led as well to difficult access to education. Children couldn't follow more than 10 grades in their village or in a neighboring one, even since the ninth grade or the fifth grade;

-The distance from the cities, where they could attend high school and further academic studies, made the education of these young people harder and expensive;

-Human resources employment opportu-nities were modest and mostly confined to agriculture. The income obtained from far-ming has always been modest, so people had to move their working places to the city;

-It was tiring to commute in the difficult transportation conditions we have men-tioned above;

-There still were some concerns of the communist authorities to diversify the occupations in the countryside and to

increase the number of working places, for example in the units of the handicraft and agricultural cooperatives;
-Collectivization led to the loss of the agricultural land ownership rights in the communist era and it reduced the possibility of obtaining significant revenue from the agricultural activity; by default, the zootechnic was less profitable being unable to use the feed from its own production;
- Health services were also poor in the countryside compared to the city, doctors were not motivated to practice in rural dispensaries and the hospitals were too few and had poor equippement.

We see that the life in the countryside as a whole was considered difficult and undesirable. That is why so few were those who resisted the temptation of the city, which had schools, comfortable habitation on the block of flats, with hot running water (even if it was provided acording to a strict timetable) and especially at a short distance from the workplace.

The real values of rural culture and tradition were only officially recognized, without being appreciated like they deserved.

A fraction of the rural population which was somewhat privileged was reprezented those who chose (when the choice was possible) to work in the city but to live is in the countryside and to profitably manage a rural household.

These people have benefited from:
- The ability to obtain the necessary food from their own work, plentiful and healthy, while in the city the food was rationed and already being obtained by industrial processing;
- Lower costs for providing meals;
-The possiblity to obtain substantial revenue from the sale of the surplus of crop and animal production.

Let us remember some details, some unnatural aspects, some of them even strange, about the countrylife and about the lifes of those who chose to move to the city:
- Both the disproportionate level of wages from the industry or from the other occupations in comparison with that from the agriculture and the added comfort of those who lived in the city, have generated contempt for choosing to live in the countryside and for the peasant condition;
- Although not everyone in the town has cherished and valued the easy access to education and culture, it was assumed that villagers were uneducated;
- The uncorrelated prices for bread and grain or fodder have determined the animal breeder’s choice to buy bread to feed them, that being a cheap and convenient option;
- Offently those who recently moved to the block could not get used to it, they chose to keep the old strengths, such as raising animals and arranging a garden, if it could be placed right around the building;
- In order to simulate the comfort of the city, but also to use as much land as possible in the agriculture, the authorities have built some apartment buildings in the village, but poorly equipped and in apparent discordance with the environ-ment;
- Children and even adults lose the feeling of belonging to the group and corrupt their behavior because the negative events may pass unnoticed;
- The dimensions of the phenomenon of migration to urban areas have become alarming, and so the authorities tried shutting off the access to the major cities in the 80’s.

The last 20 years have induced some significant changes in the Romanian village life.

The Romanian economy has entered a process of transformation, restructuring and reorganization. The market has forced change. Some enterprises have ceased to exist. The private investments appeared.

The labor market has been transformed. The official unemployment appeared. Persons under the age of 50 who were fired or restructured and who were coming from rural areas chose to move back to the countryside, primarily for the financial reasons.

Those living in the villages had not anymore to commute to the city, hardly finding a new job. The restitution of land

owned by the population gave rise to the resumption of agricultural activities.

Which are the coordinates of the evolution of population revenues in the rural area today?

Here is a brief list of them:

-The accelerated aging of the rural population, due to the natural demographic decline and the migration of the old population towards the village having the hope of a cheap and quiet life, and due to the international movement of the rural active population;

- The general decrease of salaries and pensions in the last two years;

- Reducing the number of jobs;

- Loss of interest for the work in agriculture and zootechnic, recognized as being unprofitable for the producers;

- Generally weak and uneven development of the rural tourism.

As expected, the demographic decrea-sing and aging generate more pronounced decrease of the attraction for the investment in a rural area. Some factors can act in opposition: the natural resources, human resources.

2. SOME ASPECTS IN OUR STUDY

The village we'll see is peculiar for our area, being situated under the Carpathians, near some former industrial small cities.

The land was never collectivized in this village. Properties are relatively small. Predominant crops are grass fields and orchards of apple and plum, suited to the climate and hilly terrain. Gardens are at small capacity and serve strictly the needs of householders. Planting of solariums and greenhouses are very rarely present.

Villagers have raised animals (increa-singly less) and poultry. But we note the constant presence of the beekeeper and the quality of the honey they obtain. The area is unpolluted, surrounded by forests and rich in herbs, acacia and wild cherry trees.

The local economy is limited to a bakery, a rural location, eight general stores, three bars and a lounge for festive occasions. There are four carpenters and three tailors.

The mainly active population is commuting to the close cities and chooses to work in industries like mining, constructions, wood processing, transpor-tation, education, health and even electronics.

It's difficult to quantify the income of the rural population, because it does not restrict about wages or pensions.

The families we studied have gathered a monthly household income in the past three years as shown in the table below.

The study took into account a group of 50 families in the village.

Table 1 ***Data on monthly income***

- % -

TRANCHE OF INCOME (lei)	**2008**	**2009**	**2010**
0-500	36	38	38
501-1000	24	28	36
1001-1500	18	16	12
more than 1500	22	18	14

Source: interview, own processing.

The data is heterogeneous, including families of pensioners, employees (one or both of the adults), unemployed and old widows.

How do the interviewed subjects use their money?

Educated through years of experience of inflation and providing in general modest funds, the subjects chose to use quickly the

amounts they had, avoiding to make savings. Moreover, the lack of financial education made them choose loans that were not suitable and whivh later proved to be difficult for them.

In the table below we present the usual destination of the funds that a family allocated for the main monthly current needs.

Table 1 ***Consumption data***

- lei -

DESTINATIONS MONTHLY EXPENDITURE	2008	2009	2010
Food	120-140	120-140	140-160
Clothing	80-100	100-120	100-120
Feeds	60-100	60-100	60-100
Transportation	80-100	100-120	100-120
Utilities	100-120	100-120	100-120
Drugs, health	40-60	40-60	60-80
Education	20-60	20-60	20-60
Holiday	40-60	60-80	40-60

Source: interview, own processing.

They provide the food consumption mainly from their households (pork, chicken, lamb) and buy the rest from other people (milk, meat) and also from the market (bread, sugar, oil, rice, a.s.o.). Junk food invaded the market and it has been adopted in here naturally.

The decrease of wages affects less current consumption needs, which are relatively inelastic. Sometimes the consumption is necessary and that made them seek a credit for general needs, then another one and another one, almost at the limit.

Young people tend to downplay the necessity, usefulness and importance when it comes about their studies. The access to education is almost prohibitive, because it is expensive, so the families of young people have not invested in their careers.

Over 90% of the working population operates in Ploiesti, Campina, Valeni de Munte.

The access to the labor market is an advantage. We know that the rural population in other areas doesn't have it, such as:

- The lower density areas in the central Transylvania - Alba, Hunedoara, Salaj;
- Economically weak areas in Moldova, Baragan and Oltenia.

Some village residents have chosen to work in Italy, Spain, Germany, where they did not settle, but chose to leave and come back regularly, taking care of their families and rising up their households.

3.CONCLUSIONS

An obvious loss of income from pensions and salaries was manifested in the recent period of 3 years. This has not resulted in lower consumption, but rather in lower savings and investments.

The evolution of income and expenditure indicators does not clarify the issue of the living standard or of the life quality.

The village was in decline long before the crisis, not only economically but also socially.

The gradual death of industrial enterprises in the area, in which there were employed usually either one or both adults in the family seriously affected the population of the village.

The phenomenon is even more visible if we detect in addition to the data above also the image of the rising unem-ployment, of the acute aging process of the population, of the lack of hope hereaby and of the desire to go to work somewhere else, in town or abroad.

Patients who can not afford quality health services, children too poor to attend school, and children being separated by one or both of their parents which are gone away at work – these are the victims of the current times.

But life still goes on.

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COMBAT CAPABILITY OF MODERN SUPERSONIC AIRCRAFT FOR CZECH AIR FORCE

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Abstract: *The contribution describes the modern supersonic fighter aircraft designed for fighter missions in service of the Army Czech Republic. There are also noted armament options for air combat and new trends of development in accordance with the tactics used by the fighters. In conclusion there is mentioned properties of airborne radar and calculated maneuverability of airplane in an assault.*

Keywords: *Aircraft, armament, radar, Czech Air Force.*

1. INTRODUCTION

Fighter aircraft are generally the smallest and lightest current combat airplanes with high performance, in one version fighters are able to perform both fighter tasks and destroying the ground (sea) targets, and doing the reconnaissance. In air combat they can both take part in dogfight and destroy targets beyond visual contact. We can also use them as an overflow or patrolling fighters. With special container they can perform tasks of tactical reconnaissance.

2. ANALYSIS OF SUPERSONIC AIRCRAFT AND ITS EQUIPMENT

The aircraft in Czech Air Force service is a canard-configuration aircraft, featuring a cropped delta wing with a sweep of 45 degrees (Fig. 1).

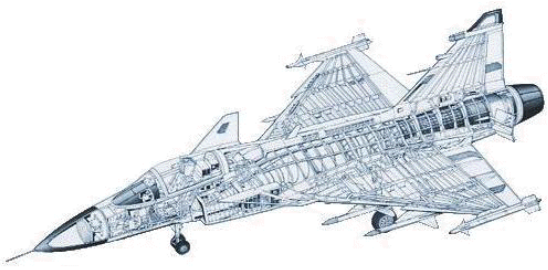

Fig. 1 Drawing of the aircraft [6]

All-moving canard forewings are with a sweep of 45 degrees and dihedral. The wings are midbody-mounted to provide clearance for underwing stores, and each has a leading-edge flap plus two trailing-edge drooping "elevons" to improve short-field performance, as well as maneuverability.

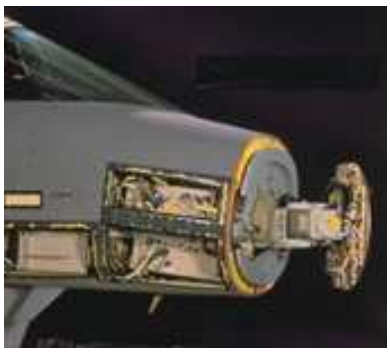

Fig. 2 Radar PS/05A [5]

There are two tiny strakes on the nose to generate vortices that improve flight control at high angles of attack. The PS-05/A works in the 8-10 GHz band and has 1 kW energy output (7 kW maximum output).

The radar is capable of detecting, locating, identifying and automatically tracking multiple targets in the upper and lower spheres, on the ground and sea or in the air, in all weather conditions, as the Fig. 2 shows. It consists of four parts and all parts can be replaced in 30 minutes. The

latest version of PS-05/A radar which is currently in use and has been available since 2005 is MK-3.

It is capable of detecting fighter aircraft from 120 km distance and can see road traffic and count ships at anchor in a harbour at 70 km. Radar modes:

a) Air-to-Air modes: Long Range Search (LRS) is used to detect and identify targets at high ranges, Track While Scan (TWS) allows to track targets and search for other targets, Multiple Priority Target Tracking (MPTT), Priority Target Tracking (PTT) allows accurate targeting and tracking Air-to-Air missiles, Single Target Track (STT) Air Combat Mode (ACM) is used for automatic target detection in dogfight.

Fig. 3 Supersonic fighter aircraft used in Czech Air Force. Foto author

b) Air-to-Surface modes: Long Range Search (LRS) is used for ground or sea target search at long distances, Raid Assessment (RA) ensures bombing, Stationary and Moving Target Indication (SMTI) is used for ground stationary or moving targets, Ground and Sea Priority Target Tracking (GSPTT), Ground Mapping (GM) ensures mapping of terrain under the aircraft for navigation purposes (e.g. terrain copying at night or adverse weather condition), High Resolution Mapping (HRM) ensures terrain mapping by synthetic aperture in order to gain high resolution pictures, RANGING high accuracy ground target ranging and all information is processed by 32-bit computer SDS-80 Ericsson with 7 000 000 operations per second.

Data from radar and other external systems gets to the pilot through the three panels **H**ead **D**own **D**isplay (HDD) in the cockpit of the aircraft (Fig 4).

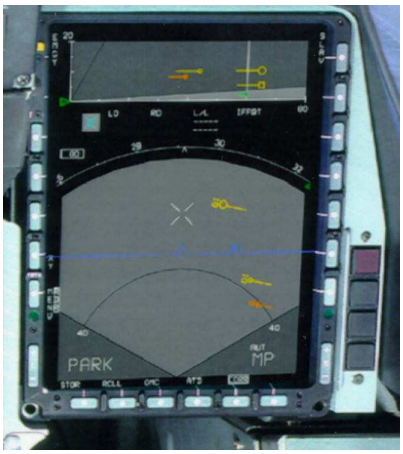

Fig. 4. Head Down Display [4]

This is all due to data communication in real time which can be used for example to supply information to other pilots who get the necessary information to engage in combat action and do not have to turn on active systems on their airplanes, which would made possible their detection.

Another important way to increase the combat use and especially to increase the combat value of the aircraft is helmet system called **HMS ODED** (Fig.5). This system is highly efficient and able to work when shooting at target, which is not in a straight line even when using bullets SRAAM with high maneuverability, which means that it is ready to missile IRIS-T and other belonging to new generation.

3 POSSIBLE ARMAMENTS OF SUPERSONIC AIRCRAFT

Already during local conflicts it has been found that although guided missiles are great in dogfight, if you run out them, you can protect yourselves only by cannon. Another factor that speaks for the gun is that it cannot be fooled by any jamming device or instruments of electronic warfare. The aircraft is equipped with the **Mauser BK27** cannon, which is designed on the revolver

principle. It is, due to the performance, a compact, lightweight revolver manufactured by German company Mauser-Werke.

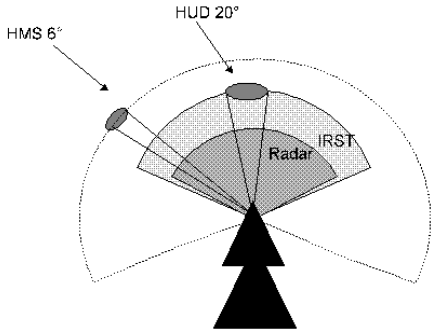

Fig. 5. System HMS ODED [5]

Basic armament is thus rapid-fire cannon BK-27 (Fig. 6) with 27 mm caliber by Mauser company with an optional rate of shooting 1000 or 1700 rounds per minute, placed in the fuselage below the right input air channel into the engine. It may also be equipped with different formations of air-to-air and air-to-surface missiles and bombs. They are hung on 6 wing and 1 fuselage weapon stations.

Fig. 6 BK-27 air cannon for aircraft [3]

For dogfight with aircraft and helicopters it can be armed with air-to-air guided missile with short range AIM-9 with infrared guidance system, medium-range missiles SKY FLASH MICA or AIM-120A with up to 100 km range. It is expected with the introduction of the IRIS-T, Meteor and ASRAAM.

To fight against ground targets and for close air support of ground troops it is possible to hang air-to-surface guided AGM-65 missiles with a range of about 3 km for the combat vessels then antiship guided missiles RBS-15F or other types of guided missiles. It may also be armed with multi-purpose container weapon with anti-tank, anti-personnel, anti-concrete guided submunition, ballistic bombs and missiles.

Analysis of actual conflicts and simulations of clashes of piloted aircraft carried out since the early nineties clearly demonstrate that more than 30% of aerial combat, no matter on the distance of opponents at the beginning of the engagement, ended at close range. It implies that the critical combat fighter weapon remains a cannon and short-range guided missile - **S**hort **R**ange **A**ir-to-**A**ir **M**issile. (**SRAAM**).

If the combat takes place at a greater distance than the potential range of cannon, mentioned guided missiles are used instead. These missiles can be divided according to the guidance system and according to range. Basically, we have only three main categories:

- Missiles with active radar homing,
- Missiles with semi-active radar homing,
- Missiles with infrared homing.

For evaluation areas of possible attack is necessary to start from mathematical relations. For example for relative coordinate system holds:

$$\frac{dD}{dq} = \frac{v_s - v_c \cos q'}{\frac{g}{v_s}\sqrt{n_s^2 - 1} \pm \frac{g}{v_c}\sqrt{n_c^2 - 1}} \qquad (1)$$

Calculation of the distance is obtained from following expresion:

$$D = \frac{V_s V_c}{g\sqrt{n^2 - 1}} \sin q \qquad (2)$$

Distance for positive overload of fighter aircraft is gained by derivative equation of circle of constant overload.

$$D = \frac{v_s v_c}{g\sqrt{n_{\max}^{+2} - 1}} \sin q' \qquad (3)$$

Fig. 7 shows area of possible assault for different opening air assault angles on air target with airspeed 800 kph and interceptor airspeed 950 kph. This figure was made by computer simulation.

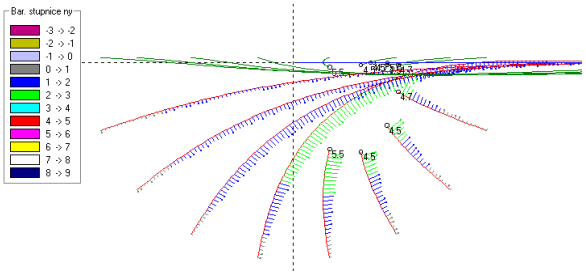

Fig. 7 Area of posible assault on the air target

Next figure (8) presents flight modeling of aircraft attack on ground target with air-to-ground missiles AGM-65 Maverick. Both models are presented in [4] written by scientists from University of Defence.

Fig. 8 Calculation of aircraft manoeuvrability using mathematical simulation

4. CONCLUSION

The aircraft is the first representative of the new generation of multipurpose combat aircraft, that entered operational assignment. It uses the most modern technologies and therefore it is able to conduct a wide range of combat tasks, both air-to-air and air-to-ground, while it can use the most modern weapon systems.

This aircraft is constructed to be able to face present and future threats and to meet strict requirements of flight safety, reliability, effective training and low-cost operation. The aircraft is in the service of Swedish Royal Air Force and Czech Air Force. It has been ordered by air forces of South Africa and Hungary. The British elite test pilot' school (Empire Test Pilots' School – ETPS) operates aircdraft as a jet trainer for advanced training of test pilots from all over the world.

In modeling area of possible assault is clear that in assault from backward hemisphere is this area smallest. From aside it increases and from forward hemisphere is largest. This is caused by energetical abilities of guided missile and range of aircraft's radar.

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THE INTERNATIONALIZATION AND GLOBALIZATION OF BUSINESS MECHANISMS AND MOTIVATIONS

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Abstract:
The paper aims to analyze several tendencies of companies which operate in the global market, in the context of internationalization and globalization. The internationalization of companies involves a complex, comprehensive and urgent process, which ought to be produced at managerial level in order to adapt to the requirements of business globalization and prevent the risks that accompany this process, but especially in order to turn to advantage the benefits that internationalization can bring. The purpose of the research is to emphasize the fact that in nowadays companies, as a consequence of the paradigm shift in the management of business and in the organizational environment, a wide range of internationalization strategies can be used and the key element in the development of these strategies continues to be the competitive potential of companies, which in its turn, depends on the size and quality of available resources, the so-called technical, research or commercial "critical mass", which is the minimum dimension that must be reached in order to participate and stand to gain the competition. The current development of business caused by the economic, social and political context acquires in addition a cultural dimension, an intense and constructive international exchange of values taking place between companies which thus enhance their organizational culture in accordance not only with the national dimension but also with the international business area.

Key-words: internalization, globalization, leadership, paradigm shift

1. THE INTERNATIONALIZATION OF BUSINESS

The most pregnant trend in the economic and extra economic field is the internationalization and globalization of business. Although this trend is part of the historical evolution of human society initiated by the expansion of world trade, we can argue that internationalization is a real component of today's business environment, since the last decades were characterized by the expansion and enhancement of business at a global scale, the emergence of spectacular modifications in the hierarchy of economic powers (at company level or even at national, macro-economic level), conducted according to the national-international approach.

The development of business in nowadays world takes place in an economic, social and political environment, being centered on one hand on a set of coordinates at a national-international level and on the other hand on the cultural dimension which leads to a progressive enlargement of the internationalization and globalization process of the socio-economic life[1].

[1] Cerchez, O. - *Eficienţa economică comerţului exterior*, Editura Logos, Bucureşti, 2007

Business internationalization represents an objective process of enhancing the involvement of companies in international transactions, which implies the existence of a global business environment of market economy.

The challenges of globalization are diverse, business internationalization having long exceeded the initial export-import stage of goods and services between states.[2] The major implications of management in business globalization leads to the internationalization of companies which occurs at management level in order to prevent the risks that come along with this phenomenon, but especially in order to benefit from the advantages that internationalization can bring.

The advantages of business internationalization are reflected in the production capacity, the expansion and improvement of markets, access to resources and information, more beneficial tax policies, the acquirement of additional profits from activities and areas which can be capitalized.[3]

The internationalization of companies in an inter-multicultural context derives from management implications as a consequence of company entrance in international markets characterized by cultural diversity, an environment with different company cultures and national cultures, all of them formed through time under the impact of the business environment in which they were created and developed. Thus, one of the major risks in business is no taking into account at management level the above mentioned impact. The elaboration of market strategy entrance and the development of the company on the foreign market is an important attribute of company management with an international vocation. This implies to take into consideration the development of the global framework and the potential of the company, in order to determine the objectives of internationalization and the forms of internationalization.

The objectives of internationalization can have in view several elements such as turnover growth, profitability enhancement, acceleration of company rate of growth by stimulating internal development, increased share of international activities across the company's business by exploiting economies of scale and the possibilities of production differentiation.[4]

Among proactive motivations there are the advantages in the achievement of profit, single producer status, technological advantage, exclusive information, managerial involvement, tax advantages, and economies of scale. Among reactive motivations the following aspects can be mentioned: competition pressure decreased domestic sales, excess capacity, saturation of domestic markets, approaching clients and partners.

The advantages of active exporters are, for example: expanding sales markets, increasing profit by seizing market opportunities, such as favorable comparative costs, economies of mass production, multiplying effects, better use of production capacity by expanding customers' data base, providing greater long term profitability by capitalizing on the sustainable benefits offered by the external market[5], improvement of marketing potential by direct confrontation with international competition, the desire to strengthen credibility, the reducing of commercial risks by their dissemination in multiple markets and by diversifying types of products and operations.[6] International scale activities inspires confidence, is a guarantee of quality and dynamism and it creates a favorable perception of the company, which is mirrored upon the activities it carries at internal level.

On the other hand, entering external markets implies a series of costs and risks which must be balanced with the estimated benefits.[7] Costs are reflected in the production

[2] Dumitru Miron - *Economia Uniunii Europene*, Editura Luceafărul , Bucureşti, 2003

[3] Puiu Alexandru - *Management,* Editura Independenţa Economică, Piteşti, 2001

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[6] Cezar Militaru - *Management internaţional*, Editura Pro Universitaria, 2009

[7] Ioan Popa - *Tranzacţii de comerţ exterior*, Editura Economica, Bucureşti, 2002

plan, in the marketing plan as well as in institutional structures. The risks of the exporter are more numerous and complex, taking into consideration the intercultural area in which the transaction takes place as well as the international market increased level of variability.

2. THE PARADIGM SHIFT FROM AN ORGANIZATIONAL PERSPECTIVE IN THE CHALLENGING CONTEXT OF INTERNATIONALIZATION AND GLOBALIZATION

In the European area, changes determined by economic integration, competing with the process of globalization caused a real mutation in management. Under the pressure exercised by the working force mobility, a shift was made to the humanization of the economic area, precisely in order to achieve the stabilization of possible tensions and conflicts created by rapid changes, fluctuations in personnel, restructuring of jobs and organizational change.

The search for order, meaning and significance for the current context with the aim of grounding a coherent vision as an efficient base for action at a personal and institutional level frequently takes the form of an increasingly used formula in the institutional theory and practice: the paradigm shift.

The new European context implies a participatory management, democratic, characterized by the divide of manager's central authority with the other employees (at least at tactical or operational level). Nowadays, managers and employees are in a position in which they have to search together effective solutions for an efficient development.

The necessity and demand of valuing the creativity of employees arises precisely because they need to be motivated, productive at their work place and also to easily adapt to the new economical environment.

The new managerial paradigm moves from the model of collective action to the model of joined competences. The action of a person in the context of the new paradigm takes place by overlapping individual objectives with the objectives of the organization, simultaneously taking into account cultural diversity. The organization of the future will be a place for lifelong learning that will enable the employee to acquire the knowledge necessary for his profession, but also a range of transferable skills that he can enhance in any other organization or at another work place.

Today's organizations are likely to work with a small number of employees and under the threat of permanent changes coming from the external environment, therefore, they need both integration and employees that will learn continuously, quickly and to prove they are creative.

The new paradigms imply principles and a value system based on competence, autonomy, personal freedom, passion for excellence and creativity. There is a shift from transactional and dogmatic leadership to transformational, inspirational leadership, where the emotional leader plays an increasingly important part.

The table below captures a summary of major organizational transformations, under the new business paradigm outlined on the background of internationalization and globalization.

Characteristics	Old paradigm	New paradigm

Strategies	Planning	Strategic architecture and the building of specific competences , entrepreneurship
Structure	Hierarchical – multi-level	Network structure; specific products and competences portfolio
Systems	Rigid	Flexible
Employees	Titles and grades	The idea to be useful and efficient at organizational level
Leadership and management style	Problem solving	Continuous style change and adaptation to the new economical and social challenges
Competences	Maintenance	„the learning organization", continuous learning, „construction"
Shared values at organizational level	„let's all be alike"	Synergy; the acknowledgment of differences
Focus	Institution	Individual; interdependence.
Source of power	Stability	The change at the level of values, leadership and management style
Leadership	Transactional dogmatic	Inspirational, transformational – emotional leader
Organizational aspects	traditional psychological contract	The commitment to people or "employability" paradigm

Table 1: Paradigm shift in the new global context: organizational perspective
Adapted after C.A. Huțu (2007, p.154)[8]

3. LEADERSHIP AND THE CHALLENGES OF THE INTERNATIONAL BUSINESS ENVIRONMENT

Leadership plays a crucial role in determining the success of business while gaining global dimensions, which are, among other issues the subject of a research project in intercultural management, GLOBE, led by House, which aims at studying the organizational and leadership practices, determine the extent to which actions and specific leadership behaviors are universal, and the extent to which these qualities and actions are related to cultural characteristics.

The corporate world's endeavors to optimally face the waves of change brought about a different philosophy, and a new leadership language, a novel approach of increased diversity that spread throughout the corporate world. The new approach entails winners and losers such that every competitor must acquire its particularities in order to avoid being unsuccessful in the new millennium's race.

The telecommunications boom considerably closed the gaps between individuals; moreover, the workforce's ever growing diversity lead to a vast array of different values, perspectives and expectations within employees' ranks. The public became increasingly perceptive and taxing, and began demanding more responsibility from the corporate world.[9]

Accordingly, corporations became more socially responsible, particularly in relation to their shareholders, employees, consumers as well as their business partners. The leader's mission is to first identify the key areas which the corporation could improve and modernize and then to harmonize said areas within the corporate environment by building new partnerships. One should expect to achieve much more working with other than on his/her own.

The international business environment puts forth appropriate challenges for corporate leaders and also presents at least two growth dimensions – regional and global.[10]

The corporate management faces a new dilemma: what is the corporations' suitable to

[8] Huțu C.A., *Cultură organizațională şi leadership. Fundamentarea capacității competitive a firmei,* Editura Economică, Bucureşti, 2007

[9] Rîlea Veronica, *Leadership*, Ed. Lumen, Iaşi, 2006

[10] Tichy M. Noel, *Liderul sau arta de a conduce,* Editura Teora, Bucureşti, 2000

successfully compete against its rivals while avoiding dominating and abusing markets?

To become more efficient, leaders must think outside the box, must look beyond the corporation, and seek to expand their relationships with their peers as well as their community. The leader should keep in mind that the corporate will only move forward as long as the adjoining community supplies qualified and dynamic labor, adaptable to change which is an essential ingredient in view of the globalized corporate competition.

The ability to perceive and critically analyze the new business opportunities constitute essential traits which every corporate leader must master in order to compete in the new economic climate dominated by top technologies and innovation.[11]

Established business environments primordially relied on the physical world, whereas the current, dynamic business environment's values turn on intangible resources.

To be successful, a leader (should master a set array of variables: intentions, interpretations, identity.

Lately, the new concept of emotional intelligence has received increased consideration. It proposes new methods, other than the traditional ones, to boost the workplace productivity and quality.[12]

Accordingly, the successful leaders of the new economic environment apply a combination of the following 10 techniques: the time invested in leadership development should be proportional with the importance he is invested with; the leader's quintessential function is to steer the employees on the right track, the leader's vision must inspire and energizes, the leader should sell his/her vision, the leader must guide, the international business leader must delegate, confer authority and provide support to his/her employees to implement his/her vision.

The novelty of the approach rests in that it pressures leaders to assist the corporation to adapt to the new times, times that do not accept the traditional leadership patterns.

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CURRENT ISSUES IN SELECTED ECONOMIC CRISIS MANAGEMENT TOOLS

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Abstract: *The author notes the importance of certain economic instruments to stabilize the security situation in the territory, which was affected by crisis nonwar situations. Stresses the importance of revision and updating of economic measures by state and municipal offices. Identifies the obstacles in the process of the basic living needs ensuring of residents in the affected area. Suggests alternative solutions with regard for social and economic changes in the world, which significantly modify the content and quality in the field of crisis management.*

Keywords*: economic instruments, regulatory measures, crisis, emergency, crisis management, private sector, vital goods and products, safety*

1. INTRODUCTION

In normal peace conditions, without risk of the military threats, terrorist, respectively other activities and operations to destabilize the country, or the state after natural disasters, the key factors in the development in the market situation are the supply and the demand. Correlation of these factors allows meeting of critical needs of the population. In crisis situations, the development in terms of basic living needs ensuring of the population is threatened by the action of specific threats, fundamentally different.

In this environment, the market ceases to operate automatically, ceases to be self-regulating ability on the basis of factors such as shortage of raw materials for production, but also finished goods due to their unavailability or excessive consumption. Production of a particular territory is insufficient or completely ceases, the importation and distribution of other geographical locations is limited or impossible.

In war, respectively during the war emergency and emergency, when under the influence of the military, respectively non-military threats in the macro environment creates situation which has its fair reflection of the microenvironment, in the production reduceing, thus the availability of certain goods, is the problem of legislative restrictions on certain fundamental rights and freedoms heightened, given by the limited possibilities of the economy and the country's economy as a whole. There is a situation where demand for food, energy sources, fuels and other everyday needs enormously exceeds the supply side possibilities. In anticipation of the shortage of the goods and energy, the consumers tend to stockpiling in volume, which exceeds many times their real need. Expected development on the supply side, in line with economic theory of the demand curve tends to appropriate increase in price, which is immediately reflected in the unavailability of products for most state

residents. States thus using the bodies of crisis management approaches to regulatory actions by which it shall be ensured necessary time for ensuring the availability of vital products and goods to all residents of the affected region without exception.

2. LEGISLATION AND CONTROL METHODS

Stressful factors, which inevitably brings with it war and other threats, accelerate social dissatisfaction, in comparison with a peaceful life several times. The risk that the country is facing from external environment, whether by natural disaster, may enter the inner dimension of destabilization in the form of civil unrest, mass looting, to bypass the state and municipal bodies and institutions and so on.

In the economy of the country begins the run of legislative specific rules for emergency situations (eg Act no. 387/2002 Coll State Control in crisis situations outside the time of war and state of war, Act 414/2002 Coll on economic mobilization), in which there is a regulation on consumption of selected goods and commodities. Regulation may be in accordance with the applicable legal standard [1] one of the following forms:

- price regulation
- regulation of the quantity (volume)
- obtaining by sampling authorisation

State also in the public interest destroys, respectively inhibits, the production of goods needed to satisfy basic human needs, in these conditions perceived as privileged, creates opportunities for the production of vital products and effectively motivates their production for private entities. Market conditions in specific crisis situations of nonwar character to the supply side represent:

- enterprises marked as entities of economic mobilization
- other businesses

Duties and system utilization entities of economic mobilization of crisis management authorities at all levels of management is closely adapted and developed in crisis management development.

As regulatory measures affect other entities, it means the secondary sector that is ensuring the needs of the population of the crisis was the objective and much broader researched by the author in r. 2009 for the research sample of 36 enterprises in the region of north Slovakia, regularly attacked by natural disasters in the form of extensive flooding.

3. ANALYSIS OF CURRENT REGULATORY MEASURES

Businesses that are not subjects of mobilizing significantly impact meeting the current needs of the population, thereby also contribute to the social stabilisation and security situation on the affected ground. Inadequate access to pricing, respectively other misuse of the threat impact may actually destabilize the situation into the induction of social unrest.

Because of that the statutory provisions are the goods exactly listed, which under the certain conditions must be controlled and other goods, works and services may be subject to regulatory measures. In order to quantify possible residue and thus the potential business impacts threats on the affected market was to focus the regulation as thr one of the research area. Specifically, in the form of the answers of respondents on the adequacy and scope of regulatory action depending on the changes, which brought into the area both economically landmark events as the entry of Slovakia into the European Union. Entrepreneurs had the possibility to express freely acquire SR in crisis situations

Goods	Form of regulation				Number of answers
	Price regulation	Volume	Sampling measures	Regulation abolishment	
flour	23	5	0	8	36
fats	14	10	0	12	36
milk	26	9	11	2	48
meat	19	14	11	4	48
eggs	12	13	1	17	43
sugar	21	7	8	5	41
potatoes	18	3	0	15	36
rice	26	21	33	1	81
salt	24	11	3	16	54
Answers in %	**43%**	**22%**	**16%**	**19%**	**423**

Table 1 Relationship type of regulation and the extent of regulation

shortage goods from Common European Economic Area and whether it creates room to change The Announcement of The Ministry of Economy of the Slovak Republic č.125/2003 laying down details of the sale of vital products or vital goods using extra regulatory measures and take-off authorizations, because of that some of the following scheduled items became in the common European market more affordable, or on the base of other experiences and arguments.

From the point of view that 78% of respondents were upheld by the interference to the vital structures of regulated products, should justify their arguments to that position. Evaluation of the respondents' answers confirmed the expected critical access of producers and traders to the contents of the annoncement. It is alleged, that is archaic and does not reflect the possibility of a common European economic space. Some of the attitudes of respondents are challenging, but the reasoning is generally not convincing and rather points to the ignorance of the present decree, respectively its subjective interpretation from the point of trader's view, as the protection of public interest.

Because the answers to this question can be evaluated in two dimensions, the primary response has been analyzed from the aspect of the attitude to various forms

of regulation. As Table 1 presents a chart No.1 most respondents agreed to the need for price regulation. Price regulation is acceptable for all commodities according to the decree, set expression 100% of respondents. This is the interval from the lowest range of 28% in control eggs up to 62% flour price controls. Of the total number of responses in favor of price regulation expressed 43% of respondents.

The second form of regulation - a limited collection of the quantity of the responses received support under half of respondents compared with those who supported price control measures. This in quantitative terms means, that the quantity regulation of of the sold goods expressed positively 22% of respondents. In terms of regulation of products and goods quantity, touches the potatoes at least, which would regulate the quantity of only 8% and maximaly this form of regulation should be used for rice according to the answers of 26% of respondents.

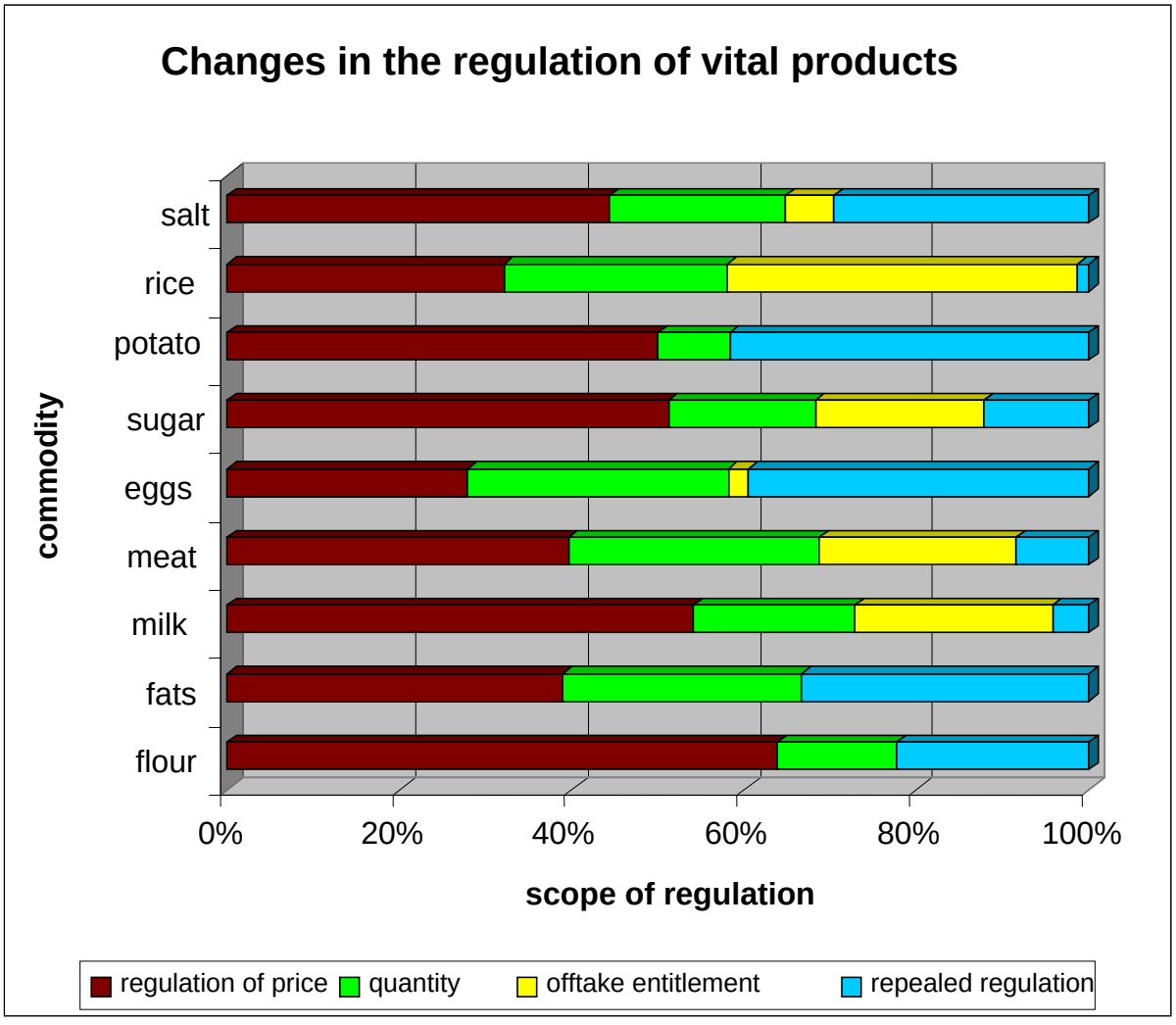
The collecting authorization (obtained only on presentation of bills) as the final form of

regulation is carried out in the polls met with little support from the three regulatory approaches taken in the public interest. Regulation under sampling authorized by all respondents considered to be unnecessary for 3 types of products which are the flour, fat and potatoes. Overall, this form of regulation supported only 16% of respondents.

For the total abolition of vital important products and goods regulation and thus the relevant provisions of the Decree of Slovak Ministry of Economy no.125/2003 laying down details of vital products or vital goods sale using extra measures and sampling privileges, was expressed 19% of entrepreneurs. In terms of commodities touched complete regulation's abolishment each of them, the least fans should abolish regulation of rice only 0.01% of the respondents and according to the most responses evaluated appropriate regulation of eggs abolishment upheld 40% of respondents.

The most frequent argument for the abolition of all types of regulation was the opportunity to buy the products and goods in the common European market for comparable quantity, quality and price conditions, especially in the case of locally operating impacts of threats (natural disasters, catastrophes, accidents). This argument was used by 73% of all respondents. A part of arguments, 14% of the number of responses, was based on the fact that the control system is difficult to control mechanisms and actually creates a real wide area of non-compliance with its principles.

Figure 1 Changes in the regulation of vital products



Source: author

convinced that the regulation is a discriminatory tool, and if necessary should be applied in any form, or vice versa across the board on all goods and products without distinction, according to the categories classification to the priorities set by central and local authorities of crisis management, separately for each type threats.

It is understandable that the regulatory action is for business best price regulation, because it seems to be the least as damaging the interest of the entrepreneur. The measure that guarantees the preservation of price status - quo, preventing possible falls in prices as a result of the interplay between supply and demand and in contrast to the amount or issue according to sampling for a part of entrepreneurs creates a space to maximize profit on a higher turnover.

And arguably inconclusive argument works just as the regulations on a discriminatory tool, although in terms of the operator entirely logical because it is a major limiting factor for business activities and therefore is perceived as the most important intervention in the business freedom.

This line of reasoning can be doubted that even if it would actually managed to vital goods and products provide on the nowadays much larger and fairly balanced priced proportion of the EU market, due to transport distances, damage to transport and industrial infrastructure in the transport endpoint, it would not be timely available to supply of sufficient volume of these commodities to the affected areas. What in this context is also not negligible is the fact that no withdrawals, based on sampling is not eligible can guarantee the availability of these products for all social levels in the affected area.

Therefore, rather confirms the assumption that the changes will lead to the most strict form of regulation and that is the dispensing of vital products and goods according to customer authorizations, as Chart 1 demonstrates. The repeal of this measure in the flour, fat and potatoes was justified by these arguments.

Withdrawal of flour on the basis of sampling measures is perceived by respondents that it has these critical elements with implications for the security of the population:

- change in the consumer environment (57% of respondents), especially today the population of urban agglomerations is not able to finalize the raw material,
- threats to energy supply for households (32%) more likely to secure these supplies for several large manufacturers – bakeries
- the change of the military threat nature from global to local as well as the nature of non-military threats to locally (11%), ensures the supply of sites affected other areas of the state or from abroad.

To go to other forms of regulation as a system of sampling eligible for fat was 84% of entrepreneurs, was justified several times by increasing range of goods compared with the period when on the market was available only essential fats of animal origin and one or two types of fats of vegetable origin. Other respondents (16%) argued by plenty of fat also thanks to the potential of a single European market without legislative, monetary barriers and complications, which can go with this product on a platform of price regulation, or volume control.

The collecting authority for goods such as potatoes is under 100% of respondents in the current market realities and threats, inadequate form of regulation. It is based on estimates of the parameters of military conflicts in the past. Today it is possible not only for the affected

region, but also state with the geographical area of Slovakia to ensure commodity from external markets in sufficient volumes and here is the corresponding agreed on the need for less drastic forms of regulation.

4. CHANGES IN REGULATORY MEASURES

Using the analysis of the information the author concludes that in order to stabilize the economic and security climate threat to the affected area is necessary to the professional public was primarily devoted to these problems:

- Indicative planning tools to define the objectives in crisis management, so that contingency plans for companies vulnerable territory primary and product mix accordingly dotvárali secondary base meeting the needs of the population, and these objectives in the public interest to see their own prospects and prosperity,
- Using bodies of crisis management at local levels to carry out the survey of the potential secondary sources in areas threatened by non-military threats and depending on their nature include this potential as a separate part of contingency plans from national up to local level of documentation on crisis management,
- Perform a consistent analysis of legal norms aimed at the regulatory measures, to assess the adequacy and proportionality of price regulation in order to minimalisation, respectively compensation of differences that arise between the application entities with a different character of provided goods and services also the need to consider some withdrawals (at the end of the research identified products), in the form of exemption certificate given to the changing conditions of supply, which creates a common European economic space,
- Such an analysis is given to the critical situation in the supply of consumer packaging, sold drinking water, creates a space to assess whether it is exactly this commodity, which should not replace some of the goods, which today is not the reasons already mentioned, necessary to regulate.

According to the more frequent non-military threats, the impact of extreme weather events as a result of global climate change, the severity and urgency of a comprehensive quantification of the potential of the private business sector are so important that in the interest rate of business plans and the public interest, it is necessary to consider enhancing relations between the two participating Parties separate statute.

4. CONCLUSION

By administrative barriers unlimited expansion of the market for almost all of continental Europe as a single trading area fundamentally alter the principles and rules of crisis management measures. This change also made significant contributions and changes in the extent and quality of potential military threat along with the change in intensity and frequency of natural disasters and catastrophes. Thus, even in this form has been alerted to the need to review crisis management measures in this area that their help managed to respond adequately to these changes in the parameters of concrete threats.

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THEORETICAL CONSIDERATIONS ON THE CALCULATION OF TURNOVER OF BREAK-EVEN IN INSURANCE COMPANIES

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Abstract: Risk management in the case of insurance companies involves two major aspects.

The first aspect refers to taking over the insurable risks of individuals and companies by signing an insurance contract instead of an insurance premium. The second aspect regards financial risks that insurance companies face. In order to evaluate the financial risks of an insurance company one of the major influence factors that has to be considered is: turnover of break-even. The paper's aims are to identify specific factors of insurance and their influence on the values of fixed and variable costs, essential parameters in determining the break-even point of any type of activity.

Keywords: *Risk management, insurances, costs, turnover of break-even*

1. INTRODUCTION

Profitability analysis of insurance companies is as important as with any productive organization.

As defined in the literature [1,4,6] profitability threshold (critical point, equilibrium point) is the volume of production to cover all expenses.

Under profitability threshold, the company works on loss. After overcoming the profitability threshold, the company gets profit again.

Profitability threshold can be determined by the algebraic method, or graphical representation of the relationships involved.

The algebraic method involves highlighting elements that make up company costs. As well known, fixed costs represent all costs over a period of time that are independent of production volume and variable costs represent costs are all costs dependent on the production volume.

To write the relations established notations are used C_F - fixed costs; C_V - variable cost; C_A - turnover, Q - production volume (in the case of insurance companies, the number of policies cashed), p - average price of a policy, v -variable costs per unit of product (policy), P - earned profits. The relationship between these elements is also known, also as that below:

$$CA = P + C_F + C_V,$$

where: $CA = p \times Q$ and $C_V = v \times Q.$

When turnover equals costs profit is zero, and the system is at the profitability threshold (critical point). Production volume corresponding to the critical point is

$$Q_{CR} = \frac{C_F}{p - v}. \qquad (1)$$

The graphical method involves representation on the same graphic the variation of turnover and total costs based on production volume. Total costs are given by the relationship:

$$C_T = C_F + v \times Q.$$

Abscissa of their intersection point represents Q_{CR}..

The above relations being known, on general level, this paper aims to highlight specific issues in insurance.

2. SPECIFIC OF COST CALCULATION IN GENERAL INSURANCES

General calculation relation [2] for any cost **C** is :

$$C = C_u \times Q \text{ [um]} \qquad (2),$$

where: C_u is the unit cost, expressed in adequate measuring units, and Q is the quantity (production volume). Relation (2) is valid also for the insurance field, so that Q signifies the number of cashed policies. In terms of direct relationship they have with insurance products, the insurance costs may be direct costs and indirect costs.

Similarly, in terms of volume dependency to insurance, costs can be fixed costs and variable costs.

2.1 Calculation of direct costs. Direct costs [2] include the following two components: material costs for the direct productive staff.

2.1.1 Costs of materials

Acquisition unit cost of materials needed for the materialization of an insurance contract: paper, toner, stickers, etc. will be:

$$C_m = \sum n_{ck} \times p_k \text{ [units/pieces], where:}$$

-n_{ck} represents consumption norm for material k;

-p_k represents unit price of material k.

For a total number of policies pro year –Q, material costs will be :

$$C_{Mat/An} = C_{Mat} \times Q \qquad \text{[um/year].}$$

2.1.2 Costs with direct productive staff

Total number of policies Q may be provided by three ways:

-Q_{Ag} represents the number of insurances concluded during a year by insurance agents.

-Q_{Br} represents the number of insurances concluded during a year by brokerage companies.

-Q_{IA} represents the number of insurances concluded during a year by insurance inspectors

The commission for agents C_{Ag} represents a percent of the selling price for a policy -p.

Yearly costs for commissions of policies concluded by agents:

$$C_{Ag/An} = Q_{Ag} \times \left(C_{Ag} \times p\right) \qquad (4)$$

The commission for brokerage companies C_{Br} represents procent of the selling price for a policy.

Yearly costs for commissions of policies concluded by brokerage companies:

$$C_{Br/An} = Q_{Br} \times \left(C_{Br} \times p\right), \qquad (5)$$

Expenses for the salaries of insurance inspectors:

$$C_{IA} = 12 \times n_{IA} \times R_{IA} \qquad (6)$$

where:- n_{IA} is the number of insurance inspectors;

-R_{IA} is the average expense recorded by an organization (monthly gross salary plus the employer's contribution to the state budget), for an insurance inspector.

Costs associated to direct productive staff will be:

$$C_{PDP/An} = C_{Ag/An} + C_{Br/An} + C_{IA}$$

Direct costs pro year:

$$C_{DAn} = C_{MatAn} + C_{PDPAn}$$

$$C_{DAn} = C_{Mat} \times Q + Q_{Ag} \times C_{Ag} \times p + Q_{Br} \times$$

$$\times C_{Br} \times p + +12 \times n_{IA} \times R_{IA}$$

2.2 Calculation of indirect costs. Indirect costs [2] include the following components:

2.2.1 Expenditure on maintenance and repairs of computer equipment (C_{IR}).

2.2.2 Electricity charges

$$C_{EE} = N_T \times T_{ef} \times p_{UE}$$

where: - N_T [KW] is the total power used;

-T_{ef} [ore] is the effective operating time;

-p_{UE} [um/kwh] is the unit price of electricity.

2.2.3 Charges for fuel used for heating and hot water

$$C_{GM} = \left(N_{GMI} + N_{GMA}\right) \times p_{UG}$$

where: -N_{GMI} [m^3] is the volume of gas used for heating;

-N_{GMA} [m^3] is the volume of gas used for hot water;

-p_{UG} [um/m^3] ist he unit price of gas.

2.2.4 Fixed assets depreciation expenses C_A:

$$C_A = \sum_{i=1}^{q} \frac{C_{MFi}}{T_{Ai}}$$

where: - q ist he number of the company's fixed assets;

- C_{MFi} [um] is the expense recorded for the asset acquisition, including freight, installation, commissioning, etc.;

- T_{Ai} [ani] is the normal service life of the fixed asset ***i.***

2.2.5 Taxes and fees expense, C_{IT} [um/year].

2.2.6 Rent expenses:

$$C_{CH} = \sum C_{Chi}$$

where: C_{Chi} is the yearly rent expense for the location „i''

2.2.7 Indirect productive staff costs: managers, accountants, etc., C_{PIP};

$$C_{PIP} = 12 \times n_{PIP} \times R_{PIP}$$

where: - n_{PIP} is the number of indirect productive staff;

- R_{PIP} is the average expense recorded by the organization (monthly gross salary plus the employer's contribution to the state budget), for a indirect productive employee.

2.2.8 Annual damage costs (**C_{Daune}**), represent the total value of compensation paid in a year.

$$C_{Daune} = Q \times R_D \times p \qquad (7)$$

where: - R_D – loss ratio.

Total indirect costs are:

$$C_{IND/An} = C_{IR} + C_{EE} + C_{GM} + C_A + C_{IT} + C_{CH} + C_{PIP} + C_{Daune}$$

Direct and indirect costs calculation serves to highlight aspects of business efficiency, since only directly productive activities are related to the activity of the company. Indirect activities provide the conditions to achieve directly productive activities.

2.3 Fixed costs. C_F – fixed costs, represent the total expenditure over a period of time, which are independent of production volume.

$$C_F = C_{IR} + C_{EE} + C_{GM} + C_A + C_{IT} + C_{CH} + + C_{PIP} + C_{IA} \qquad (8)$$

2.4 Variable costs. C_V – variable costs, represent the total expenditure increased with increasing production volume.

The category of variable insurance costs includes: material costs, annual costs for policies concluded by agents and annual costs for commissions on policies concluded by brokerage companies as well as damage costs.

$$C_V = C_{Mat/An} + C_{Ag/An} + C_{Br/An} + C_{Daune} \qquad (9)$$

Yearly damage costs - **C_{Daune}** are considered as variable costs, because they depend on the yearly concluded policies (**Q**).

2.5 Total costs. Total costs (**C_T**) – represent the sum of fixed costs and variable costs

$$C_T = C_F + C_V \qquad (10)$$

3. PROFITABILITY ANALYSIS

3.1 Calculation of fixed costs. In the relation (8) we are noting

$$C_{IR} + C_{EE} + C_{GM} + C_A + C_{IT} + C_{CH} + + C_{PIP} = C_0,$$

resulting:

$$C_F = C_{F0} + 12 \times R_{IA} \times n_{IA} \qquad (11)$$

3.2 Calculation of variable costs. In the relation (9), we replace (3), (4), (5), and (7). We obtain:

$$C_V = C_{Mat} \times Q + Q \times R_D \times p + + Q_{Ag} \times C_{Ag} \times p + Q_{Br} \times C_{Br} \times p \qquad (12)$$

We note: f_{Ag} - share of the number of policies concluded by agents from the total number of policies and

f_{Br} – share of the number of policies concluded by the brokerage companies from the total number of policies.

Then: $Q_{Ag} = f_{Ag} \times Q$ and $Q_{Br} = f_{Br} \times Q$, The relation of variable costs calculation (12) becomes:

$$C_V = Q \times [C_{Mat} + p \times R_D + \\ + p \times (f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br})] \quad (13)$$

The unitary variable costs are:

$$v = C_{Mat} + p \times R_D + \\ + p \times (f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br}) \quad (14)$$

The slope of variable costs is:

$$Tg\alpha_1 = C_{Mat} + p \times (R_D + \\ + f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br}) \quad (15)$$

3.3 Determination of profitability threshold

We use the most common method that applies linear model of costs and revenue growth with increases in output.

3.3.1 Analytical method

Replacing (11) and (14) in relation (1) we obtain:

$$Q_{CR} = \frac{C_{F0} + 12 \times R_{IA} \times n_{IA}}{p \times [1 - (R_D + f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br}) - C_{Mat}]} \quad (16)$$

Turnover of the profitability threshold (breakeven) is calculated with relation:

$$CA_{CR} = p \times Q_{CR}$$

3.3.2 Graphic method

Functions chart is plotted

Turnover: $CA = p \times Q$ and of total costs

$$C_T = C_{FO} + 12 \times R \times n_{IA} + [C_{Mat} + p \times R_D + \\ + p \times (f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br})] \times Q$$

At the intersection of the two graphs Q_{CR} is obtained.

3.4 Dependency of fixed costs to a production level. Maximum turnover achieved by a number ,,n_{IA}'' of inspectors is:

$$C_{MaxIA} = n_{IA} \times T_{IA} \quad (17)$$

where:- T_{IA} is the target imposed to an insurance inspector, ie. total of insurance premiums cashed during a year.

We note f_{IA}- weight of turnover achived by insurance inspectors from the total turnover CA_{Max} of the insurance company.

We have $CA_{MaxIA} = f_{IA} \times CA_{Max}$ `

$$CA_{Max} = \frac{n_{IA} \times T_{IA}}{f_{IA}} \quad (18)$$

$$CA_{Max} = p \times Q_{Max}$$

where :Q_{Max} – is the maximum number of policies.

From relation (18), we obtain the number of insurance inspectors who could achieve Q_{Max}

$$n_{IA} = \left[\frac{f_{IA} \times p \times Q_{Max}}{T_{IA}} \right] + 1 \quad (19)$$

where; $\left[\frac{f_{IA} \times p \times Q_{Max}}{T_{IA}} \right]$ represents the full part of the respective expression.

Replacing relation (19) into the relation of fixed costs (11) we obtain the dependency between fixed costs and Q_{Max} :

$$C_F = C_{FO} + 12 \times R_{IA} \times \left\{ \left[\frac{f_{IA} \times p \times Q_{Max}}{T_{IA}} \right] + 1 \right\} \quad (20)$$

where Q_{Max} is the maximum number of policies which may be concluded by this level of fixed costs.

3.5 The case of the company turnover growth over $CA_{Max.}$ We note: $\mathbf{n_{1IA}}$ – initial number of insurance inspectors;

CA_{1Max} - maximum turnover reached by the company with n_{1IA} – insurance inspectors;

Q_{1Max}- maximal number of policies due to this turnover;

The due fixed costs are:

$$C_{F1} = C_{F0} + 12 \times R_{IA} \times n_{1IA} \quad (21)$$

The new turnover imposed by the insurance company is CA_{2Max}

$$CA_{2Max} = CA_{1Max} + \Delta CA ,$$

where - ΔCA represents the turnover growth.

The number of policies is:

$$Q_{2Max} = Q_{1Max} + \Delta Q$$

This turnover growth is achieved only by employing a certain number of insurance inspectors, namely ,, $\mathbf{n_{2IA}}$ '' calculated by the relation**:**

$$n_{2IA} = \left[\frac{\Delta Q \times p}{T_{IA}}\right] + 1$$

$$n_{2IA} = \left[\frac{(Q_{2Max} - Q_{1Max}) \times p}{T_{IA}}\right] + 1$$

Fixed costs $\mathbf{C_{F2}}$ corresponding to the new situation will be**:**

$$C_{F2} = C_{F1} + 12 \times R_{IA} \times n_{2IA} \qquad (22)$$

By operating the accordingly replaces, we obtain:

$$C_{F2} = C_{FO} + 12 \times R_{IA} \times n_{1IA} + 12 \times R_{IA} \times n_{2IA} \qquad (23)$$

Variable costs:

For $Q = Q_{1Max}$, variable cost will be:

$$C_{V1} = Q_{1Max} \times [C_{Mat} + p \times R_D + p \times (f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br})], \qquad (24)$$

If Q exceeds Q_{1Max} variable costs will be:

$$C_V = C_{V1} + (C_{Mat} + p \times R_D) \times \Delta Q, \quad (25)$$

The new slope of variable costs will be:

$$Tg\alpha_2 = (C_{Mat} + p \times R_D) \quad (26)$$

By comparing relations (26) and (15) we found the variable costs lowering.

In relation (25) we replace: $\Delta Q = Q - Q_{1Max}$, and (24) obtaining:

$$C_V = Q_{1Max} \times p \times (f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br}) + (C_{Mat} + p \times R_D) \times Q, \qquad (27)$$

Variable costs as per product unit are:

$$v = [Q_{1Max} \times p \times (f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br})]/Q + (C_{Mat} + p \times R_D), \qquad (28)$$

To obtain analytic profitability threshold (breakeven) we replace (28) and (22) into the relation (1). We obtain:

$$Q_{CR} = \frac{C_{F2} + (f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br}) \times Q_{1Max}}{p \times (1 - R_D) - C_{Mat}} \qquad (29)$$

To obtain graphically profitability threshold function graphs will be plotted

Turnover: $CA = p \times Q$, and of total costs:

$$C_T = C_{F2} + Q_{Max} \times p \times (f_{Ag} \times C_{Ag} + f_{Br} \times C_{Br}) + + (C_{Mat} + p \times R_D) \times Q,$$

At the intersection of the two graphs we obtain Q_{CR}

4. NUMERICAL RESULTS

Data are coming from the **„X''** insurance company

- Yearly turnover :
  CA=16,800,000 [RON] ;
- Number of ywarly cashed policies:
  Q_{AN}=12,000 [buc}] ;
- Average price of a policy:
  p=1,400 [RON];
- Number of indirect productive employees: n_{PIP}=42;
- Average expenditure for an indirect productive employee
  R_{PIP}=2,000 [RON/month] ;
- Number of insurance inspectors:
  n_{IA}= 12;
- Average expenditure for an insurance inspector:
  R_{IA}=2,000 [RON/month] ;
- Turnover share achieved by the insurance inspectors form the total turnover:
  f_{IA}=30%=0.3 ;
- Commission for agents as percent of the selling price of a policy:
  C_{Ag}=10%=0.1 ;
- Turnover share achieved by the insurance agents from the total turnover:
  f_{Ag}=40%=0.4 ;

Calculation of fixed costs

$\mathbf{C_{PIP}}$=1,008,000 [RON /YEAR];

Maximum turnover to be obtained with the n_{1IA}=12, is

CA_{Max1}=16,000,000 [RON];

Maximum number of policies to be obtained:

Q_{1Max}=11,430 [policies]

To this production, both the n_{1IA}=12 inspectors and the agents and brokerage companies are contributing.

The company wishes the turnover growth to: CA_{Max2}=24,000,000 [RON];

This growth can be achieved only by increasing the number of inspectors.

ΔCA_{Max}=8,000,000 [RON];

Additional number of inspectors will be:

n_{2IA}=21 inspectors

In this situation fixed costs will be:

C_{F2}=4,000,000 [RON];

By operating replacements, relations (21) and (22), become:

$$C_{F1} = 3{,}500{,}000 + 24{,}000 \times \times ([0{,}00105 \times Q_{1Max}] + 1)$$

$$C_{F2} = 3{,}500{,}000 + 24{,}000 \times \times ([0{,}00105 \times Q_{1Max}] + 1) + + 24{,}000 \times ([0{,}0035 \times (Q_{2Max} - Q_{1Max})] + 1)$$

Variable costs:

For $Q \le Q_{1Max}$, we have:

$$C_V = 801 \times Q$$

Total costs:

$$C_T = 3{,}500{,}000 + 801 \times Q$$

For $Q \ge Q_{1Max}$, we have:

C_{V1}=9,160,000 [RON]

$$C_V = 9{,}160{,}000 + 682 \times \Delta Q,$$

By replacing $\Delta Q = Q - Q_{1Max}$, we have:

$$C_V = 1{,}360{,}000 + 682 \times Q$$

The slope for variable costs in the new situation:

$Tg\alpha_2$=682;

The slope of variable costs decreased from $tg\alpha_1$= 801 to $tg\ \alpha_2$= 682

Total costs will be:

$$C_T = 5{,}360{,}000 + 682 \times Q \quad (32)$$

The business turnover will be:

$$CA = 1{,}400 \times Q \quad (33)$$

Equaling the relations (33) and (34) we obtain:

Q_{PR} =7,465 (policies)

Profitability threshold may be determined also analytically, as per relation (29) Q_{PR}= 7,465 (policies).

5. CONCLUSIONS

The paper deals with specific issues in insurance cost calculation of the profitability threshold (breakeven).

By determining the computing relations we found two fundamental features. The first concerns the dependence of the *threshold function* depending on the fixed costs. The second concerns the change of the straight lines slope that shapes variable costs once with the appearance of fixed costs thresholds.

This makes the total cost depending on the number of insurances to be a fairly complex function, so that profitability threshold (breakeven) is difficult to be determined by solving an algebraic equation. Therefore, the graphical representation allows much easier to determine the profitability threshold.

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MANAGERIAL COMPONENTS IN IMPROVING THE EFFICIENCY OF THE MANAGEMENT OF ROMANIA'S STATE BORDER SECURING

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Abstract: *The geographical position of Romania's borders imposes a regional and systemic approach of the issues related to the management of an extremely important portion of the integration into the Schengen Space.*

Key words: *management, frontier, regional, secure, integration.*

1. INTRODUCTION

The securing of the national border, the strengthening of the surveillance and control at the state border, with the participation of all the institutions having competences in this field, based on an effective inter-institutional collaboration, represents a major objective of the process of Romania's integration into the European Union and the Schengen Space.

The Romanian Border Police is the specialized state institution which ensures the development of securing actions in a unitary and coherent system at the state border, exerting its attributions according to the provisions of article 1 of the Government's Emergency Ordinance no. 104/2001 on the organization and functioning of the approved as amended by Law no.81-2002 as subsequently amended and completed by Government's Emergency Ordonance no.105-2001 regarding Romania's borders, Romanian Border Police, approved as amended by the Law no. 243/2002 as subsequently amended and completed, to the methodological norms of enforcement of the Government's Emergency Ordinance no. 105/2001, approved by the Government Decision no. 445/2002, as well as to the EC Regulation no. 562/2006 of European Parliament and Council of Europe of March 15, 2006 on the creation of a Community Code on the rules governing the movement of persons across borders (Code of Schengen Borders) [1].

The creation of a united Europe and the establishment of the new frontiers of the European Union and of the North Atlantic Treaty Organization represents an important step in the process of security and socio-economic development of the Eastern European countries. In the EU accession process, the candidate states, including Romania, assumed a number of responsibilities, namely to observe, as the member states did, the rules and requirements meant to contribute to a secure life.

Within this process, the Schengen provisions became a part of the conditions for the EU accession, the member states showing the candidate states that the issue of free circulation is a matter of security, and the related obligations must be assumed by all those who wish to be part of a united Europe.

For Romania and its competent state institutions the previous years were a period of hard work aimed at fulfilling the recommendations for joining both the European Union and the Schengen Space and

coming into line with the measures taken at international level for fighting terrorism and ensuring the citizens' security.

In attaining the objectives proposed, the Romanian Border Police enjoyed the support of European Union experts, through the nine institutional twinning conventions concluded, taking important steps towards the adoption of their specific work to the international standards.

2.REGIONAL SYSTEMIC - APPROACH

The geographical position of Romania's imposes a regional and systemic approach of the issues related to the management of an extremely important portion of the future external frontier of the Schengen Space. Its importance is mainly given by the length of the frontier segment – over 2000 Km – and by the positioning on the East-West axis of the cross-border criminality, within which an important place is held by illegal migration, trafficking in human beings and luxury cars.

The efforts will have to be directed towards the application of measures of reconstruction of the institutional system, of decisional decentralization, of increasing the staff's responsibility and professional level, of improving the procedures of surveillance and control of the state border crossing, in accordance with the European standards, and of enhancing the operative and economic efficiency of the logistic support, which is continually developing and modernizing, both by individual efforts and with decisive external aid [2].

Attaining these goals means establishing priorities and identifying the ways to achieve them, which should constitute an individual managerial program of securing this border.

The complexity of the goals to attain and of the tasks to accomplish in the field of Romania's state border securing, require a modern European approach of the internal and external cooperation relationships, which should confer new quantitative but, most of all, qualitative capacities to the informative-operative activities in the fight against cross-border criminality and international organized crime.

Within the framework of the practical activities, Romania's state border "securing" represents a major objective of the current stage, aiming at counter-acting illegal migration and other actions which infringe the state border regime.

The state border securing, the strengthening of border checks and the improvement of general management constitute the sine-qua-non conditions of success in the effective fight against cross-border criminal activities.

The necessity of securing Romania's borders is determined by the increase of cross-border crime, both in extent and in complexity, as well as by the existence of conditions favoring such phenomena by the persistence of the economic crisis, of social, ethnic and religious conflicts, the proliferation of terrorist actions in some states neighboring Romania's borders or worldwide. This is why the complexity and the extent of the criminal phenomenon, its pressure at the borders and the necessity of fighting it effectively while concurrently implementing measures of border securing, impose the actual participation of all the state structures and bodies having responsibilities at the border, so as to achieve an integrated border management compatible with the Community practices.

Securing the border does not suppose and does not mean adopting measures that contradict the free circulation of persons. It means, first of all, the fight against criminal and unlawful actions.

Implementing the management procedures and methods specific to the frontiers of the Schengen space at Romania's external border, on the basis of the enforcement of the Romanian border-related legislation adapted to the European one, is a priority action direction for the coming period.

The complexity of the objectives to attain and of the tasks to fulfill in the domain of Romania's state frontier securing generates a new attitude and a modern European approach of the internal and external cooperation, conferring new quantitative but, most of all,

qualitative capacities to the information and operative activities in the fight against cross-border criminality and international organized crime.

The establishment of the new European Union frontiers represents an important step in the process of security and socio-economic development, especially of the countries of the Eastern part of the continent.

In this context, given Romania's geographical position, it has been found that illegal migrants tend to transit our country in their way to their main target – Western Europe. This is a reason why Romania plays an extremely active role in identifying and annihilating the main transit routes of illegal migration.

Romania assumed a number of responsibilities in the adhesion process: first of all the observance of the rules and requirements supposed to contribute to a secure life, similar to that in the member states.

In order to fulfill the recommendations of the European Union, the Government of Romania and the Supreme Council of the Country's Defense have adopted a number of documents containing the principles and action directions for training, organizing and equipping the Romanian Border Police. The main document is the "Strategy of Romania's State Border Securing and the Strategy of Integrated Management at the Border".

In compliance with the Strategy provisions, the border securing will be approached in accordance with the current stage, namely the integration into the European Union, concurrently aiming at creating the premises so that, in the period following its integration into the European Union, Romania should meet the preliminary requirements to become a part of the Schengen Agreement, considering that the elimination of the checks at the inner borders is achieved as a result of a unanimous decision of implementation of the Schengen acquis, not on the basis of bilateral agreements concluded between Romania and the neighboring states.

3. MANAGERIAL KNOWLEDGE (SCIENCE) IN THE PUBLIC ORDER FIELD

In the domain of public order in general, and of border police in particular, the science of management is represented in all the spheres of activity, at all hierarchical levels, from the highest to the lowest levels, to subunits and other formations.

In order to continue implementing the management of the surveillance and control of the border crossing at EU standards, emphasizing the particularities of the management of the border police units is a priority concern of the decision-making factors.

In this respect, the organizational factors or variables which determine the size and configuration of the organization structure are critical. Such factors or variables were identified and presented in the report, and their detailed analysis allows a solid substantiation of the structure from a complex operative, economic, human, technical and legal point of view.

In the paper we emphasized the management methods and techniques that contribute to the organization and development of activities aimed at fulfilling specific attributions. Thus, we identified general management methods applicable in the border police units (management through objectives, participative management and management through budgets), as well as the specific methods and techniques used in the management of the border police units

(diagnosis, delegations and meetings) [5].

By analyzing the structure and functionality of a border police unit, both as a whole and in detail, by first taking into account the nature of the management activities, we can appreciate that the decision-making subsystem is represented by the managers (chiefs), those who, on the basis of the principle of the unity of command – a principle specific to public order – are invested with the full and indisputable authority to make decisions for the purpose of attaining the objectives at the level of the whole unit, and are responsible for the fulfillment of such objectives.

Considering that, in the sphere of border police, the most frequent situations in which decisions are made are situations of uncertainty and risk, we can say that, within this institution, the decision is the highest stage, the most refined and standardized form that the optional approach has attained. It answers two major commandments: it provides sufficient accuracy in a field with the biggest charge of uncertainty; it guarantees the strictly necessary opportunity in a spere characterized by the biggest dynamism and instability.

The elaboration of correct decisions is only possible if the managers of the border police units, along the whole hierarchy, dispose of truthful and complete information. In other words, the modern and effective management of the border police units implies the existence of a reasonable and timely information system, able to provide the elements on which decisions should be founded [3].

Without an information system that works properly, no border police unit is able to work properly.

Knowing the work parameters of the information system, we consider that any manager (chief) will size the system of the unit he manages at strictly necessary levels, and will not accept the occurrence of parasitic information circuits and flows, the doubling or trebling of circuits and documents and, consequently, the inefficient use of human, material and financial resources available [6].

The organizational subsystem, as a result of exerting the organization function, reflects all the changes that occur in the other components of management – the methodological, decision-making and information components.

The formal organization in the border police units is regulated both by normative acts (laws, ordinances and government decisions) and regulations, orders of the hierarchic superiors and internal orders of the unit chiefs. The activities specific to the border police units are also regulated by the rules of organization and functioning of each unit, the organization chart, job descriptions etc. [4].

The processual organization ensures the delimitation and sizing of tasks, attributions and functions, and their correlation with the objectives and the structural and organizational components of the units within the border police.

The units belonging to the border police structure are characterized by the existence and manifestation of the functions of research and development, social command, execution, personnel, financial and accounting.

The organizational structure of the border police units, with its two components - management (command) and execution, includes the organizational sub-divisions defined by modern management as: job, position, compartment, hierarchical level, hierarchical weight, organizational relationships, which are conceived and sized in such a way as to ensure the fulfillment of the objectives in an efficient and effective manner.

4. MODERNIZATION STRATEGY

In the strategy of the the border police modernization, several stages of transformation of this MAI department were established, aiming at its organization both as a whole and by components: processual, structural, organization of individual, collective and management activity.

The institutional reconstruction of the border police and of its composing structures must continue by the acceleration of its reorganization and restructuration, with the view of eliminating parallelisms and intermediary links, reducing oversized structures, achieving the harmony between the

tasks and the organizational structure of the units, increasing the degree of interoperability with similar institutions of the European Union, by correlating the new organizational architectures, enhancing the efficiency of the operative formations, rationally redistributing effectives and increasing flexibility in fulfilling specific missions.

Establishing objectives leads to establishing the mode of actions, to suggesting certain types of action specific to the area of responsibility, to correctly assessing the possibilities and restrictions imposed by internal and external factors generated by the realities of the present and the estimates for the future.

In order to apply the fundamental objectives long terms are used, while for the derived ones, which are individualized by structures, the short-term staging is used, which ensures the success of quantitative accumulations.

The complexity and rhythmic staging of the objectives to attain generates, in following their fulfillment, decisions having a strong "prophylactic", and often corrective character.

In evaluating the fulfillment of the objectives, the personnel's reward is given the same importance as the operative, logistic and financial aspects.

The purpose of the established objectives and of the measures and actions taken is to enhance the efficiency of the normal functioning of each structure: Directorate, Inspectorate, Sector, and Border Crossing Point. All the other commandments – human resources, logistics, financial and decision-making – are subordinated to the operative and informative work.

Without diminishing the importance of any modern management principle, steady action is taken towards promoting specialists to managing positions, on the basis of competence criteria, towards achieving a real correspondence between the responsibility and the authority of the position, towards the promotion of the team spirit by work structures and groups and, last but not least, bringing the management close to execution.

The management of Border Police for applying the strategy of securing the Eastern border, in the dynamics of its application, of its completion with objectives and directions of action, related to the evolution of cross-border crime, to the identification of the necessary resources, to the priorities and new requirements of the European Union, involves its inclusion and the application of its regulations in the yearly and periodical plans of the border police structures, in which responsibilities are clearly established, in terms both of execution agents and of deadlines.

The Management for Romania's state border securing, adopted at the level of the Border Police, ensures the success, in conditions of normality and in crisis situations, of the missions of surveillance and border crossing control, of the prevention and combatting illegal migration and the specific factors of cross-border crime perpetrated in the area of competence, of the observance of the legal regime of the state border, of passports and aliens, the securing of the Romanian interests on the lower Danube, the respect of public order and peace in the area of competence, in the legal conditions, and using, as reasonably as possible, the human, material and financial resources available. No effort is too big in this major approach, as the incapacity of managing, mastering and combatting cross-border crime generates threats not only to the national security of the Romanian state, but also of the other European states. In these conditions, securing the Eastern border is not only an objective, but also a

necessity for the existence of a united Europe.

5. CONCLUSIONS

The current characteristic features of the international security environment necessarily lead to the requirement of a unitary and efficient response to the global threats generated by international terrorism and cross-border organized crime, in all its forms of manifestation. Globalization has made the states feel the same needs of security at the border.

From this point of view, the building of a united Europe and, most of all, the dynamics of the UE, by the accession of other states, represent new challenges in terms of ensuring the global security of our common space of freedom. The security of each member state is conditioned by global stability and vice versa. The diversity and national specificity in approaching the security concepts are brought together, within the European Union, by the common belief and objective of the member states, expressed in the establishment of the fundamental goal of securing a space of wide assertion, of freedom, justice and security. The integrated border management – a concept which has been introduced rather recently in the approach of the security of the EU borders – seems to offer the most appropriate solution for ensuring global security and, implicitly, the security of each nation, by respecting the citizens' fundamental freedoms, including the free circulation in the Community space, as well as by providing proper fluency of the economic exchanges among the states. Romania has endorsed the values and principles of the Union. Its firm option, its present and future actions for attaining a guaranteed degree of security of its own borders, represent in this respect one of the conditions which provide the Romanian citizens with full access to the European space of freedom, with the possibility of escaping the confined isolation and of giving the national territory the attribute which it deserves, that of a common European territory.

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FROM MANAGING INFORMATIONAL ASYMMETRIES TOWARDS A SYSTEMIC ASYMMETRIES APPROACH IN TECHNOLOGY TRANSFER: A critique based on the SME strategy at ONERA – the French Aerospace Lab™

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(ABSTRACT)

The technology transfer process between a public laboratory and a company has been the subject of many publications and has been widely discussed in economic theory. This paper highlights several newly identified asymmetries occurring between the different agents taking part in the process.

The theoretical corpus of the article draws upon empirical sources, being based on the recent experience of one of the most dynamic Technology Transfer Offices (TTOs) in France: the case of ONERA (the National Office for Aerospace Studies and Research) and the SMEs.

In such a cooperative innovation process, we will show that certain collaborative tools or practices emerge, aimed at reducing information asymmetries or acting as compensation mechanisms for other types of asymmetries between the partners at a microeconomic level; especially in France where there is a gap between the public R&D laboratories and the SMEs in terms of Technology Readiness Levels (TRLs). Some of these compensation mechanisms, particularly those related to the knowledge management, could be adapted and reshaped for agents engaged in R&D and innovation in various other sectors, perhaps inducing positive amplification effects on innovation behavior, and thereby on economic growth at the macroeconomic level within the "national innovation system".

Keywords: *French SMEs, technology transfer, information asymmetries, innovation systems, TRL, DRL*

INTRODUCTION

The technology transfer process between a public laboratory and a company has been the subject of many publications and has been widely discussed in economic theory as well as in applied economics (e.g. the *Journal of Technology Transfer*). Here we will deal with the specificities related to this process in France and, in particular, in the field of technology transfer arising from the field of aerospace and defense.

These specificities relate to the characteristics, capabilities and competencies of SMEs and public research laboratories. This paper will be based mainly on feedback regarding the strategy implemented for the development of an economically 'healthy' relationship between ONERA (*Office National d'Etudes et Recherches Aérospatiales*, the National Office for Aerospace Studies and Research) and the SMEs. The choice and definition of collaborative tools will be explained together with the analysis of the initial results and the prospects envisaged.

We will contend that, in a cooperative process of innovation, these tools become mechanisms for reducing informational asymmetries (Stiglitz & Weiss, 1992) or "compensation mechanisms" (Paun, 2009) for other asymmetries between the various players at a microeconomic level. These newly identified asymmetries, **Institutional (Culture) asymmetry** (regarding the institutionalist theory of Veblen, 1914), **Technological (Information in the case of Technology Transfer) asymmetry, Risk and Time Scaling asymmetry**, often act as barriers to the technology transfer process, while simultaneously being critical for the eventual high intensity of the innovations pursued. The

greater the asymmetries, the stronger the impacts on the intensity of innovations, always supposing that the differently involved actors in the innovation process do succeed in working together. This involves the effective implementation of asymmetries reduction (or compensation mechanisms) bridging the various agents.

Some of these mechanisms, more related to the knowledge economy, could be adapted and reshaped for other agents in the R&D and innovation domain, and for evaluation or regulation authorities of this domain. Their implementation for these other players could induce a amplification effect on innovation and its direct effects on economic growth at the macroeconomic level within the framework of the "national innovation system" **(**Freeman, 1987; Lundvall, 1992; Nelson, 1993**)**.

I – CONTEXT, POSITIONING AND ROLE OF THE ACTORS IN INNOVATION

A brief description of ONERA's economic environment is necessary for a better understanding of the reasons for these tools and their operation, as well as a reminder of the fundamental principles of innovation and the role of technology transfer in this process.

ONERA is a scientific and technical public corporation with commercial and industrial characteristics (EPIC). Its mission is defined as follows: "... to develop and direct research in the aerospace field; to design, develop and implement the necessary technical tools and benches for carrying out this research; to ensure, in association with other R&D organizations, the circulation, at a national and international level, of the results of this research; to support their utilization by the aerospace industry; and possibly to facilitate their application outside the aerospace field".

This quotation is important for understanding ONERA's position in the TRL[1] chain (Mankins, 1995), its role in technology transfer, and more generally its role in innovations generated on the basis of the technology that it has created.

This nuance is very important, particularly in the 'ideological opposition' between those who prioritize a 'publication' strategy and those who prefer one that stresses a 'patent', because premature disclosure, in the form of articles or conferences, ensures the circulation of knowledge but also facilitates uncontrolled utilization of the results of research by industry, including competitors of the national or European industry.

It must also be observed that ONERA has to transfer the results of its research (in order to "... support utilization...") to the aerospace industry and also "... outside the aerospace field..."

Its supervisory authority is the Head of the French national armaments organization (DGA). The other organizations with which ONERA has close relationships are the DGAC[2], CNES[3], the ESA[4] and of course the European Commission (EC) through contracts that are part of the PCRD[5]. Its strategic customer-partners are the large French or European aerospace groups, such as Airbus, Eurocopter, Astrium, Snecma, Thales and Dassault. During its entire existence ONERA has devoted most of its activities to studies directed by or for this first circle of institutional or industrial partners.

The last consolidated figures show an annual operational budget of 230 M€, of which 62% comes from R&D service contracts, and a labor force of 2040 employees.

I.1 - Specificities of the Aerospace and Defense field

This brief description of ONERA's economic environment needs a complementary analysis of the players from the point of view of the utilization of its research results by industry.

[1] Technology Readiness Levels

[2] General Directorate of Civil Aviation
[3] National Centre for Space Studies
[4] European Space Agency
[5] Research and Development Framework Programme

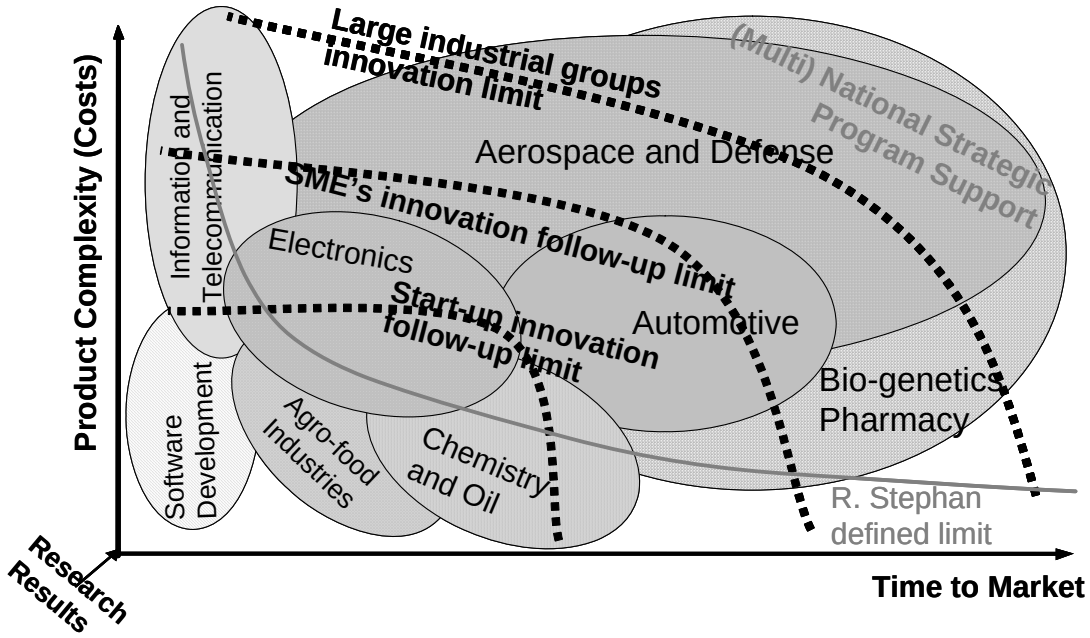

Figure 1: Limits to innovation process control by the creator (or assimilator) of technology, by technological sector : - R Stephan limit - - Authors proposed limits

So Figure 1 presents a classification of the market sectors according to two parameters: the time involved in launching products resulting from a new technology on the market, and the complexity of the products intended for this market, roughly approximated by the cost of a unit of the product (Stephan, 2006).

R. Stephan, while presenting this figure, proposed a generic limit to innovation process control (up to the successful delivery of the new product and/or service to the market) by the carrier-creator of the technology itself.

It must be admitted that an SME has less material means to establish a successful new product/ service in the market than a large group. This is even more evident for a start-up partner. Thus we proposed to decline the limitation curve into 3 limits corresponding to these 3 type of actors and modify the original shape of the curve to one better adapted. These new proposed limits are generically represented in the Figure 1.

The specificity of the aerospace and defense markets asserts itself very quickly because these sectors, which are generally 'complex systems' (Hobday, 2000), require a lot of time for the development and introduction of a new product on the market. We note that even large groups, beyond a certain limit, need institutional support at the national level, if not at the international level, to develop new technologies.

So in what circumstances would ONERA be able to respond well to its prospective mission of "developing and directing research" and its transfer mission "to support the utilization of its results by the national industry"?

By being located within the upper limit of the diagram, the large aerospace sector and French and European defense groups stand out as designated partners for successfully 'bearing' (i.e. acting as generator, carrier and

user of) the new technologies suggested and/or developed by ONERA. This is particularly the case for the incremental or specialized innovation of the large groups. Such 'bearing' is however less obvious in the case of technological breakthroughs (see McCooe, quoted in Golob, 2006), and this is even more the case in the civil aerospace sector where technologies used onboard planes must be safe and tested technologies. For these aspects, since its creation ONERA has developed and maintained effective strategic partnerships with the large national groups which have mostly become multinationals in recent years. This partnership policy will not be the subject of our analysis here.

The fundamental question raised during the development of ONERA's implementation strategy is that of access to markets, for breakthrough technologies resulting from a specialized research sector such as aerospace. From this point of view, the preceding diagram, presenting the limits to innovation processes, illustrates the point that, to put a 'breakthrough technology' on the market, thus challenging the existing products and/or business models, such as may be designed by a national skill centre, the best vectors are the SMEs.

Technological demonstrations that result in innovation will not necessarily take place in the aerospace market but can arise in any of the market sectors in which the SME receiving the technology can itself control the innovation process completely (until the successful introduction of the new product to the market). Some niche markets will be accessible, even in the aerospace sector (green aviation, small-scale drones, leisure, etc.). Once the technology is demonstrated, there are strong chances that the large aerospace groups will integrate this technology as a tested module into the systems they are designing **(**Mouchnino & Sautel, 2007**)**.

The strategic choice was taken at ONERA for the development of a partnership relationship with a national and European SME. If no SME is identified, the launching of a start-up partner could be studied, subject to the economic outlook and adequate financial support.

I.2 - ONERA-SME Relationships

Like any healthy partnership relationship, that between ONERA and an SME must be a winning one for both parties. Both partners must have strong positions **(**Cowan, Jonard & Zimmermann, 2003) with each adopting its own role so that their collaboration generates significant added value. So ONERA develops its best technological solutions, possibly breakthrough technologies, and the SME implements its product development, industrialization and marketing capabilities in order to reinforce its competitive advantage in its markets or to create new ones.

These complementary roles, based for one side on a 'craftsman instinct' and for the other on a 'predatory instinct', opposable in the sense given by the theory of Veblen **(**1899**),** generate significant asymmetries between the two partners.

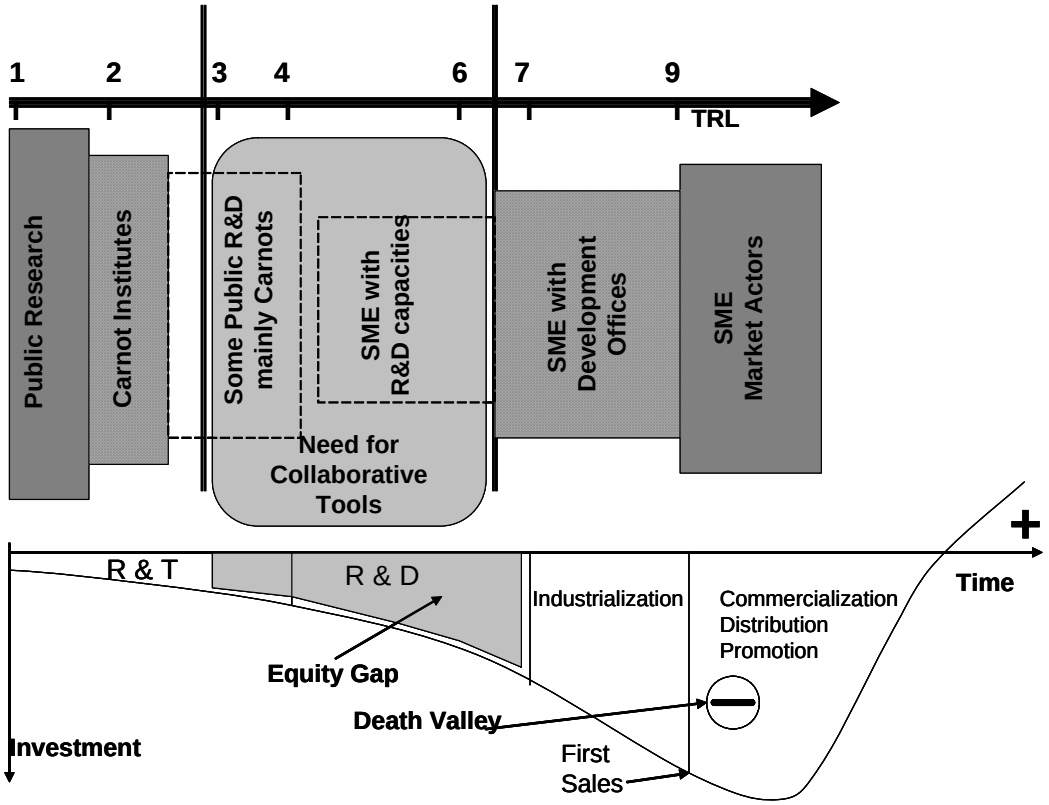

Figure 2: Asymmetries between public R&D laboratories and SMEs, by TRL scale

Figure 2 presents the existing asymmetries between the public R&D laboratories and the SMEs in France by showcasing their respecting positions with regard to the TRLs (Mankins, 1995).[6] It should be stressed that the majority of the public R&D laboratories in France carry out their activities at the levels TRL 1 (basic research) and TRL 2 (applied research). The 33 Carnot Institutes, being responsible for 470 million of research carried on in partnership with industry, representing about a half of the yearly budget for French research undertaken in partnership with industry, are generally well involved in applied research (TRL 2). Very few of the Carnot Institutes could carry their research up to laboratory demonstration levels (TRL 3-4). Exceptionally and limited to particular programs, some of the Carnot Institutes could bring their technology to the operational levels (TRL 6-7).

Beside these figures, the SMEs are currently running their business at TRL 9 (these are selling products, services or components). Fewer than 10% of French SMEs have Development Offices able to integrate (or absorb) operational prototypes (TRL 6-7), in order to structure production chains and introduce new products to the market. And even fewer have R&D capacities able to understand technologies available at Lab Demonstration Levels (TRL 3-4). Thus, the Technological Asymmetry existing between public R&D labs and the SMEs becomes obvious.

[6] This figure was first presented and generally accepted at the 'Rendez Vous Carnot', Lyon, France, 2010 within the last Round Table dedicated to collaboration between Carnot Institutes and the SMEs.

In addition, is well known that between the same levels an equity gap is evident in some European countries, hence the European Investment Fund (EIF) and several publicly-owned banks (like CDC in France) have dedicated important financing programs to compensate for this Europe-specific 'amorcage' equity gap. This of itself will induce an important Risk Asymmetry between the public R&D and the SMEs.

These asymmetries must be reduced (for the informational asymmetries) or compensated for (technological capacities, financial and institutional risks) in order to support this new co-development relationship between the parties, as put forward in this analysis. The collaborative tools will thus be reduction and/or compensation mechanisms of the existing asymmetries between ONERA and its SME partners, with the aim of creating a "Trust environment" between the two agents.

Owing to their small size (INSEE, 2008) but also to the structural weaknesses of the innovation support system set up by SMEs and/or start-up partners in France **(**Serfati, 2008**;** Levy & Jouyet, 2007**),** French SMEs must have suitable support mechanisms (private or public) for the success of a possible common development program with ONERA, in order to absorb new technology and to make a success of their international commercial deployment.

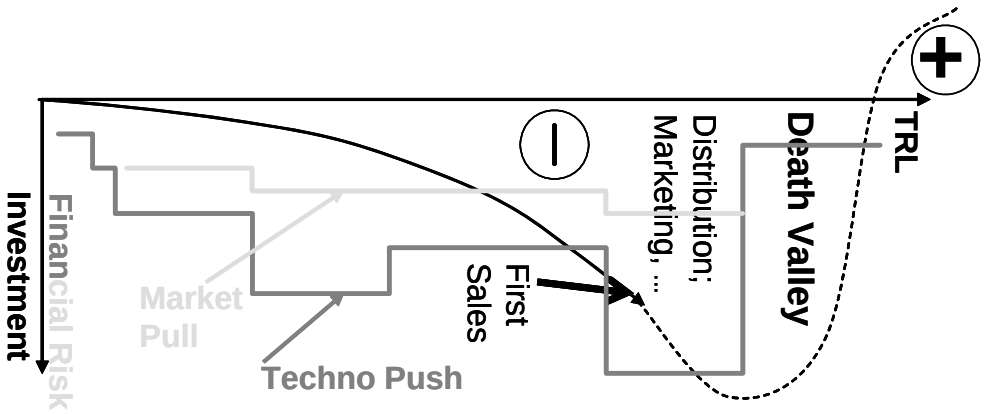

Figure 3: Risk curves related to the Technology Development Investment Curve

Two different approaches were targeted by ONERA's Technology Transfer Office (TTO). More than ¾ of the signed agreements were obtained through a Market-Pull approach and under ¼ were obtained from a Technology-Push approach. Figure 3 supports this part of our analysis.

Indeed, following an intensive advertising campaign based on slogans like: "Come to see us if you have a Technology issue! We are the MacGivers of the Science and you will never be alone", the majority of its SME partners did come to see ONERA addressing their technology issues. They had generally already identified a business-growing opportunity while calling on ONERA's TTO and they were looking for missing competencies in their company. We call this a Market-Pull approach. Technology-Push occurs when ONERA's TTO promotes a technology newly developed within ONERA and negotiates a license with an interested SME (or start-up).

Market-Pull projects have until now been successful to a higher degree. Accordingly, we propose our analysis of these results. In Figure 3, the risk curve for the technology-push approach is given by the blue line, while the red line shows the case of the market-pull approach. We can observe that both exhibit a high level of risk while investing in operational technology demonstrations and above all in launching New Products (goods and services) into the market. Nevertheless, we remain confident about our implicit assertion in Figure 3 that, throughout the

cycle, the risk levels are lower in the Market-Pull approach than with Technology-Push.

This lower risk exposure is induced at each stage by the fact that the SME partner has already identified a market and already possesses a structured production chain (including a supply chain). These considerations act as drivers throughout the technology collaborative development process, raising the company's rating on the TRL scale, thus reducing its risks and costs. The Market-Pull approach also seems to accelerate the technology development process; thereby accentuating the dynamic capabilities that the firm is able to parade,.

We further adopted a hybrid strategy for ONERA while working with SMEs. Indeed even if the market-pull approach seems to be less risky and sooner beneficial, and even if it is producing incremental and often radical innovations by changing the domain for the adopted aerospace technology, we do believe that some technology-push activity will continue to be important for eventually nurturing disruptive innovations in ONERA's core business domain. Another important reason in continuing to promote technology-push activities through its TTO is the higher degree of motivation provided to its scientists while promoting their newly developed technologies.

This hybrid strategy places the agents of the innovation system in a cooperative network generating newly created value through a process of technology transfer.

II – THE ONERA-SME PARTNERSHIP STRATEGY

The ONERA-SME technology transfer process cannot be analyzed without taking account of the relationships of the two players with their own reference frames, in terms of evaluation and sectoral/territorial regulations, in the sense of Granovetter **(**1985**)**. These are mechanisms that are external to the simple ONERA-SME relationship which must intervene and accompany this dual relationship throughout the entire collaborative project, and some of the collaborative tools proposed take them into account.

Initially, an analysis of the role of each player during the innovation process is proposed and even, albeit in a more restrictive way, in the technology transfer phase.[7] As mentioned above, the activity of the public R&D laboratories in France involves, structurally, TRL levels lower than level 3-4, corresponding to the laboratory prototype stage. Only a few basic ideas conceived by the researchers attain this level of technological maturity and even fewer cross levels 3-4 to go on to levels 6-7, corresponding to the demonstrator in operational conditions or a product. This is because the development of technological demonstrators is no longer part of the mission given to public research in France, a situation that is actually even worse for products.

II.1 - Asymmetries in technology transfer relations and collaborative tools to reduce them

It can be seen that the research activities in TRL 1 and 2 are really mostly by the research laboratories because few SMEs are able to conduct their own research at these low TRL levels. Most innovating SMEs (apart from those that ate really small labs in their own right) invest more in R&D activities after demonstrating technological feasibility, because their ultimate mission is to sell

[7]We are being reductive here, and consider that ONERA will have little influence on the launching of the new product developed by the SME; in fact, this neglects the power of publicity represented by the 700 annual participations by ONERA scientists in International Conferences, as well as the capacity to bring into play synergies with large industrial companies and institutions.

products successfully, with an economic logic of seeking profits.

So, what can be done with a technology that reaches a research laboratory at level TRL 2? At this stage, a laboratory prototype can be shown to be feasible by simulation and/or the existence of certain elementary components with strong chances of success. Who must now invest in the development of this prototype and on which criteria should the decision be based?

It seems obvious that at this stage the laboratory should consult the possible bearing vectors in the market: large groups and SMEs. If the technology developed corresponds to a strategic axis of development in a large group, quite naturally the latter will be interested in the appropriation of this technology or, at least, in a competitiveness comparison with other solutions. The partnership process that would take place between the laboratory and this large group is not the subject of this analysis.

The case that interests us is that in which an existing SME is interested in this technology, whatever its branch of industry. When no SME or large group expresses interest in the use of the new technology then there only remains the option of launching a start-up partner, in the case of a 'disruptive' technology with high development risks and market potential, to be confirmed by market research; otherwise the development has to be abandoned.

II.1.1 - *Technological asymmetry and Risk asymmetry*

On the two assumptions, both for a SME and for a start-up partner, the problem of maturing technology up to the TRL 3-4 level is still the same. It will be very difficult to get the SME or the start-up partner to finance this maturation. All this is related to the structural problem of financing developments in France but also to the lack of leading-edge scientific skills within the SME, allowing dialog with researchers and the appropriation of technology under the TRL 3-4. An asymmetry of technological capacity is revealed here and an asymmetry of the risk (financial) between the two participants: the public research laboratory and the small company.

Indeed, 95% of French SMEs are small companies with less than 50 employees **(**INSEE, 2008). The development and demonstration of a new technology based on emerging technology from aerospace costs at least around one million euros (according to our own experience in the relationships with our SME partners), without counting the launching and development costs of the product line. However, most of the innovation assistance available in France is limited to 50% of the global amount (see Oseo, 2008, on refundable advance). This means that an SME that undertakes the development of a new product for a breakthrough innovation must assume half of the costs itself. For an SME with twenty people, €500K may well represent 25% of its annual wage bill.

Here, a significant risk asymmetry is to be noted between the SME and ONERA because possible failure could mean a cessation of activities for the former. The same amount represents the cost of four ONERA researchers. Moreover, the financial risk exists and is not negligible, especially in the EPIC culture, where we will see later that the scientists involved in the technology transfer relationship are very little aware of the risk for ONERA compared to the degree of the risk assumed by the SME. Other authors **(e.g.** Serfati, 2008) have also stressed the importance of social relationships (including cultural relationships) in the innovation process. This difference in mentality was identified without any ambiguity in the collaborations undertaken by ONERA with various SMEs.

II.1.2 - *The shared risk development contract*

A mechanism to try to solve this technological maturation and asymmetry problem has been developed at ONERA: the *shared risk development contract*. This type of contract was developed and signed, for the first time in France, between an EPIC and a business firm.

For this phase of technology maturation ranging between TRL 2 and TRLs 3-4**,** the risk is still too great to be borne entirely by an SME as long as the technological proof, at least in the laboratory, as well as a complete comprehension of the technology, have not been achieved. It seemed right to us that ONERA, as a creator of technology, should be able to join future industrial and commercial owners in order to reduce the risks, and share the possible future benefits. The partnership is based on a technical and economic analysis of various phases of the development and on a *Business Plan* detailing the market prospects and investment returns on the new product. Based on this, ONERA can decide to assume part or all of the costs, within the framework of the co-development, the refunding of which, with profit-sharing based on business success, will take place or not, depending on the prospects for the use of the product.

The negotiation of the percentage allocated to sales, so as to cover ONERA's costs and its exposure to risk, is conducted according to criteria allowing the development of the company but also bearing in mind the fact that ONERA must make a positive return on all the operations of this kind. Thus, this contract is not a sort of license, nor a subsidy. The principles on which this contract is based are those of a service provided by ONERA on the basis of a determinable (though undetermined) price with payments deferred in time, negotiated between the parties on the basis of later sales and for a length of time agreed upon as part of the same negotiation.

This type of contract proves to be a very good tool, both financially but also technically, for collaboration with co-design in mind, for the development of a new product, a logic equivalent to that described by Cowan **(**2003**)**. This tool means two parties can together cross, within the meaning of Aoki's theory **(**Aoki, 2000**),** based on a Nash equilibrium (Nash, 1950), a possible financial and technological comprehension barrier that may otherwise induce blocking.

In addition to compensating for risk and technological asymmetries between the two parties, this contract has also subsequently proved to be a good tool for reducing transactional information asymmetries **(**Akerlof, 1970; Stiglitz & Weiss, 1992**)** between the start-up partner and its investors. Indeed, at the time of the phase of 'due diligence' between the creators of the start-up partners and the Business Angels, the *shared risk development contract*, signed with ONERA, yields paramount information on both the product and the target market, and on the technological developments and their costs.

This last years, at ONERA, several contracts of this type were signed with various commercial companies. Four of these companies have succeeded in raising significant funds from investors.

II.1.3 - *Institutional asymmetry (mentality and behavior)*

The *shared risk development contract* is a collaborative tool that compensates for technological and risk asymmetries. Such a tool also compensates indirectly for a very important asymmetry in the relation between the transmitter and the receiver in the process of technology transfer, institutional asymmetry, a term introduced here analogously with the terminology of institutional economy, within the meaning of "thought and action practices" by Veblen (1899) of "shared mental models" and "belief structures that intervene as formal and abstract constraints to structure human interactions" by North (1994).

This asymmetry has been thoroughly analyzed because it can sometimes induce a more significant form of blocking in a dual relationship: cultural blocking. The institutional word must be understood as a sum of the rules, but also in its abstract aspect,

as a sum of beliefs, prejudices, instincts and behaviors: “Institutions are dominant thought and action practices” (Veblen, 1899). All these elements are generated historically, according to the way in which the actions are carried out and are assessed, but more especially through received education.

Historically, applied research in France is really quite concentrated in national research centers specialized in a particular field (IFP, CEA, ONERA, Inrets, Inra, Inria, etc.). The universities have generally not been perceived as possible players in applied R&D. The proof is that before the Allegre Law in 1999, very few universities in France had a research result utilization service, and even these, before the Pecresse Law in 2007, did not have a complete autonomy which would allow them, among other things, to have a close relationship with the economic world.

The *Summary report of assessment of the universities of the wave* B (AERES) made an observation which alludes to this: “... Socio-economic milieus.... their influence on the policies and strategies of the establishments are generally weak, because of their lower level of involvement in the councils of the establishments”.

The utilization activity developed since the Allegre law seems itself to be directed toward research contractualization and expertise-based services, but hardly at all in the field of technology transfer. The following can be read in the same report: “Utilization - this is a declared objective in all establishment strategies. Management structures (service, SAIC[8], subsidiary companies, direction, etc.) exist in the majority of these, for industrial contracts and service performance. On the other hand, the management of patents and licenses and, generally, of intellectual property, financially costly and requiring specialized skills, is accessible to these establishments with great difficulty. A really effective utilization policy would require the creation of consortia within a regional or even national framework to reach the critical size necessary for effectiveness.”

[8] Industrial and Commercial Business Services

Leaving, in passing, to the reader the appreciation of the desirable ways of improvement, as they are recommended in this quotation, we should mention that, nowhere in this report is a mechanism suggested for listening to the needs for development being expressed by the markets.

In the *Guide of the expert - Wave C* of May 2008 of the same Agency (AERES) we can find positive developments going in the direction, in terms of the evaluation criteria, of taking into account activities around the utilization of research within the organizations being assessed.

It is explicitly requested that the number of patents, the number of declarations of inventions, the cost of the patents, as well as the revenue generated by these all be taken into account but, above all, the number of licenses. However, other fundamental indicators are lacking for a complete measurement of utilization activity, such as the revenue from possible capital shares held in the companies profiting from technology transfer, the evolution of the value of these companies, or the number of jobs created on the basis of these technologies.

This, coupled with consideration of a criterion on the patentable technology detection activity within the establishment, but not of one on the capacity of listening to the market needs, or the capacity to carry out market research, will generate a culture of *technology push* instead of a *market driven* culture, generally recognized as a better generator of innovation.

Thus, the economic culture of the researchers is built throughout their career by indicators on the basis of which they are assessed, the most important indicator being recognition by peers, gained mainly through publications by the researcher according to panel reviews. However, while publication circulates research results efficiently, without an adequate preliminary control it is contrary to the utilization mission of national industry and likely to reveal unprotected know-how.

In this same guide, the number of A and A+ type publishers is an important criterion in

assessing establishments. The identification criteria of these authors include international patent deposits but do not stress those that were granted a license. Also, protection of the results is confused with their utilization and as a result it is likely that a great number of patents of no importance may be obtained because they do not contain any criterion bearing on their economic impact. It would undoubtedly be necessary to optimize the respective weights of a license, the incomes obtained with the latter, the patent and the publication.

There is a legitimate question to be asked here: when does a license generating significant income have the same weight (or even a greater weight) than an article published in *Nature*? There is indeed no antagonism between a patent and the publication of results from their source, only a priority on the submitting of the patent is to be respected. Our colleagues in the Anglo-Saxon world have shown that publications in *Nature* are not in contradiction with very profitable licenses. If a license counted for three traditional patents or nine publications … could this induce a change of mentality within the public research community?

Moreover, this mentality is the subject of an unambiguous analysis in this same report concerning the governorship of research establishments: "in multiple-field establishments, faculty-centered organization remains very vigorous. In certain recent universities, it is an acknowledged will. The evolution of mentalities and practices is thus very slow…".

The recent "Carnot Label" awarded to research establishments with partner research activities with industry (Carnot Law), has made it possible to evaluate the co-operation between industry and public research in France. Thus, the 33 Carnot Institutes, accounting for only 12% of the French public R&D manpower, generate nearly 50% of the research contracts with industry, for a total budget of €450 M, representing merely 1/3 of their annual consolidated budget. The share of this budget with the SME is however insignificant.

So how could a researcher be convinced that the utilization of research results is a noble aspect of his or her activity? This mentality, based rather on the "craftsman instinct" within the meaning of Veblen (1914), induces a strong asymmetry in the relationship between a researcher and an SME director, who will rather act according to a "predator instinct" from the "cultural" point of view, during their interaction for a technology transfer. This asymmetry may be strong at the beginning of the relationship, and can be compensated for gradually if a favorable environment is created to help the relationship to evolve from a transactional framework towards that of co-operation.

Now that this institutional asymmetry concept has been introduced, we can see that the technological capacity asymmetry triggers collaboration between both participants and that the compensation of information and institutional asymmetries is the facilitator because, at the beginning of their relationship, both parties face problems arising at the same time from the lack of technical information but also from the capacity to implement these once they are available (for example, it is not enough to read a patent to be able to manufacture a new product).

II.1.4 - *Spin-off Charters*

The *shared risk development contract* is one of the mechanisms allowing the compensation of institutional, technological and financial risk asymmetries, during the first phases of technology transfer. To allow later developments, up to the marketing of products, ONERA has adapted its *Spin-off Charter*, as another collaboration tool, in order to support the integration of researchers into the SME, when a technology transfer towards the SME takes place.

This evolution results from acknowledging the failure of the existing spin-off policies of the public research establishments, whether in France or elsewhere in Europe. The great scarcity of researcher spin-offs is a logical consequence of the natural differences in skills necessary as between the enterprise world and that of research. Success in the creation of a company depends not only on the quality of technology, but particularly on that of the management team, and on financial and operational resources, in order to control marketing, commercial, financial, industrial and productive components, making it possible to move, in a limited period of time, from a good technology to a business success. The goal of the *Charter* revision, toward integration of the researcher wishing to "spin-off" into an existing structure, is thus to support the meeting, within a pre-existent framework, that of the SMEs, of these components of success so as to reduce the risks, both for the researcher, and the SME, and ONERA as well.

The departure of the researcher to the SME wishing to accommodate him or her, with the transfer of a technology in which he or she is an expert, takes place under conditions that are at the same time safe and incentivating; in particular, the traditional conditions: the possibility of returning to ONERA during the first three years, financial aid, and the financing of training to reinforce the necessary skills for his or her new mission.

The main point is however the condition of opening the SME capital to the researcher in order to position him or her as an "entrepreneur" on the same level as his or her new partners (at least 5% for a small company; flexible for an average-sized company). This makes development of "cultural" positioning possible for the spin-off researcher, and a clear confirmation of the interest of the receiving SME for the new business that the researcher will contribute to develop and manage within it.

II.1.5 - *ONERA-SME Technology Charter*

In order to give a more general framework to these relations, to gather the collaborative tools, to define the principles of the expected collaboration with the SME, and to ensure this collaboration policy can be maintained for the foreseeable future, ONERA made the strategic choice of setting up an *ONERA-SME partner technology Charter*.

This Charter itself had to go beyond the simple problems of technology transfer and explore all the collaboration possibilities between ONERA and the small business world. It represents a moral engagement of the two parties, based on the principles and methods of collaboration and the values governing them. It also means the two parties wishing to collaborate can be on active watch, reciprocally validating their collaboration potential, and be able to start a collaborative project at the earliest opportunity.

This Charter is fully positioned as an institutional collaborative tool, within the meaning of Aoki's theory (Aoki, 2000**)**. The two participants do more than give themselves the means by which to develop together because they are both on active technological watch in their respective markets, identifying opportunities for joint projects.

It relies on simple and tested principles of « win - win » and « give - give », providing benefits for each participant, as summarized below:

<u>i) Mutual benefits</u>

a) Technological [9] benefits and opportunities for an SME

This partnership makes it possible for the SME to have access to R&D contracts in partnership with ONERA, to scientific expertise in the entire civil and defense aerospace field and to technology by means of licenses, simulations, calculations, testing tools, simulation tools or software runs[10] and technological watches.

This can reinforce its competitive advantages within the framework of R&D contracts by

[9] for SMEs involving themselves also in the development of technologies in addition to their use

[10] launching of the computations on the ONERA super-computers

proposing solutions comprising a stronger scientific added value thanks to the contribution of ONERA, both by becoming integrated into experimental projects and technological demonstrations, and by allowing more competitive services with a better adjusted division of the types of services provided by ONERA and the SME.

It gives access to markets and customers that would be difficult for an SME to reach alone, since the latter will now have the benefit of the "ONERA Partner" label to present to large institutional and industrial accounts.

The SME can also profit from the outcome of developments in contracts with ONERA for progressing towards commercial use of new products in its markets.

b) Benefits and opportunities for ONERA

This partnership reinforces the competitive advantages of ONERA within the framework of R&D contracts, achieving this in various ways:

- by offering more cost-competitive services with a superior division of the types of service provided by ONERA and the SME;
- by proposing more flexible and more directly operational solutions;
- by allowing greater reactivity, in particular in "original" and "changing" requests, within the framework of prototypes and experimental projects;
- by better controlling the costs and times of the production tasks necessary for the projects.

The partnership offers access to customers/end-users not directly accessible by ONERA, supports mutual enrichment and emulation between the teams of ONERA and the SME, allows ONERA to be proactive and play a driving role in the industrial world and offers more dynamic potential outlets for utilizing the research results and, in particular, ONERA's technology transfers.

ii) Types of partnership

Several partnership modes can be implemented to carry out this project, such as partnerships in R&D contracts, the expertise and use of ONERA means, shared risk development contracts, technology transfer/utilization of ONERA know-how, this going as far as the detachment of researchers and/or their spin-off to the SME.

ii() Profile of targeted SMEs

The desirable profile for **targeted SMEs** must allow a fast self-identification by the SME of its own capacity to enter into a partnership framework with ONERA by:

- having a production activity or technology service;
- working in a field that can benefit from the outcome of ONERA's research;
- devoting - or having an objective to devote – at least 8% of its AC to R&D (this minimum can be modulated according to the size of the company)
- having a financial viability;
- satisfying the SME criteria of the European Union;
- adhering to the values of the *ONERA-SME Charter*.

iv) The "values"

This *Charter* is primarily a moral engagement between the parties, resting in particular on a common vision of the business rules of the partnership like, innovation based on scientific and technical excellence, a quest for performance, constructive competition and fair-play, independence and commercial ethics.

II.1.6 - *Results*

To date, 87 SME have signed the *ONERA-SME Charter* and more than 40 licensing

agreements, know-how communication agreements or shared risk development contracts are currently running, with various industrial partners in a variety of fields. Of these, 28 were signed over the past four years, corresponding to the new development policy, while the remainder (12) represent the historical "heritage" of the old ONERA development policy.

Following the successful implementation of the new collaborative tools during this period, the number of collaboration agreements signed went from one to more than ten agreements per year. The number of spin-offs went from one spin-off every five years to one spin-off on average per year. Fifteen new proposals for common R&D contracts also came to light during this last period.

Table 1 provides a selection of the partnerships with SMEs, this selection having been made on the basis of their diversity.

Table 1: ONERA–linked SME partners (selection only)

Partner	**Application**	**Type of collaboration**
Leosphere	Wind lidar	License, common R&D and spin-off contract
Oktal-SE	Electromagnetic environment simulation	Software licenses and common R&D contracts.
Phasics	Laser interferometer	License and ONERA post-graduate student recruiting
Protip	Biomedical prosthesis containing porous Titanium	License and shared risk development contract
Ixsea	Inertial navigation	License
Sirehna	UAV	Common R&D contract and software license in fluids
Satimo	Medical imagery	Common development contract and license
Isitek	Medical supervision in residence	License on sensors
Microcertec	US machining of ceramics	License
Fogale-nanotech	Capacitive sensors	License
Andheo	Fluid mechanics and energetic	Software license and common R&D contracts
Sofratest	Flow measuring	License
C3EM	Fissure monitor and experimental data acquisition station in wind tunnels	License, common R&D contracts
Secapem	Real-time shot acquisition and validation system	R & D contract and software license considered
Mapaero	Pressure-sensitive paint	Know-how communication agreement
Michalex	Micro-indentation at very high temperatures	License and shared risk development contract
ACV Aeroservice	Quiet green aircraft	R & D contract and shared risk development contract envisaged

Nheolis	New type of wind power station	Shared risk development contract
Keopsys	Laser	License

II.2 - The point of view of the SME – changes and perspectives

A first experience feedback is now available with the results of an investigation conducted with the SME partners. A questionnaire concerning the ONERA-SME collaboration was addressed to them, and 42 of the 68 SME partners, at that time, answered it. Of these 42 SMEs, more than 80% have become partners of ONERA over the last four years.

This questionnaire thus made it possible to confirm the first concrete results, in particular the creation of 170 jobs, at these 42 SMEs that answered the questionnaire, since the beginning of their relationship with ONERA. Among these, 104 jobs can be ascribed directly to the new activities developed by SMEs based on ONERA technology. The amount of funds raised by the partner SMEs amounts, to date, to more than €20 million.

One of the particularly important questions with regard to the confirmation of the role of collaborative tools in the reduction of information asymmetry between the SME and other economic participants was: “To what extent has your relationship with ONERA influenced your development?” It revealed that half of those who answered confirmed having an image or credibility benefit thanks to the partnership.

With regard to the development of the relationship with ONERA, half of those who answered would like to reinforce their direct relationship with ONERA researchers (either in the form of direct expertise, or within the framework of a spin-off of the researcher into their team). Half of those who answered also wish to be better informed about developments in hand and the strategy of ONERA. The two indicators show a will and need for compensation of the technological asymmetries and reduction of the information asymmetries that still exist between the SMEs and ONERA.

The answers to this questionnaire and the knowledge of the operating rules of ONERA have led to proposals for new mechanisms, mostly within ONERA, which could compensate for a number of the asymmetries between the SMEs and the Office even more. Thus, a need for the following aspects was identified:

- development of a specific strategy whereby several SME partners develop together, with ONERA, technological demonstrators of the ‘systemic’ type; the consortium thus constituted no longer adopting a management characteristic of a sequential innovation process but horizontal management (Rothwell, 1992) more suited to multiple-field and multifunctional teams;
- the development of an *SME partner skill catalogue*, to be distributed within ONERA to the research teams;
- the periodic organization of a joint event between ONERA and the SME, to which other participants such as customers will be invited, and the various innovation assistance structures;
- the creation of a network of experts, with adequate training, to provide a single interface with the SME;
- the possibility of conducting market research;
- the development of joint ONERA-SME laboratories for maturing technologies.

II.2.1 - The common technological maturing laboratory as a collaboration tool

In addition to other collaborative tools, it seems appropriate, in the case of complex projects requiring a technological maturation between TRL 2 and TRLs 3-4, for it to be possible for this to take place in the public laboratory’s own maturation lab, a joint arrangement for which future technological

developments are managed cooperatively with the SME partners. This laboratory would accommodate mixed teams composed of SME (or start-up) employees and researchers. The personnel costs would have to be borne by each party for its own staff. Mechanisms external to the SME-ONERA relationship, making it possible to ensure up to 80% of the wages of a professor (or researcher) recruited by an SME, have been put in place recently at Oséo.

The question of the financing of this Common Technological Maturation laboratory could also be resolved by making use of the additional Carnot contributions (under the Carnot Law) that the Institutes that are members of the Carnot Institute Association receive to boost their scientific and technological resources within the framework of their partnership policy. This is because one of the goals of the Carnot label, amongst others, is to support technology transfers. It remains a fact that no technological maturation should be done without preliminary market research, with product/market cross-referencing as obligatory methodology.

The Common Technological Maturation laboratory will also function as a new collaborative tool facilitating the compensation and reduction of technological asymmetries (in its institutional aspect and in terms of its lack of information) between the two participants in the technology transfer but also compensation for the risk asymmetry.

II.2.2- DRL, new concept for understanding and measuring the Market Pull approach

We observed that the innovation process was subordinated to the reference adopted system. Indeed, all the actors involved in Technology Transfer process have their attention “glued” to the TRL scale. In practice, even speaking about the Customer Voice we still ask (or are asked) about “what is the TRL level” for the appropriate technology sensed to tackle the Expressed Need by an industrial who’s addressing our R&D Commercialization Office.

Why continuing to refuse the evidence? : Even the Customer Voice is sunk inside the TRL scale and our minds are thus Technology Push driven. Why not referring from now on, when facing an industrial expressing to the R&D Commercialization Office to a new scale related this time to what we call the **Demand Readiness Level (DLR)** (Paun, F., under press for the Innovation Encyclopedia by Springer) identified by a customer on a given market?

It actually means that it is the right timing to define an additional scale and plot it in a reverse manner related to the classic TRL scale in order to have the appropriate comprehension of the Market pull process. The author is proposing this schematic further for a better comprehension.

DRL Level	**Demand Readiness Level**		
1	Occurrence of a Feeling "something is missing"		
2	Identification of a specific need	Market certification and sales authorisation	9
3	Identification of the expected functionalities for the new Product/Service	Product Industrialisation	8
4	Quantification of the expected functionalities	Industrial Prototype	7
5	Identification of the systemic capabilities (including the project leadership)	Field demonstration for the whole system	6
6	Translation of the expected functionalities into needed capabilities to build the response	Technology development	5
7	Definition of the necessary and sufficient competencies and resources	Laboratory demonstration	4
8	Identification of the Experts possessing the competencies	Research to prove feasibility	3
9	Building the adapted answer to the expressed need on the market	Applied research	2
		Fundamental research	1
		Description Technology Readiness Level	**TRL Level**

Paun. F., 2010 : Demand Readiness Level as equilibrium tool for the hybridisation between Technology Push et Market Pull approaches

For example, if an industrial partner have a DRL on 8, he will be able to identify and speak with the appropriate scientist to launch a collaborative R&D program for developing a new product or service. Same type of matching between different levels could be observed at each level of the previous table.

This is now better understood why "each case is a specific one". Looking in two references systems, one for the Technology Push approach and the other one for the Market Pull approach, we could predict the given particularly timing when an technology transfer agreement is ready for signature. Further research are on the process to Postulate that the Technology Transfer Agreements between R&D laboratories and Industrials are only possible if the sum DLR+TRL is at least equal to 10.

Since many years the TRL scale allowed various analysis of the technology transfer and technological innovation processes by positioning the various stakeholders along this scale. TRL scale allowed the identification of various asymmetries between the actors and thus suggested the introduction of various reduction or compensation tools at Onera (and not only). Trough this contribution, we proposed a new reference system for better addressing the Market Pull approach while doing technology transfer and technological innovation. The DLR scale could also be the object of the same dynamic exchanges and analysis that the TRL scale induced among the academics or practitioners communities. The aim is that this new tools for a hybridized approach will significantly improve the innovation and TT practices trough a better understanding of the different factors and staging allowing the agreements signatures to creating value. For a TT Officer or a Strategy Industrial Director will be important to survey the matching of the levels on the 2 scales while placing the participating actors, identifying the existing asymmetries between them and activate compensation or reduction tools for dealing with these asymmetries. When the sum of the 2 indicators will equalize 10 the deal between the Industrial and the R&D laboratory becomes feasible and will interest all the stakeholders of the innovation project, including the investors (private or public).With a better understanding and control of the hybridization strategy between Technology Push and Market Pull approaches the innovation system tends to evolve towards a better compatibility with the social and environmental requirements inevitably market pull driven as in the case of eco-innovation.

III – CONCLUSIONS

The first results show a series of development successes for innovative products/services based on technologies created by ONERA, and this in very varied sectors, going from biomedical prostheses to the wind power market.

As for any form of transaction, in a technology transfer process, the parties involved are informationally asymmetric. The new SME policy at ONERA has highlighted other forms of asymmetries characterizing the technology transfer and partnership research between a public research organization and an SME in France: technological capacity asymmetries, institutional 1 time scaling asymmetries and those related to the financial risk.

The collaborative tools deployed at ONERA within the framework of its new development policy, the *shared risk development contract*, the *ONERA-SME Charter* and the *Spin-off Charter* are mechanisms designed and implemented to ensure the reduction of the information asymmetries and compensation for other asymmetries between ONERA and its partners. The Common Technological Maturation Laboratory and the use of the

DRL are another proposals for collaborative tools similar to those already in place.

The relationship established between ONERA and an SME is perceived more as a cooperative relationship for a co-development rather than as a simple study service (i.e. transactional). This relationship imposes compensation for financial risk and technological capacity asymmetries in addition to institutional (mentality) asymmetries and the reduction of information asymmetries between the two parties. Attention is thus drawn to the importance of the "issues of confidence and interest" (Cowan et al, 2003) in a technology transfer relationship with regard to the questions of opportunity and uncertainties in a product/service sales relationship.

Moreover, the *ONERA-SME Charter* and the *shared risk development contracts*[11] have also proven to be very effective tools in the reduction of information asymmetries between the SME (or the start-up partners) and other socio-economic players (investors, competitiveness centers).

This research work contributes to Stiglitz's "information asymmetry theory" by acknowledging the need to reduce and/or compensate for different asymmetries while carrying on a cooperative process like technology transfer which has impacts on all levels: direct impact on the agents (micro), on the regulators (regions and sectors – meso), and on economic growth (macro).

III.1 - Impacts at the micro-economic level

At ONERA, the cultural change taking place amongst the researchers involved in a relationship with an SME can be noted. Their contractual liability is reinforced by a better awareness of what is at stake that the successful transfer of their know-how to the SME represents. They adopt the "predatory instinct" (Veblen, 1914) of an entrepreneur, interested in transfer opportunities for their technology outside the aerospace field. The implemented tools operate as relational facilitators in the relationship between ONERA and the SME but also in the internal relationship with ONERA between the scientists and the support structures for utilization.

The success of the operation of collaborative tools changes the internal operation rules specific to ONERA and allows proposing new internal mechanisms, such as the creation of a network of experts as a single ONERA interface with the SMEs, and the future possibility of carrying out Market Research. The purpose of these mechanisms will be to increase still further the effectiveness of the partner relationship with the SME.

III.2 - Impacts at the meso-economic level

The first successes with the signing of the *ONERA-SME Charter* by more than 80 SMEs recognize and prove the significant role that ONERA can play as a source of innovations and also as a catalyst for a cluster of skills and multi-sector innovations. This is valid for all the regions where ONERA is represented, thus confirming the views of other authors (Etzkowitz, 1999; Florida & Cohen, 1999).

ONERA's change of strategy in the choice of its customers, because of its opening to the world of the SME, has had an effect on the diffusion of its technologies beyond the aerospace field and especially on its

[11] *The shared risk development contract has been developed by ONERA DCV team during the last 5 year. The authors of this article who took part in developing of this tool, wish especially to thank Corinne Le Hong for her contribution in updating the Risk Sharing co-Development contract and to Frédéric Lamy for his contribution in updating the same contract but also to the entire team who is now continuing capitalizing and developing the concept with SME partners.*

positioning in other market sectors as well as in its relationship with its customesr. Having a study service relationship with a large industrial group, ONERA has now also given itself the opportunity of having a co-development relationship with the SME partners.

The intervention of ONERA in multi-sector innovations, on the basis of its research results in the aerospace field, puts the Office in competition with other traditional suppliers of research, in each of their specific fields. This has an impact on the "forms of competition" (costs, quality, speed of development) and ONERA could thus find itself in an advantageous position due to its multidisciplinary skills.

The new form of "multi-sector innovation" competition, induced by the new ONERA-SME policy, could prove to be important from the point of view of access to public funds. Thus ONERA, in partnership with a suitable cluster of SME partners, is able to bid for public programs to build technological demonstrators. In some of these programs, this could generate fair-play competition with its own strategic partners among the large aerospace industry groups.

ONERA's new policy of development with SMEs offers a solution to the problem encountered in a general way by clusters of companies, of the competitiveness center type, that are based on the effects of agglomeration and of specialization (Weber, 1909/1929). This cluster model has proved risky for long-term development due to exaggerated territorial specialization and the lack of job diversification, skills and sectors in the region, which could thus become a "small world" (Watts & Strogarz, 1998).

The positive effects of this new policy at the territorial level have been confirmed for the effects of complementarity and the interactions thus generated between various SMEs (Zimmermann, 2002), encouraging them to work in complementary sectors, not necessarily belonging to the region competitiveness centers.

One of the results of the practical application of the new ONERA-SME policy is that ONERA became a "distant source" (Maskell et al., 2005) of new ideas and expertise for other competitiveness centers outside the aerospace field. Thus, ONERA's SME partners and members of these so-called competitiveness centers no longer depend only on internal interactions specific to the center that they are members of in order to have access to R&D resources, but also benefit in their innovation work from skills that are external, in the geographical and sector sense. This reasoning has proved to be valid also for the case of geographically isolated SMEs that encounter difficulties in becoming members of the centers of another area, the partnership with ONERA allowing them an important access to R&D skills.

As a transition to the macro economic level, an important perspective could directly impact the development policies of regionally specialized clusters, as with the national strategies for innovation. The R&D laboratories will adapt their behavior by intensively using asymmetries compensation/reduction mechanisms in their relationship with the regionally specialized SMEs but also with other SMEs, not regional or acting in other domains. Thus, the regionally specialized clusters (supposing there is more than one present in the same region) will be interconnected through direct collaborations occurring between some of their "provider (R&D labs)" and technology "consumer (technology adopter SMEs)" members. They will also be interconnected with other non-regional clusters. These types of interactions, driven through either Market-Pull, Technology-Push or Hybrid approaches, will exchange technology inside and outside their related clusters, with no more monitoring by Clusters Authorities. To upgrade this type of possible multiple embedded innovative system, mainly based on technology transfer between providers and consumers of technology, we consider that smart grids models could be an appropriate approach (Paun, 2010).

III.3 - Impact at the macro-economic level

The relationships that the SME partners have developed with ONERA allow changes towards sector-based operating rules specific to the innovation assistance structures or to regional development, in relation to professional networks, in the sense of "cumulative causality" (Veblen, 1914) or of "recursive causality" (Morin, 1990). Thus, it has been observed that some of ONERA's SME partners, especially the decisional committees of this type of structure (competitiveness centers, trade associations), proselytize for this new type of tool for collaboration with public research with other members of the said committees.

Other national structures grouping various innovation players actively examine some of the collaborative tools developed within the framework of the new SME policy of ONERA. These tools are often the subject of analyses by think tanks made up of these national structures, in order to exchange ideas regarding good practices between their respective members.

The adoption and/or generalization, after the inherent adaptations due to the sector-based specificities of the various parts, of these collaborative tools by these other structures or networks could induce the same positive results as those obtained by ONERA and its SME partners, on innovation at a national scale.

Many authors have identified, in the various studies of the conditions and mechanisms of financial support for innovation and their impact on economic growth, that information asymmetry (Akerlof, 1970; Stiglitz & Weiss, 1992) is one of the major factors influencing the financial risk taken to generate innovations.

The ONERA-SME collaborative tools have shown what their role can lie in the reduction of this asymmetry between these SME (and start-up) partners and their respective investors. Indeed, the fund-raising required for the development of projects by the SMEs became much easier. The generalization of this type of tool will no doubt mean the constitution of a better *Business Angels* culture and *Venture Capital* in France and, especially, the appearance of new investors due to the reduction in financial risk as a result of the reduction of information asymmetry between the SMEs (or start-up partners) and investors. As an example, the *shared risk development contract*, signed by start-up partners with ONERA, proved thereafter to be a facilitator document in the phase of *due diligence* between the start-up partner and its *Business Angels*.

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TRANSFERRING NEW DYNAMIC CAPABILITIES TO SMES: THE ROLE OF ONERA – THE FRENCH AEROSPACE LAB™ IN PROMOTING ASYMMETRIES MANAGEMENT

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ABSTRACT :*The technology transfer process between a public laboratory and a company has been the subject of many publications and has been widely discussed in economic theory. This paper highlights several newly identified asymmetries occurring between the different agents taking part in the process, dealing specifically with the aerospace and defense R&D sectors in France.*

These specificities concern the characteristics, capabilities and competencies (the 'capacities') of French SMEs and public research laboratories. The theoretical corpus of the article draws partly upon the analyses of 'dynamic and interactive capabilities' (and competencies), and for the rest upon various asymmetries identified and conceptualized on empirical sources, being based on the recent experience of one of the most dynamic Technology Transfer Offices (TTOs) in France: the case of ONERA (the National Office for Aerospace Studies and Research) and its dyadic relations with the SMEs.

In such a cooperative, interactive innovation process, we will argue that certain collaborative tools or practices emerge, aimed at reducing information asymmetries or acting as compensation mechanisms for other types of asymmetries between the partners at a microeconomic level; especially in France where there is a gap between the public R&D laboratories and the SMEs in terms of Technology Readiness Levels (TRLs). Some of these compensation mechanisms, particularly those related to the knowledge economy, could be adapted and reshaped for agents engaged in R&D and innovation in various other sectors, perhaps inducing positive amplification effects on innovation behavior, and thereby on economic growth at the macroeconomic level within the "national innovation system".

Keywords: *French SMEs, technology transfer, information asymmetries, dynamic capabilities, innovation systems*

Objectives

This paper presents the analysis made by the authors on the process of transferring technology from an R&D organization toward SMEs. This analysis, based on the experience of the 2 authors from Onera while defining and applying the innovation strategy of their institute in collaboration with the SMEs, proposes concepts identified and proposed by the authors related to this relationship and finally collaborative tools to improve it. The authors identified relational drivers and barriers and they either used existing economic concepts to described them or created new concepts to better address these issues. Their concepts were already largely shared within the community of practitioners among various presentations they made inside CURIEs, AUTM or AI Carnot networks. Their economic analysis was also

submitted to the attention of academicians through various presentations they made at the T2S annual meetings or RRI network forums being thus several times encouraged to publish it.

Methodology

The two authors from Onera were in charge with business development at their organisation. They lead the Technology Transfert offices and the Intellectual Property service. They defined validate and implemented the new strategy of industrial innovation in collaboration with the SMEs. The major change they induced trough their new strategy was the switch of the TTO activity from an exclusive Technology Push approach to a hybridised approach integrating also the Market Pull one. The message promoted trough the various communication channels of their organisation towards SMEs was changed from "look how good are our technologies" to "We are here to listen you and answer to your technological needs". Their main message while addressing SMEs was "Building together your future market success". They also conceived and promoted a collaborative charter between Onera and the SMEs. And it start to work with unexpected fast results. One question occurred at that stage. Why is working so well and what do we have to expect as consequences? We started at that point a scientific economic approach to understand the reasons of this fast growing knowledge based cluster. Florin Paun thus started his PhD in economics to better understand the identified issue. We first focused in identifying drivers and barriers occurring inside the collaborative patterns of the ONERA – SMEs relationship. It appeared very clearly that the majority of the barriers were linked to structural locking or to existing asymmetries between actors.

This paper mainly refer to the analysis made on the asymmetries identified inside the Technology Transfer process between Onera and its SMEs partners. To continue the research work (aiming to improve the collaborative relationship for a better performance of technology transfer activities) a Questionnaire was addressed to more then 60 SMEs partners and a series of 30 interviews with scientists and directors of Onera were carried by the authors. Florin Paun, proposed first to use the information asymmetry (Stiglitz, 1992) in understanding the actors and the process of innovation while analysing these various feed backs.

For a better understanding of the various issues revealed by the obtained feed back, in addition to the information asymmetry (insufficient by itself in a first analysis) Paun identified and conceptualised new types of asymmetries specific to the innovation process. This paper is presenting these asymmetries and the role that the authors attributed to the collaborative tools as reduction or compensation mechanisms of existing asymmetries. Further to a presentation of their research work during a workshop organised by the RRI network in 2010 in Marseille, Nick von Tunzelmann perceived the scientific interest of associating the asymmetries and the collaborative tools with the concept of "dynamic capabilities". He highlighted in this paper the importance of the asymmetries identification between the actors of the TT process and the use of the appropriate collaborative tools as reduction/compensation mechanisms for these asymmetries in providing the needed "dynamic interactive capabilities" to the SMEs, capabilities able to reshape them in innovation champions

INTRODUCTION

The technology transfer process between a public laboratory and a company has been the subject of many publications and has been widely discussed in economic theory as well as in applied economics (e.g. in the *Journal of Technology Transfer*). Here we will deal with the specificities related to this process in France and, in particular, in the field of technology transfer arising from the field of aerospace and defense.

These specificities relate to the characteristics, capabilities and competencies ('capacities') of SMEs and public research laboratories. This paper will be based mainly on feedback regarding the strategy implemented for the development of an economically 'healthy' relationship between ONERA (*Office National d'Etudes et Recherches Aérospatiales*, the National Office for Aerospace Studies and Research) and the SMEs surrounding it with

mostly dyadic relations between themselves. The choice and definition of collaborative tools will be explained together with the analysis of the initial results and the prospects envisaged.

We will contend that, in a cooperative process of innovation, these tools become mechanisms for reducing informational asymmetries **(**Stiglitz & Weiss, 1992**)** or "compensation mechanisms" (Paun, 2009) for other asymmetries between the various players at a microeconomic level. These newly identified asymmetries, **Institutional asymmetry** (regarding the institutionalist theory of Veblen, 1914), **Technological asymmetry** and **Risk asymmetry**, often act as barriers to the technology transfer process, while simultaneously being critical for the eventual high intensity of the innovations pursued. The greater are the asymmetries, the stronger will be the impacts on the intensity of innovations, always supposing that the differently involved actors in the innovation process do succeed in working together. This involves the effective implementation of asymmetries reduction (compensation mechanisms), through 'blending' the capacities for change of the various agents.

Some of these mechanisms, more related to the knowledge economy, could be adapted and reshaped for other agents in the R&D and innovation domain, and for evaluation or regulation authorities of this domain. Their implementation for these other players could induce an amplification effect on innovation and its direct effects on economic growth at the macroeconomic level within the framework of the "national innovation system" **(**Freeman, 1987; Lundvall, 1992; Nelson, 1993**)**.

In the first part of this paper we present the concepts of capabilities and appropriabilities related to industrial processes. Further, we present the role of the asymmetries together with the collaborative tools, aimed to compensate or to reduce them, occurring inside the technology transfer process, in providing capabilities and appropriabilities to the SMEs to better perform while innovating. In the second part we present the asymmetries occurring between Onera and its SMEs partners during their collaborative technology transfer process. We choose, for the sake of a better reader understanding, to present the relevant asymmetries related to their respective reduction or compensation collaborative tools. This presentation is made in the context of a full view of all the stakeholders and inside the complete Onera's economic environment. The third part presents the early stage results of the Onera's SME strategy by showcasing successful SME innovations based on Onera's technologies

I. THEORETICAL ISSUES RELATED TO CAPABILITIES AND APPROPRIABILITIES CONCEPTS

In appealing to a systems approach, in accounting for the points of conjuncture and disjuncture between small companies and large establishments, and between research labs and aerospace/ defense companies/contractors, we are thinking of both the vertical elements – here the progression from micro-level (of individual agents, like people and organizations) via the mesolevel (of individual sectors and/or regions) up to the macro-level (of national systems) and even global levels – and of the horizontal dimension, here the various types of asymmetry incurred by the various types of organization with which we are concerned, viewed both individually and collectively.

I.1 Meaning of 'capabilities'

The line of argument we shall pursue is given by the recent popularity of the so-called 'dynamic capabilities' school, as launched by David Teece and his colleagues in the 1990s (Teece et al., 1997, etc.). Both words however fall into a category described by the eminent Austrian economist from the middle of the 20th century, Fritz Machlup (1959), as 'weasel-words', i.e. words that promised the hope of clarification but ended up just sowing more confusion, through

their very presumptuousness; or more simply, words that mean less than they first appear to say. Mindful of such problems, Teece et al. thus define dynamic capabilities in terms of 3 P's, namely *position* and *paths*, which define the dynamics, together with 'processes', which we can interpret as '*business processes*', i.e. what we will term the 'functions of the firm', and this brings them close to our own final definition as provided below. These authors do not distinguish between capabilities and 'competencies' in their descriptions of the meanings, which is precisely where our own study takes off from.

Our approach, in brief, is to assess what 'capabilities' are through adapting Nobel Laureate Amartya Sen's concept of 'consumer capabilities',[1] according to which capabilities comprise the *ability* to consume the product effectively, together with the *circumstances* constraining that consumption process (e.g. the financial and legal environment in our case, or the 'entitlements' to income in Sen's situation of famines). 'Ability' to consume involves both the *competencies* acquired by purchasing[2] skills from other sources and *capabilities* proper, learnt within the organization. 'Capabilities' in this sense represent an intermediate transformational concept between orthodox 'characteristics' of a product, or technology, etc. (see Gorman, 1956; Lancaster, 1966) and the orthodox set of 'rewards' (or motivations) for making use of the characteristics for some stated purpose (e.g. utility in Sen's case of consumer capabilities). 'Capabilities' are highly heterogeneous as between individuals or organizations, in terms of both their differentiated nature, and the amounts with which each individual or organization is endowed (or dynamically able to enhance them through learning).

Table 1 clarifies the distinction drawn in our analysis between capabilities and 'competencies', pointing out the need for both in order for a region or country (or individual firm or industry) to be able to claim its capacity with regard to full dynamic capabilities.[3]

[1] Defined for very different purposes by Sen (e.g. for famines in poor countries; see Sen, 1985, etc.).

[2] Even if there are no monetary charges for this acquisition process, there must be opportunity costs of the time etc. involved, as in Friedman's celebrated concept of there being "no such thing as a free lunch" – without even attempting to cost up the risks involved in changing one's skill base (see below).

[3] The list here is loosely based on that given by von Tunzelmann (2009) which also lists a further 8 'associated' differences, regarded as less definitive and more by way of elaboration. Key pointers to the definitional differences are probably points (1) – functional differences, and (7) to (9) – the dynamics.

Table 1: Competencies vs. Capabilities: Essential differences

Essential: **Competencies**	**Capabilities**
1. Function Enhancements to 'resources'	Enhancements to 'services'
2. Stocks Human and R&D capital stocks	Knowledge stocks
3. Chain position Inputs related	Outputs related
4. Product area Specific, focused	General, adaptable
5. Supply–demand Supply driven	Demand and supply driven
6. Stage Potential	Realised
7. Development Acquired and/or hired	Accumulated within
8. Learning Learning by searching (STI)	Learning by doing (DUI)
9. Dynamics Externally available as needed	Internally deployable in real time

The sum of competencies and capabilities then gives us a figure for 'capacity', as in building capacity both external and internal resources need to be meshed together. Such a meshing or 'blending' process is contrary to the difficult alternatives of blocking or bridging proposed by

Putnam et al. (1993). We shall return to this point in discussing interactivity below.

This three-tiered and nested approach is then extended by our research (e.g. von Tunzelmann & Wang, 2003, 2007; von Tunzelmann, 2009, etc.) to producer capabilities (involving production of all kinds and not necessarily standard manufacturing processes), drawing for this purpose on Edith Penrose's theory of the 'growth of the firm' (Penrose, 1959) and also to 'supplier capabilities', where issues of IPRs may become paramount because of possibilities for appropriation by giant firms. Thus in Figure 1 there are 3 types of actors, which occupy the full area of prospective agents. From a supply chain or supply network perspective, all actions are ones of production or consumption or supply, and often all three at the same time. Thus in the *process of producing* this paper, intended for the *consumption* of various types of readers including policy-makers as well as academics, there is therefore a 'forward linkage' to users, in addition to 'backward linkage' (in the sense of Hirschman, 1958) to our *suppliers* – on this occasion the accumulated wisdom of our forebears, plus the accumulation of technology in the form of instruments and artifacts, like computer hardware and software, This 3x3 matrix thus applies quite generally to any form of production, whether governmental (producing policies, etc.), or academics (producing research papers), or firms (producing products), however different the actual production processes are and also the conditions of governance. Most of these are in fact multi-agencies, whereby academics produce students and consultancy reports as well as 'papers'; governments produce physical and social infrastructure as well as policies; increasingly one finds manufacturing companies producing services alongside their traditional goods, etc. (Davies & Hobday, 2005). Note that we find it useful to distinguish between ***agents***, as the physical embodiments of people or the organizations to which they belong, with either being represented by its name, and ***actors***, representing the multiple roles that nearly all agents will have to play. Not surprisingly, perhaps, we have to relax this distinction in our discussion to follow, where we shall be taking ONERA as 'the' technology supplier and the SMEs as 'the' customers.

Figure 1: The model of capabilities in the technology supply chain

Actors:	Suppliers (technology)	Producers	Consumers
Characteristics	S&T possibilities	Production possibilities	Product possibilities
Capabilities	Technological capabilities	Producer capabilities	Consumer capabilities
Rewards	IPR returns	Profitability	Utility

demand Knowledge exchange supply

In the figure, the markets operate effectively, though they are limited to being the outcome of exercising capabilities and competencies. In the row of characteristics, there is first the matching

of the supply of and demand for technology (NB a 'derived demand',[4] depending on the next market along, which is the one given here in the final column as the match between the supply of and demand for products). There are mirror image mappings to those from the capability vector to that of characteristics, in the mappings from capabilities to motivations, or 'rewards', again inserting a physical differentiation into a value-defined space (here 'profitability' rather than prices though). Finally there are non-market exchanges which take place directly among the agent producers themselves, with the horizontal arrows typically representing asymmetries of knowledge between the agents and the respective capabilities.

I.2 Dynamic and interactive capabilities

The first 'static' version of the approach as discussed so far via Figure 1 can then be straightforwardly extended further to the context of interactive learning (Lundvall, 1992), and hence to 'dynamic capabilities' proper (Teece et al., 1997). As shown in the diagram, the interactive elements are partly mediated through market mechanisms relating to supply and demand factors, in connection with both the characteristics (product possibilities, etc.) and the rewards (profitability etc.); however the most interesting form of interactive learning consists of direct interchanges of knowledge among the actors, shown by the two-headed horizontal arrows in Figure 1. Although this is often represented as 'absorptive capacity', we take here the opportunity for a more proactive role, of 'giving as good as one is getting' through reciprocity in networks and partnerships. This might be termed the third face of R&D,[5] following the first face of original technological development and the second face of the ability to reproduce the technological results of others – this third face indicates what the company or other recipient agent can bring to the negotiating table in terms of the stage of knowledge acquisition. In these respects there is already a dynamic component to interactive capabilities, but strictly speaking dynamic capabilities in our sense of the term concern responses in real time to stimuli, such as would be emitted by market competition or technological change. 'Real time' here signifies a period of time which extends for just long enough to capture some or all of the potential rewards from the innovation. The emphasis lies on speed – being in the first place ready to hand to match the new requirements, i.e. any suitable set of human and non-human resources,

[4] cf. von Tunzelmann, 1995, p. 2.

[5] The reference here is to the seminal paper by Cohen and Levinthal (1989), which discusses the first 'two faces'.

while the latter is more a question of adequate entrepreneurial flair. All of this accounts for our stress on speed and catching-up in real-time activities of the organization.

Relationships posited can be thought of as linked dyads, with alternative time sequences (i.e. with the supplier-producer links and producer-consumer links preceding or succeeding each other in rather random fashion). The effectiveness of such links depends on the motivations (incentives of expected profitability etc.) but also the 'capabilities' for operating the links, on both sides of each dyadic relationship.

I.3 Dynamic scale and scope economies

Such gains in speed come at a cost, as reflected in time–cost trade-offs (Scherer, 1967). To justify themselves they must cover these and any ancillary costs over the medium to longer run. We shall pursue them below in the guise of so-called 'limit curves', by sector. These 'dynamic' scale economies most often arise at a systemic level; e.g. the increasing prices of an 'average' microprocessor unit ('chip') over time as the complexity rises is more than offset by the downstream impacts of much faster speeds of working and much higher levels of integration, according to the operation of 'Moore's Law'.

Economists have become accustomed to talking about economies of scope as well as of more traditional scale, even though there is an inherent tension between the two concepts when applied in practice. Putting the argument another way, there would seem to be an inherent trade-off between economies of scale and economies of scope. While vertical integration generally requires large plants in most manufacturing industries (e.g. integrated steel mills), horizontal integration, i.e. at a specific product or technological level, can often be achieved by using smaller-scale production methods, in order to reap the synergies on offer from economies of

scope at other levels, e.g. mini-mills in steel. It is worth emphasizing at this point that economies of scope, just like economies of scale, can arise in any of the functions of the firm or other organization under analysis, e.g. in marketing or in finance, and not necessarily in production or technology.

Dynamic scale and scope economies are of two main kinds, One is the long-term secular improvement associated typically with infant industries and their protection, often as part of a catching-up strategy of development. The second way, which is of more concern to us here, is through short-term, real-time gains that reflect speeding-up behavior, e.g. in big business, where Chandler (1977) refers to increased throughput in production and increased stock turnover in distribution (marketing). Such gains, which despite arising in the short run tend to be quasi-permanent and quasi-irreversible, are what we term 'time-saving' (von Tunzelmann, 1995), and are as already indicated crucial (or so it is alleged) in the resort to networking by individual firms. They do so in order to leverage their own 'home-grown' capabilities through acquiring competencies from other organizations

I.4 Dynamic appropriabilities

Commensurate with such dynamic scale and scope economies at the production possibilities level there are dynamic appropriabilities to be reaped at the rewards level. In much the same manner, these potentially arise out of being quicker or more accomplished at seizing the market or technological opportunities going. Thus, as Reinert (1994) has stressed, developing countries have tended to place too many of their hopes on the perfection of markets for their export goods, without allowing sufficiently for the fact that it is turning imperfect markets to one's advantage that secures the highest private gains from trade.

Our own position when it comes to looking into the economic dynamics of appropriabilities reflects our views of dynamic scale and/or scope economies, namely that they have to do with developing speedy responses to constantly changing circumstances, such as are associated with continual incremental technical change and product development. More specifically these may emerge in such respects as opening up lead times over rivals, changes in corporate or brand reputations, changing patterns of trade secrets, etc. And whereas traditional static forms of IPRs include such aspects as patents, trademarks and copyright, the newer 'anti-IPR' elements incorporate such (ostensibly) radically different opinions as 'open-source' software, 'copyleft', etc.

II. CONTEXT, POSITIONING AND ROLE OF THE ACTORS IN ONERA'S TECHNOLOGY TRANSFER ACTIVITY TOWARDS SMES

A brief description of ONERA's economic environment is necessary for a better understanding of the reasons for the tools it uses and disseminates, and their operation, as well as being a reminder of the fundamental principles of innovation and the role of technology transfer therein.

ONERA is a scientific and technical public corporation with commercial and industrial characteristics (EPIC), created by Law no. 46-895 on May 3rd 1946 and modified by decrees no. 63-385 and no. 84-30. Its mission is defined as follows: "... to develop and direct research in the aerospace field; to design, develop and implement the necessary technical tools and benches for carrying out this research; to ensure, in association with other R&D organizations, the circulation, at a national and international level, of the results of this research; to support their utilization by the aerospace industry; and possibly to facilitate their application outside the aerospace field". Thus its mission so far as interactive capabilities are concerned is to

diffuse them as widely and rapidly as seems feasible.

The quotation just given is important for understanding ONERA's position in the TRL[6] chain (Mankins, 1995), its role in technology transfer, and more generally its role in innovations generated on the basis of the technology that it has created.

So the legal text gives a futurology mission to ONERA "... to develop and direct...", a mission as originator and owner of experimental resources, to circulate the results and to be a discriminatory facilitator (for the national and European industry) for the creation of value "...to support utilization... "

This nuance is very important, particularly in the 'ideological opposition' between those who prioritize a 'publication' strategy and those who prefer one that stresses a 'patent', because premature disclosure, in the form of articles or conferences, ensures the circulation of knowledge but also facilitates uncontrolled utilization of the results of research by industry, including competitors of the national or European industry. However we should recall from our analytical study already reported in section I.4 above that this gives a somewhat loaded view of IPRs, focusing on static results, to the possible detriment of longer-term dynamic gains.

It must also be observed that ONERA has to transfer the results of its research (in order to "... support utilization...") to the aerospace industry and also "... outside the aerospace field..."

Its supervisory authority is the Head of the French national armaments organization (DGA). The other organizations with which ONERA has close relationships are the DGAC,CNES, the ESA[7] and of course the European Commission (EC) through contracts that are part of the PCRD[8]. Its strategic customer-partners are the large French or European aerospace groups, such as Airbus, Eurocopter, Astrium, Snecma, Thales and Dassault. During its entire existence ONERA has devoted most of its activities to studies directed by or for this first circle of institutional or industrial partners.

[6] Technology Readiness Levels [7] Respectively: General Directorate of Civil Aviation; National Center for Space Studies; European Space Agency [8] Research and Development Framework Programme

The last consolidated figures show an annual operational budget of €187 m, of which 57% comes from R&D service contracts, and a labor force of 2047 employees.

II.1 -Specificities of the Aerospace and Defense field

This brief description of ONERA's economic environment needs a complementary analysis of the players from the point of view of the utilization of its research results by industry.

Hence Figure 2 presents a classification of the market sectors according to two parameters: the time involved in launching products resulting from a new technology in the market, and the complexity of the products intended for this market, roughly approximated by the cost of a unit of the product **(**Stephan, 2006**)**.

successful delivery of the new good and/or service to the market) by the carrier-creator of the technology itself. The originally defined curve, of the kind already noted in our survey in Part I above, supposes that a new product requiring very low development costs or complexity could be introduced to a market if time were expandable. We consider that for a low complexity product with low development costs many actors could proceed to develop this type of new product. Its time for introduction to the market will depend mainly on its acceptability by the consumers. As soon as they can accept the new product, everybody could provide it. Thus the time will be cut short instead of being expandable (or else the product will never be introduced because of never getting accepted).

The original defined curve supposes also that a new product requiring unlimited development costs with exceptionally high complexity could be introduced in a market only if it could be delivered in a very short time ('real-time'). The development means are assumed to be limited even in a large industrial group. This will induce a limit on engaging costs for any economic agent.

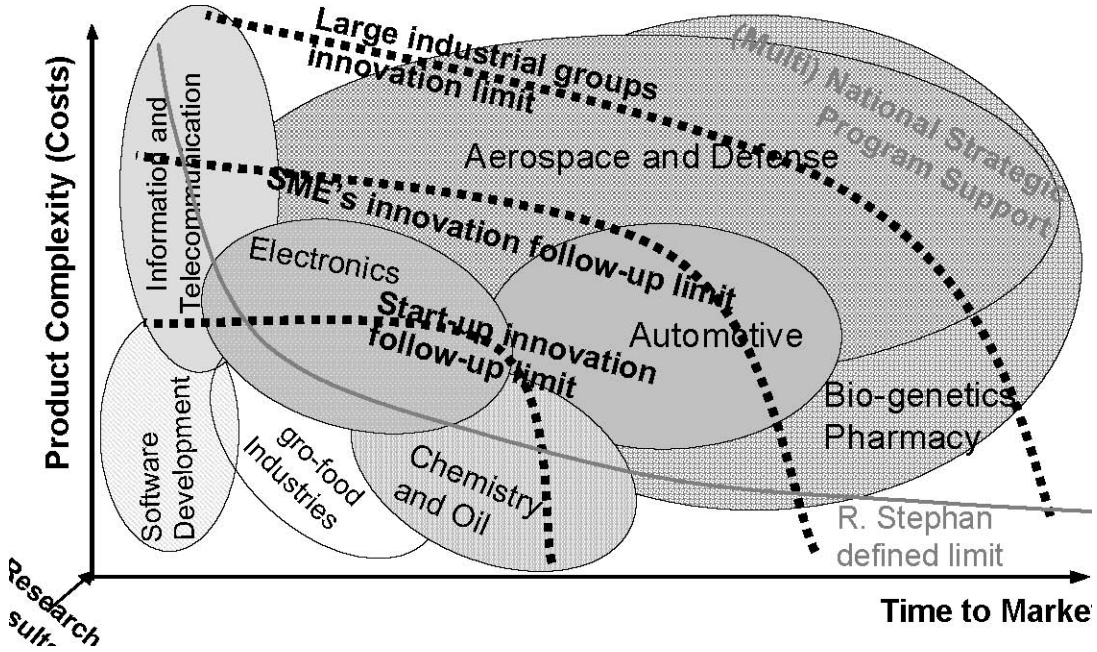

Figure 2: Limits to innovation process control by the creator (or assimilator) of technology, by technological sector: -R Stephan's limit --Authors' proposed limits

Stephan, in presenting this figure, proposed a generic limit to innovation process control (up to the Acknowledging this analysis with Stephan, we nevertheless contend that this generic limit curve has to be transformed in an elliptic type curve from an initial hyperbolic type, of the kind encountered previously in discussing time-cost trade-offs above. The basic reason for abandoning the hyperbolic shape is derived from considering the sectoral space here and thus the (approximate) sectoral contrasts. It also must be admitted that an SME has less material means to establish a successful new good/service in the market than a large group. This is even more evident for a start-up partner. Thus we also propose to divide the limit curve into three branches corresponding to these three types of agents. These new proposed limits are generically represented in Figure 2. The specificity of the aerospace and defense markets asserts itself very quickly because these sectors, which are generally 'complex systems' (Davies & Hobday, 2005), require a lot of time for the development and introduction of a new product to the market. We note that even large groups, beyond a certain limit, need institutional support at the national level, if not at the international level, to develop new technologies. So in what circumstances would ONERA be able to respond well to its futurology mission of "developing and directing research" and its transfer mission "to support the utilization of its results by the national industry"? By being located within the upper limit of the diagram, the large aerospace sector and French and European defense groups stand out as designated partners for successfully 'bearing', i.e. acting as generator, carrier and user of (hence, all the 'actor' roles for) the new technologies suggested and/or developed by ONERA. This is particularly the case for the incremental or specialized innovation of the large groups. Such 'bearing' is however less obvious in the case of technological breakthroughs (see McCooe,

quoted in Golob, 2006), and this is even more the case in the civil aerospace sector where technologies used on-board planes must be safe and tested. For these aspects, since its creation ONERA has developed and maintained effective strategic partnerships with the large national groups which have mostly become multinationals in recent years. This partnership policy will not be the subject of our analysis here. The fundamental question raised during the development of ONERA's implementation strategy is that of access to markets, for breakthrough technologies resulting from a specialized research sector such as aerospace. From this point of view, the preceding diagram, presenting the limits to innovation processes, illustrates the point that, to put a 'breakthrough technology' on the market, thus challenging the existing products and/or business models, such as may be designed by a national skill centre, the best vectors are the SMEs. This provides the systemic element of the dynamic scale economies already referred to in Part I. Technological demonstrations that result in innovation will not necessarily take place in the aerospace market but can arise in any of the market sectors in which the SME receiving the technology can itself control the innovation process completely (until the successful introduction of the new product to the market). Some niche markets will be accessible, even in the aerospace sector (green aviation, small-scale drones, leisure, etc.). Once the technology is demonstrated, there are strong chances that the large aerospace groups will integrate this technology as a tested module into the systems they are designing **(**Mouchnino & Sautel, 2007**)**. The strategic choice was taken at ONERA to develop a partnership relationship with a national and European SME. If no SME is identified, the launching of a start-up partner could be studied, subject to the economic outlook and adequate financial support.

II.2 -ONERA-SME Relationships

Like any healthy dyadic partnership, that between ONERA and an SME must be a winning one for both parties. Both partners must have strong positions **(**Cowan, Jonard & Zimmermann, 2003) with each adopting its own role so that their collaboration generates significant added value. So ONERA develops its best technological solutions, possibly breakthrough technologies, and the SME implements its product development, industrialization and marketing capabilities in order to reinforce its competitive advantage in its markets or to create new ones.

These complementary roles, based for one side on a 'craftsman instinct' and for the other on a 'predatory instinct', opposable in the sense given by the theory of Veblen **(**1899**),** generate significant asymmetries between the two partners.

Figure 3 presents the existing asymmetries between the public R&D laboratories and the SMEs in France by showcasing their respecting positions with regard to the TRLs (Mankins, 1995);[9] it should be stressed for joint projects. It relies on simple and tested principles of « win - win » and « give -give », providing benefits for each participant, as summarized below:

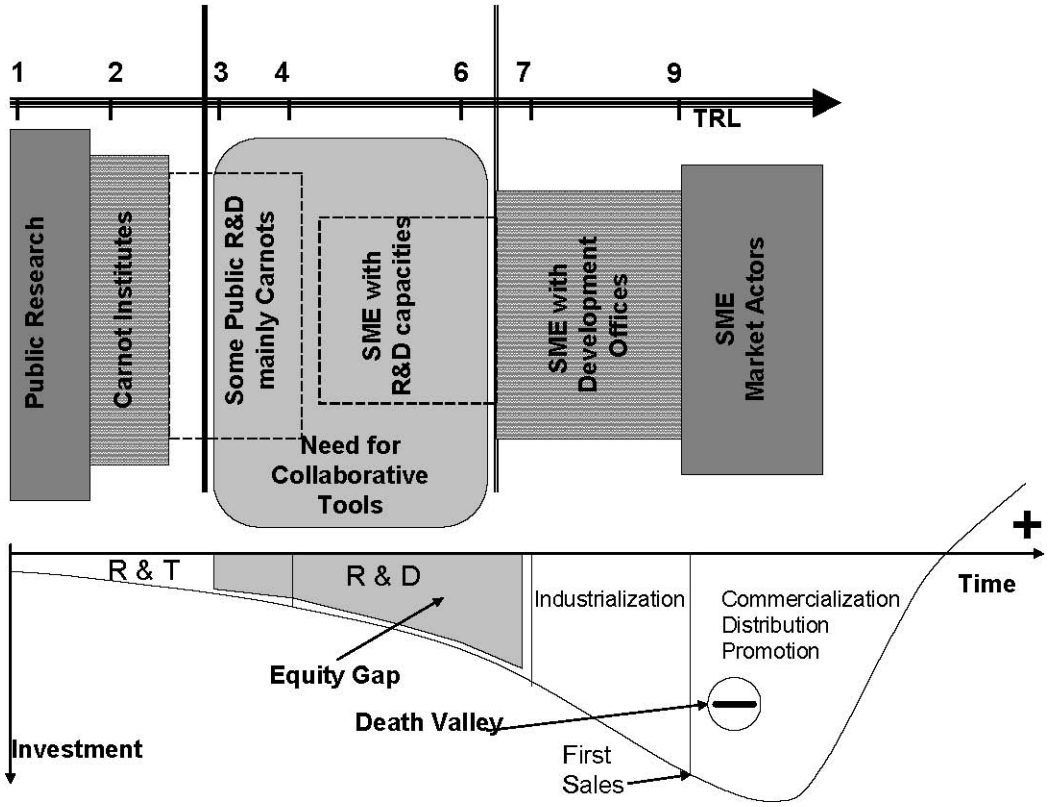

Figure 3: Asymmetries between public R&D laboratories and SMEs, by TRL score

It should be emphasized that the majority of the public R&D laboratories in France carry out their activities at levels TRL 1 (basic research) and TRL 2 (applied research). The 33 Carnot Institutes, being responsible in [AI Carnot, 2008] for some €470 million of research carried on in partnership with industry, and representing about a half of the yearly budget for French research undertaken in partnership with industry, are generally well involved in applied research (TRL 2). Very few of the Carnot Institutes could carry their research up to laboratory demonstration levels (TRL 3-4). Exceptionally and limited to particular programs, some of the Carnot Institutes could bring their technology to operational levels (TRL 6-7).

Beside these figures, the SMEs are currently running their business at TRL 9 (these are selling products, services or components). Fewer than 10% of French SMEs have Development Offices able to integrate (or absorb) operational prototypes (TRL 6-7), in order to structure production chains and introduce new products to the market. And even fewer have R&D capacities able to understand technologies available at Lab Demonstration Levels (TRL 3-4). Thus, the *technological asymmetry* existing between public R&D labs and the SMEs becomes obvious.

In addition, is well known that between the same levels an equity gap is evident in some European countries, hence the European Investment Fund (EIF) and several public-owned banks (like CDC in France) have dedicated important financing programs to

[9] This figure was first presented and generally accepted at the 'Rendez Vous Carnot', Lyon, France, 2010, in the last Round Table dedicated to collaboration between Carnot Institutes and the SMEs.

compensate for this Europe-specific 'amorçage' equity gap. This of itself will induce an important *risk asymmetry* between public R&D and the SMEs.

These asymmetries must be reduced (for the informational asymmetries) or compensated for (technological capacities, financial and institutional risks) in order to support this new codevelopment relationship between the parties, as put forward in this analysis. The collaborative tools will thus be reduction and/or compensation mechanisms for the existing asymmetries between ONERA and its SME partners, with the aim of creating a *trust environment* between the two agents.

Owing to their small size (INSEE, 2008) but also to the structural weaknesses of the innovation support system set up by SMEs and/or start-up partners in France (Serfati, 2008; Levy & Jouyet, 2007), French SMEs must have suitable support mechanisms (private or public) for the success of a possible common development program with ONERA, in order to absorb new technology and to make a success of their international commercial deployment.

Two different approaches were targeted by ONERA's Technology Transfer Office (TTO). More than ¾ of the signed agreements were obtained through a Market-Pull approach and under ¼ were obtained from a Technology-Push approach. Figure 3 supports this part of our analysis.

Indeed, following an intensive advertising campaign based on slogans like: "Come to see us if you have a Technology issue! We are the MacGivers of the Science and you will never be alone", the majority of its SME partners did come to see ONERA addressing their technology issues. They had generally already identified a business-growing opportunity while calling on ONERA's TTO and they were looking for missing competencies in their company. We describe this as a Market-Pull approach. Technology-Push instead occurs when ONERA's TTO promotes a technology newly developed within ONERA and negotiates a license with an interested SME (or start-up).

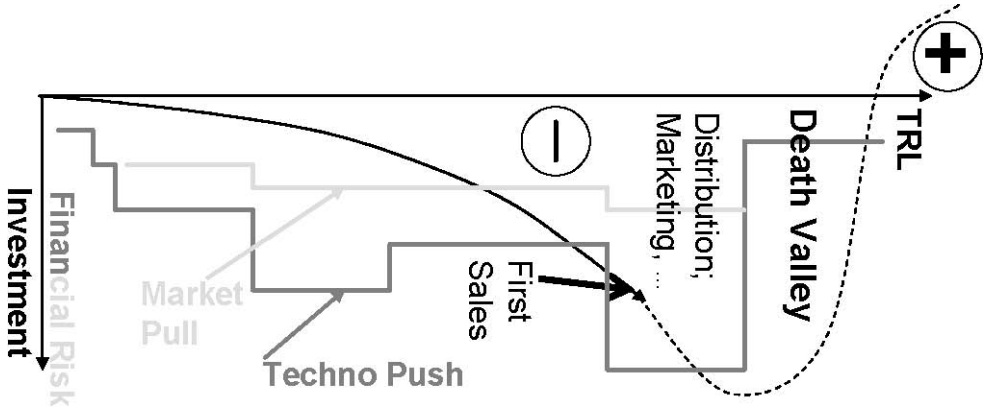

Figure 4: Risk curves related to the Technology Development Investment curve

Based on our observations and royalties return, Market-Pull projects have until now been the more successful. Accordingly, we propose our analysis of these results. In Figure 4, the risk curve for a technology-push approach is given by the continuous stepped line, while the dotted line shows a case of the market-pull approach. We can observe that both exhibit a high level of risk while investing in operational technology demonstrations and above all in launching New Products (goods and services) into the market. Nevertheless, we remain confident about our implicit assertion in Figure 3 that, throughout the cycle, the risk levels are lower in the Market-Pull approach than with Technology-Push.

This lower risk exposure is induced at each stage by the belief that the SME partner has already identified a market and already possesses a structured production chain (including a supply chain). These considerations act as drivers throughout the technology collaborative development process, raising the company's rating on the TRL scale, thus reducing its risks and costs. The Market-Pull approach also seems to accelerate this technology development process; thereby accentuating the dynamic capabilities that the

firm is able to parade.

We further adopted a hybrid strategy for ONERA while working with SMEs. Indeed even if the market-pull approach seems to be less risky and sooner beneficial, and even if it is producing incremental and often radical innovations by changing the domain for the adopted aerospace technology, we do believe that some technology-push activity will continue to be important for eventually nurturing disruptive innovations in ONERA's core business domain. Another important reason in continuing to promote technology-push activities through its TTO is the higher degree of motivation provided to its scientists while promoting their newly developed technologies.

This hybrid strategy places the agents of the innovation system in a cooperative network generating newly created value through a process of technology transfer.

II.3 -ONERA-SME partnership innovative strategy

The ONERA-SME technology transfer process cannot be analyzed without taking account of the relationships of the two players with their own reference frames, in terms of evaluation and sectoral/territorial regulations, in the sense of Granovetter (1985). These are mechanisms that are external to the simple ONERA-SME relationship which must intervene and accompany this dual relationship throughout the entire collaborative project, and some of the collaborative tools proposed take them into account.

Initially, an analysis of the role of each player during the innovation process is proposed and even, albeit in a more restrictive way, in the technology transfer phase. As mentioned above, the activity of the public R&D laboratories in France involves, structurally, TRL levels lower than levels 3-4, corresponding to the laboratory prototype stage. Only a few basic ideas conceived by the researchers attain this level of technological maturity and even fewer cross levels 3-4 to go on to levels 6-7, corresponding to the demonstrator in operational conditions or a product. This is because the development of technological demonstrators is no longer part of the mission given to public research in France, a situation that is actually even worse for products.

If, generically, during the TRL 1 level (basic research) and TRL 2 level (applied research), 1000 original ideas finish up numbering 100 (via the personal filter of each researcher leading him or her to retain only one idea for every ten that he or she may have), are then cut down from 100 to 10 (by discussions with his or her 'close' circle of colleagues), and finally slimmed down from 10 to 2 or 3 by debates with the line management and/or decision committees, it will be interesting to see how these 2 or 3 results from various projects can cross level TRL 2 to arrive at levels 3-4 of prototyping.

II.3.1 -Asymmetries in technology transfer relations and collaborative tools

It can be seen that the research activities in TRL 1 and 2 are really mostly by the research laboratories because few SMEs are able to conduct their own research at these low TRL levels. Most innovating SMEs (apart from those that are really small labs in their own right) invest more in R&D activities after demonstrating technological feasibility, because their ultimate mission is to sell products successfully, with an economic logic of seeking profits.

So, what can be done with a technology that reaches a research laboratory at level TRL 2? At this stage, a laboratory prototype can be shown to be feasible by simulation and/or the existence of certain elementary components with strong chances of success. Who must now invest in the

development of this prototype and on which criteria should the decision be based?

It seems obvious that at this stage the laboratory should consult the possible bearing vectors in the market: large groups and SMEs. If the technology developed corresponds to a strategic axis of development in a large group, quite naturally the latter will be interested in the appropriation of this technology or, at least, in a competitiveness comparison with other solutions. The partnership process that would take place between the laboratory and this large group is not the subject of this analysis.

The case that interests us is that in which an existing SME is interested in this technology, whatever its branch of industry. When no SME or large group expresses interest in the use of the new technology then there only remains the option of launching a start-up partner, in the case of a 'disruptive' technology with high development risks and market potential, to be confirmed by market research; otherwise the development has to be abandoned.

II.3.1.1 -Technological asymmetry and Risk asymmetry

On the two assumptions, both for an SME and for a start-up partner, the problem of maturing technology up to the TRL 3-4 levels remains the same. It will be very difficult to get the SME or the start-up partner to finance this maturation. All this is related to the structural problem of financing developments in France but also to the lack of leading-edge scientific skills within the SME, allowing dialog with researchers and the appropriation of technology under the TRL 3-4. An asymmetry of technological capacity is revealed here and an asymmetry of the risk (financial) between the two participants: the public research laboratory and the small company.

Indeed, 95% of French SMEs are small companies with less than 50 employees (INSEE, 2008). The development and demonstration of a new technology based on emerging technology from aerospace together research cost at least around one million euros (according to our own experience in the relationships with our SME partners), without counting the launching and development costs of the product line. However, most of the innovation assistance available in France is limited to 50% of the global amount (see Oseo, 2008, on refundable advances). This means that an SME that undertakes the development of a new product for a breakthrough innovation must assume half of the costs itself. For an SME with twenty people, €500K may well represent 25% of its annual wage bill.

Here, a significant risk asymmetry is to be noted between the SME and ONERA because possible failure could mean a cessation of activities for the former. The same amount represents the cost of four ONERA researchers – in other words, of its far higher R&D 'capacity'. Moreover, financial risk exists and is not negligible, especially in the EPIC culture, where we will see later that the scientists involved in the technology transfer relationship are very little aware of the risk for ONERA compared to the degree of the risk assumed by the SME. Other authors (e.g. Serfati, 2008) have also stressed the importance of social relationships (including cultural relationships) in the innovation process. This difference in mentality was identified without any ambiguity in the collaborations undertaken by ONERA with various SMEs.

A mechanism to try to solve this technological maturation and asymmetry problem has been developed at ONERA: the *shared risk development contract*. This type of contract was developed and signed, for the first time in France, between an EPIC and a business firm.

For this phase of technology maturation ranging between TRL 2 and TRLs 3-4, the risk is still too great to be borne entirely by an SME as long as the technological proof, at least in the laboratory, as well as a complete comprehension of the technology, have not been achieved. It seemed right to us that ONERA, as a creator of technology, should be able to join future industrial and commercial owners in order to reduce the risks, and share the possible future benefits. The partnership is based on a technical and economic analysis of various phases of the development and on a Business Plan detailing the market prospects and investment returns on the new product. Based on this, ONERA can decide to assume part or all of the costs, within the framework of the co-development, the refunding of which, with profit-sharing based on business success, will take place or not, depending on the prospects for the use of the product.

The negotiation of the percentage allocated to

sales, so as to cover ONERA's costs and its exposure to risk, is conducted according to criteria allowing the development of the company but also bearing in mind the fact that ONERA must make a positive return on all the operations of this kind. Thus, this contract is not a sort of license, nor a subsidy. The principles on which this contract is based are those of a service provided by ONERA on the basis of a determinable (though undetermined) price with payments deferred in time, negotiated between the parties on the basis of later sales and for a length of time agreed upon as part of the same negotiation.

This type of contract proves to be a very good tool, both financially but also technically, for collaboration with co-design in mind, for the development of a new product, a logic equivalent to that described by Cowan (2003). This tool means two parties can together cross, within the meaning of Aoki's theory (Aoki, 2000), based on a Nash equilibrium (Nash, 1950), a possible financial and technological comprehension barrier that may otherwise induce blocking.

In addition to compensating for risk and technological asymmetries between the two parties, this contract has also subsequently proved to be a good tool for reducing transactional information asymmetries (Akerlof, 1970; Stiglitz & Weiss, 1992) between the start-up partner and its investors. Indeed, at the time of the phase of 'due diligence' between the creators of the start-up partners and the Business Angels, the shared risk development contract, signed with ONERA, yields paramount information on both the product and the target market, and on the technological developments and their costs.

This last year, at ONERA, three contracts of this type were signed with various commercial companies and four others are in advanced negotiations. Two of these companies have succeeded in raising funds from investors.

II.3.1.2 -Institutional asymmetry (mentality and behavior)

The shared risk development contract is a collaborative tool that compensates for technological and risk asymmetries. Such a tool also compensates indirectly for a very important asymmetry in the relation between the transmitter and the receiver in the process of technology transfer, institutional asymmetry, a term introduced here analogously with the terminology of institutional economy, within the meaning of "thought and action practices" by Veblen (1899) of "shared mental models" and "belief structures that intervene as formal and abstract constraints to structure human interactions" by North (1994).

This asymmetry has been thoroughly analyzed because it can sometimes induce a more significant form of blocking in a dual relationship: cultural blocking. The word 'institutional' must be understood as a sum of the rules, but also in its abstract aspect as a sum of beliefs, prejudices, instincts and behaviors: "Institutions are dominant thought and action practices" (Veblen, 1899). All these elements are generated historically, according to the way in which the actions are carried out and are assessed, but more especially through received education.

Historically, applied research in France is really quite concentrated in national research centers specialized in a particular field (IFP, CEA, ONERA, Inrets, Inra, Inria, etc.). The universities have generally not been perceived as possible players in applied R&D. The proof is that before the Allegre Law in 1999, very few universities in France had a research result utilization service, and even these, before the Pecresse Law in 2007, did not have that complete autonomy which would allow them, among other things, to have a close relationship with the economic world.

The Summary report of assessment of the universities of the wave B (AERES) made an

observation which alludes to this: "... Socio-economic milieus.... their influence on the policies and strategies of the establishments are generally weak, because of their lower level of involvement in the councils of the establishments".

The utilization activity developed since the Allegre law seems itself to be directed toward research contractualization and expertise-based services, but hardly at all in the field of technology transfer. The following can be read in the same report: "Utilization -this is a declared objective in all establishment strategies. Management structures (service, SAIC, subsidiary companies, direction, etc.) exist in the majority of these, for industrial contracts and service performance. On the other hand, the management of patents and licenses and, generally, of intellectual property, financially costly and requiring specialized skills, is accessible to these establishments with great difficulty. A really effective utilization policy would require the creation of consortia within a regional or even national framework to reach the critical size necessary for effectiveness."

Leaving, in passing, to the reader the appreciation of the desirable ways of improvement, as they are recommended in this quotation, we should mention that nowhere in this report is a mechanism suggested for listening to the needs for development being expressed by the markets.

In the Guide of the expert -Wave C of May 2008 of the same Agency (AERES) we can find positive developments going in the direction, in terms of the evaluation criteria, of taking into account activities around the utilization of research within the organizations being assessed.

It is explicitly requested that the number of patents, the number of declarations of inventions, the cost of the patents, as well as the revenue generated by these, all be taken into account but, above all, the number of licenses. However, other fundamental indicators are lacking for a complete measurement of utilization activity, such as the revenue from possible capital shares held in the companies profiting from technology transfer, the evolution of the value of these companies, or the number of jobs created on the basis of these technologies.

This, coupled with consideration of a criterion on the patentable technology detection activity within the establishment, but not of one on the capacity of listening to the market needs, or the capacity to carry out market research, will generate a culture of technology push instead of a market driven culture, generally recognized (among discussions at T2S or AUTM Annual Meetings) as a better generator of innovation.

Thus, the economic culture of the researchers is built throughout their career by indicators on the basis of which they are assessed, the most important indicator being recognition by peers, gained mainly through publications by the researcher according to panel reviews. However, while publication circulates research results efficiently, without an adequate preliminary control it is contrary to the utilization mission of national industry and likely to reveal unprotected knowhow.

In this same guide, the number of A and A+ type publishers is an important criterion in assessing establishments. The identification criteria of these authors include international patent deposits but do not stress those that were granted a license. Also, protection of the results is confused with their utilization and as a result it is likely that a great number of patents of no importance may be obtained because they do not contain any criterion bearing on their economic impact. It would undoubtedly be necessary to optimize the respective weights of a license, the incomes obtained with the latter, the patent and the publication.

There is a legitimate question to be asked here: when does a license generating significant income have the same weight as (or even a greater weight than) an article published in *Nature*?
There is indeed no antagonism between a patent and the publication of results from their source, only a priority on the submitting of the patent is to be respected. If a license counted for three traditional patents or nine publications … could this induce a change of mentality within t he public research community?

Moreover, this mentality is the subject of an unambiguous analysis in this same report concerning the governorship of research establishments: "in multiple-field establishments, faculty-centered organization remains very vigorous. In certain recent universities, it is an acknowledged will. The

evolution of mentalities and practices is thus very slow…"

The recent "Carnot Label" awarded to research establishments with partner research activities with industry (Carnot Law) has made it possible to evaluate the co-operation between industry and public research in France. Thus, the 33 Carnot Institutes, accounting for only 12% of the French public R&D manpower, generate nearly 50% of the research contracts with industry, for a total budget of €450 M, representing merely 1/3 of their annual consolidated budget. The share of this budget with the SME is however insignificant.

So could a researcher become convinced that the utilization of research results is a noble aspect of his or her activity? This mentality, based rather on the "craftsman instinct" within the meaning of Veblen (1914), induces a strong asymmetry in the relationship between a researcher and an SME director, who will rather act according to a "predator instinct" from the "cultural" point of view, during their interaction for a technology transfer. This asymmetry may be strong at the beginning of the relationship, and can be compensated for gradually if a favorable environment is created to help the relationship to evolve from a transactional framework towards that of cooperation.

Now that this institutional asymmetry concept has been introduced, we can see that the technological capacity asymmetry triggers collaboration between both participants and that the compensation of information and institutional asymmetries is the facilitator because, at the beginning of their relationship, both parties face problems arising at the same time from the lack of technical information but also from the capacity to implement these once they are available (for example, it is not enough to read a patent to be able to manufacture a new product).

The shared risk development contract is one of the mechanisms allowing the compensation of institutional, technological and financial risk asymmetries, during the integration of researchers into the SME, when a technology transfer towards the SME takes place.

This evolution results from acknowledging the failure of the existing spin-off policies of the public research establishments, whether in France or elsewhere in Europe. The great scarcity of researcher spin-offs is a logical consequence of the natural differences in skills necessary as between the enterprise world and that of research. Success in the creation of a company depends not only on the quality of technology, but particularly on that of the management team, and on financial and operational resources, in order to control marketing, commercial, financial, industrial and productive components, making it possible to move, in a limited period of time, from a good technology to a business success. The goal of the Charter revision, toward integration of the researcher wishing to "spin-off" into an existing structure, is thus to support the meeting, within a pre-existent framework: that of the SMEs, of these components of success so as to reduce the risks, for both the researcher and the SME, and for ONERA as well.

The departure of the researcher to the SME wishing to accommodate him or her, with the transfer of a technology in which he or she is an expert, takes place under conditions that are at the same time safe and incentivizing; in particular, the traditional conditions: the possibility of returning to ONERA during the first three years, financial aid, and the financing of training to reinforce the necessary skills for his or her new mission.

The main point is however the condition of opening the SME capital to the researcher in order to position him or her as an "entrepreneur" on the same level as his or her new partners (at least 5% for a small company; flexible for an average-sized company). This makes development of "cultural" positioning possible for the spin-off researcher, and a clear

confirmation of the interest of the receiving SME for the new business that the researcher will contribute to develop and manage within it.

II.3.2 -ONERA–SME Technology Charter

In order to give a more general framework for these relations, to gather the collaborative tools, to define the principles of the expected collaboration with the SME, and to ensure this collaboration policy can be maintained for the foreseeable future, ONERA made the strategic choice of setting up an *ONERA–SME partner technology Charter*.

This Charter itself had to go beyond the simple problems of technology transfer and explore all the collaboration possibilities between ONERA and the small business world. It represents a moral engagement of the two parties, based on the principles and methods of collaboration and the values governing them. It also means the two parties wishing to collaborate can be on active watch, reciprocally validating their collaboration potential, and be able to start a collaborative project at the earliest opportunity.

This Charter is fully positioned as an institutional collaborative tool, within the meaning of Aoki's theory (Aoki, 2000). The two participants do more than give themselves the means by which to develop together because they are both on active technological watch in their respective markets, identifying opportunities for joint projects.

It relies on simple and tested principles of 'win–win' and 'give–give', providing benefits for each participant, as summarized below:

i) Mutual benefits

a) Technological [10] benefits and opportunities for an SME

Such partnerships make it possible for the SME to have access to R&D contracts in partnership with ONERA, to scientific expertise across the entire civil and defense aerospace field, and to technology by means of licenses, simulations, calculations, testing tools, simulation tools or software runs [11] and technological watches.

These can reinforce its competitive advantages from accumulating competencies out of the framework of R&D contracts, by proposing solutions that involve a stronger scientific added value thanks to the contribution of ONERA, both from becoming first phases of technology transfer. To allow later developments, up to the marketing of products, ONERA has adapted its *Spin-off Charter*, as another collaboration tool, in order to support

integrated into experimental projects and technological demonstrations, and by allowing more competitive services with a better adjusted division of the types of services provided by ONERA and the SME.

They permit giving access to markets and customers that would be difficult for an SME to reach alone, since the latter will now have the benefit of the "ONERA Partner" label to present to large institutional and industrial accounts, thereby dodging some of the weaknesses of being small through taking part in the cooperation project.

The SME can also profit from the outcome of developments in contracts with ONERA for progressing towards commercial use of new products in its markets.

b) Benefits and opportunities for ONERA

[10] For SMEs that involve themselves in the development of technologies in addition to their use. [11] Launching the computations on ONERA's super-computers

This partnership reinforces the competitive advantages of ONERA within the framework of R&D contracts, achieving this in various ways: -by offering more cost-competitive services with a superior division of the types of service jointly provided by ONERA and the SME; -by proposing more flexible and more directly operational solutions; -by allowing greater reactivity, particularly in 'original' and 'changing' requests, within the framework of

prototypes and experimental projects; - by better controlling the costs and times of the production tasks necessary for the projects.

The partnership offers access to customers/end-users not directly accessible by ONERA, supports mutual enrichment and emulation between the teams of ONERA and the SME, allows ONERA to be proactive and play a driving role in the industrial field, and offers more dynamic potential outlets for utilizing the research results, particularly for its technology transfers.

ii) Types of partnership

Several partnership modes can be implemented to carry out this project, such as partnerships in R&D contracts, the expertise and use of ONERA methods, shared risk development contracts, technology transfer/utilization of ONERA know-how; this goes as far as the detachment of researchers and/or their spin-off into the SME.

iii) Profile of targeted SMEs

The desirable profile for **targeted SMEs** must allow fast self-identification by the SME of its own capacity to enter into a partnership framework with ONERA by:

-having a production activity or technology service;

-working in a field that can benefit from the outcome of ONERA's research;

-devoting – or having an objective to devote – at least 8% of its Turnover to R&D activities (this minimum can be modulated according to the size of the company)

-having financial viability;

-satisfying the SME criteria of the European Union;

-adhering to the values of the *ONERA-SME Charter*.

iv) The "values"

This *Charter* is primarily a moral engagement between the parties, resting in particular on a common vision of the business rules of the partnership:

-*innovation based on scientific and technical excellence*: scientific and technical excellence is one of the basic elements identified by the SME for the development of its innovating products and services. This excellence is based on an internal R&D policy at the SME, as well as on external contributions, including among others those of ONERA;

-*a quest for performance*: the concretization and perpetuation of success are guaranteed by a permanent search by the SME for improved economic performance, within the framework of the development and marketing of its goods and services;

-*constructive competition and fair-play*: in the event of competition between SMEs on contractual or utilization activities, this will only proceed on the basis of technical and economic criteria, seeking performance and in a spirit of fair-play between them, respecting the customer and/or ONERA. In particular, it would be a case of forbidding higher technical or economic bids likely to lead to an unidentified risk for the customer and/or ONERA. In the event of competition with ONERA, the rules of free

competition apply; a reciprocal tendering procedure could be considered to assess a possible cooperative venture;

-*independence*: each SME preserves its independence; the network may be mobilized in defense of shared interests, but – barring exceptions – cannot be used to support private interests;

-*commercial ethics*: the operation of the project shall be according to recognized commercial rules of ethics, in particular to exclude any private interest situation between ONERA and SME researchers that may generate specific conflicts.

III. RESULTS

To date, 87 SMEs have signed the *ONERA-SME Charter* and more than 40 licensing agreements, know-how communication agreements or shared risk development contracts are currently running, with various industrial partners in a variety of fields. Of these, 28 were signed over the past four years, corresponding to the new development policy, while the remainder (12) represent the historical 'heritage' of the old ONERA development policy

Table 2: ONERA–linked SME partners (selection only)

Partner	Application	Type of collaboration
Leosphere	Wind lidar	License, common R&D and spin-off contract
Oktal-SE	Electromagnetic environment simulation	Software licenses and common R&D contracts.
Phasics	Laser interferometer	License and ONERA postgraduate student recruiting
Protip	Biomedical prosthesis containing porous Titanium	License and shared risk development contract
Ixsea	Inertial navigation	License
Sirehna	Drones and gliders	Common R&D contract and software license in fluids
Satimo	Medical imagery	Common development contract and license
Isitek	Medical supervision in residence	License on sensors
Microcertec	US machining of ceramics	License
Fogale-nanotech	Capacitive sensors	License
Andheo	Fluid mechanics and energetic	Software license and common R&D contracts
Sofratest	Flow measuring	License
C3EM	Fissure monitor and experimental data acquisition station in wind tunnels	License, common R&D contracts
Secapem	Real-time shot acquisition and validation system	R & D contract and software license considered
Mapaero	Pressure-sensitive paint	Know-how communication agreement
Michalex	Micro-indentation at very high temperatures	License and shared risk development contract
ACV Aeroservice	Quiet green aircraft	R & D contract and shared risk development contract envisaged
Nheolis	New type of wind power station	Shared risk development contract
Keopsys	Laser	License

Following the successful implementation of the new collaborative tools during this period, the number of collaboration agreements signed went from one to more than ten agreements per year. The number of spin-offs went from one spin-off every five years to one spin-off on average per year. Fifteen new proposals for common R&D contracts also came to light during this last period.

Table 2 provides a selection of the partnerships with SMEs, this selection having been made on the basis of their diversity.

III.1 -The point of view of the SME – changes and perspectives

A first experience feedback is now available with the results of an investigation conducted with the SME partners. A questionnaire concerning the ONERA-SME collaboration was addressed to them, and 42 of the 68 SME partners, at that time, answered it. Of these 42 SMEs, more than 80% have become partners of ONERA over the last four years.

This questionnaire thus made it possible to confirm the first concrete results, in particular the creation of 170 jobs, at these 42 SMEs that answered the questionnaire, since the beginning of their relationship with ONERA. Among these, 104 jobs can be ascribed directly to the new activities developed by SMEs based on ONERA technology. The funds raised by the partner SMEs amount, to date, to more than €20 million.

One of the particularly important questions with regard to the confirmation of the role of collaborative tools in the reduction of information asymmetry between the SME and other economic participants was: "To what extent has your relationship with ONERA influenced your development?" It revealed that half of those who answered confirmed having an image or credibility benefit thanks to the partnership. Such reputational effects represent a case of dynamic appropriability that seems well worth pursuing in the near future.

With regard to the development of the relationship with ONERA, half of those who answered would like to reinforce their direct relationship with ONERA researchers (either in the form of direct expertise, or within the framework of a spin-off of the researcher into their team). Half of those who answered also wish to be better informed about developments in hand and the strategy of ONERA. The two indicators reveal a need to compensate the technological asymmetries and reduce the information asymmetries that still exist between the SMEs and ONERA.

The answers to this questionnaire and the knowledge of the operating rules of ONERA have led to proposals for new mechanisms, mostly within ONERA, which could compensate for a number of the asymmetries between the SMEs and the Office even more. Thus, a need for the following aspects was identified:

-the development of a specific strategy whereby several SME partners, together with
ONERA, develop technological demonstrators of the 'systemic' type; the consortium
thus constituted no longer adopting a management characteristic of a sequential
innovation process but horizontal management (Rothwell, 1992) more suited to multiple-
field and multifunctional teams;
-the development of an *SME partner skill catalogue*, to be distributed within ONERA to
the research teams;
-the periodic organization of joint events

between ONERA and the SME, to which other
participants such as customers would be invited, and the various innovation assistance
structures;
-the creation of a network of experts, with adequate training, to provide a single interface
with the SME;
-the possibility of conducting market research;

-the development of joint ONERA–SME laboratories for maturing technologies

III.2 -The common technological maturing laboratory as a collaboration tool

In addition to other collaborative tools, it seems appropriate, in the case of complex projects requiring a technological maturation between TRL 2 and TRLs 3-4, for it to be possible for this to take place in the public laboratory's own maturation lab, a joint arrangement for which future technological developments are managed cooperatively with the SME partners. This laboratory would accommodate mixed teams composed of SME (or start-up) employees and researchers. The personnel costs would have to be borne by each party for its own staff. Mechanisms external to the SME–ONERA relationship, making it possible to ensure up to 80% of the wages of a professor (or researcher) recruited by an SME, have been put in place recently at Oséo.

The question of the financing of this Common Technological Maturation laboratory could also be resolved by making use of the additional Carnot contributions (under the Carnot Law) that the Institutes that are members of the Carnot Institute Association receive, to boost their scientific and technological resources within the framework of their partnership policy. This is because one of the goals of the Carnot label, amongst others, is to support technology transfers. It remains a fact that no technological maturation should be undertaken without preliminary market research, with product/market cross-referencing as obligatory.

The Common Technological Maturation laboratory would also function as a new collaborative tool, facilitating the compensation and reduction of technological asymmetries (in its institutional aspect and in terms of the lack of information) between the two participants in the technology transfer but also as compensation for the risk asymmetry.

IV. CONCLUSIONS

This study has attempted to blend the theoretical demands imposed by approaches such as those relating to innovation studies (the viewpoint of dynamic and interactive capabilities), or the economics of information (highlighting asymmetries) especially as SMEs prevail on the side of customers for the technological competencies supplied in such circumstances. The first results show a series of development successes for innovative products based on technologies created by ONERA, and this in a great variety of sectors viewed at the meso level, going from biomedical prostheses to the wind power market.

The study, as far as it goes casts some light on the old and still largely unresolved question of how largely tacit knowledge – locked away inside a large and probably discreet organization, and representing its penrosian slack (Penrose, 1959; Brusoni et al., 2001) or 'excess knowledge capacity' -can recirculate around its coterie of knowledge-hungry SMEs. Moreover it can do so effectively enough to become not just their new competencies but their new capabilities. Basically, to do so involves close relationships to weaken all the forms of asymmetry, built around constant interchange of personnel as well as ideas and information, etc.

This research also contributes to Stiglitz's "information asymmetry theory" by acknowledging the need to reduce and/or compensate for different asymmetries while carrying on a cooperative process like technology transfer which has impacts on all levels: direct impact on the agents (micro), on the regulators (regions and sectors – meso), and on economic growth (macro)

IV.1 – The impact at the micro level

As for any form of transaction, in a technology transfer process, the parties involved are informationally asymmetric. The new SME policy at ONERA has in addition given serious consideration to other forms of asymmetries characterizing the technology transfer and partnership research between a public research organization and an SME in France: technological capacity asymmetries, institutional asymmetries and those of financial

risk.
The collaborative tools deployed at ONERA within the framework of its new development policy, the *shared risk development contract*, the *ONERA-SME Charter* and the *Spin-off Charter* are mechanisms designed and implemented to ensure the reduction of the information asymmetries and compensation for other asymmetries between ONERA and its partners. The Common Technological Maturation Laboratory is another proposal for a collaborative tool similar to those already in place.

The relationship established between ONERA and an SME is perceived more as a cooperative relationship for a co-development rather than as a simple study service (i.e. just transactional). This relationship imposes compensation for financial risk and technological capacity asymmetries in addition to institutional (mentality) asymmetries and the reduction of information asymmetries between the two parties. Attention is thus drawn to the importance of the "issues of confidence and interest" (Cowan et al., 2003) in a technology transfer relationship with regard to the questions of opportunity and uncertainties in a product/service sales relationship (in the Ford sense). Each partner must, to some extent, learn and understand the culture of the other, without losing its own, in order to understand better and more generally to do what is necessary in order to balance the various asymmetries.

IV.2 -Impacts at the meso-economic level

The first successes with the signing of the *ONERA–SME Charter* by more than 70 SMEs recognize and prove the significant role that ONERA can play as a source of innovations and also as a catalyst for a cluster of skills and multi-sector innovations. This is valid for all the regions where ONERA is represented, thus confirming the views of other authors (Etzkowitz, 1999; Florida & Cohen, 1999).

Moreover, the *ONERA–SME Charter* and the *shared risk development contracts*[12] have also proven to be very effective tools in the reduction of information asymmetries between the SME (or the start-up partners) and other socio-economic players (investors, competitiveness centers, etc.).

At ONERA, the cultural change taking place amongst the researchers involved in a relationship with an SME can be observed. Their contractual liability is reinforced by a better awareness of what is at stake, which the successful transfer of their know-how to the SME represents. They adopt the "predatory instinct" (Veblen, 1914) of an entrepreneur, interested in transfer opportunities for their technology outside the aerospace field. The implemented tools operate as relational facilitators in the relationship between ONERA and the SME but also in the internal relationship within ONERA between the scientists and the support structures for utilization.

The success of the operation of collaborative tools changes the internal operation rules specific to ONERA and allows proposing new internal mechanisms, such as the creation of a network of experts as a single ONERA interface with the SMEs, and the future possibility of carrying out market research. The purpose of these mechanisms will be to increase still further the effectiveness of the partnering relationship with the SME.

ONERA's change of strategy in the choice of its customers, because of its opening to the world of the SME, has had an effect on the diffusion of its technologies beyond the aerospace field and

[12] The shared risk development contract has been developed by the ONERA DCV team during the last 5 years. The authors of this article who were involved in developing this tool wish especially to thank Corinne Le Hong for her contribution in updating the Risk Sharing Co-Development contract and to Frédéric Lamy for his contribution in updating the same contract, but also to the

entire team (led by Michel Humbert) who are nowadays continuing to capitalize upon (thanks also to the work of Veronique Tanguy and Hervé Lachaud) and develop innovative practices with SME partners.

especially on its positioning in other market sectors as well as in its relationship with its customers. Having a study service relationship with a large industrial group, ONERA has now also given itself the opportunity of having a co-development relationship with the SME partners.

The intervention of ONERA in multi-sector innovations, on the basis of its research results in the aerospace field, puts the Office in competition with other traditional suppliers of research, in each of their specific fields. This has an impact on the 'forms of competition' (costs, quality, speed of development) and ONERA could thus find itself in an advantageous position due to its multidisciplinary skills.

The new form of "multi-sector innovation" competition, induced by the new ONERA-SME policy, could prove to be important from the point of view of access to public funds. Thus ONERA, in partnership with a suitable cluster of SME partners, is able to bid for public programs to build technological demonstrators. In some of these programs, this could generate fair-play competition with its own strategic partners among the large aerospace industry groups.

ONERA's new policy of development with SMEs offers a solution to the problem encountered in a general way by clusters of companies, of the competitiveness center type, which are based on the effects of agglomeration and of specialization (Weber, 1909/1929). This cluster model has proved risky for long-term development due to exaggerated territorial specialization and the lack of job diversification, skills and sectors in the region, which could thus become a disadvantaged "small world" (Watts & Strogarz, 1998).

The positive effects of this new policy at the territorial level have been confirmed for the effects of complementarity and the interactions thus generated between various SMEs (Zimmermann, 2002), encouraging them to work in complementary sectors, not ne**cessarily belonging to the regional competitiveness centers; this has been in order to develop innovative** solutions in their sectors based on the high technology licensed by ONERA, a form of technology originally developed for the aerospace sector but potentially adaptable to the needs of low and medium-tech sectors (von Tunzelmann & Acha, 2005). .

One of the results of the practical application of the new ONERA–SME policy is that ONERA became a "distant source" (Maskell et al., 2005) of new ideas and expertise for other competitiveness centers outside the aerospace field. Thus, ONERA's SME partners and members of these so-called competitiveness centers no longer depend only on internal interactions specific to the center that they are members of in order to have access to R&D resources, but also benefit in their innovation work from skills that are external, in the geographical and sector sense. This reasoning has proved to be valid also for the case of geographically isolated SMEs that encounter difficulties in becoming members of the centers of another area, the partnership with ONERA allowing them an important access to R&D skills.

As a transition to the macro-economic level, an important perspective could directly impact the development policies of regionally specialized clusters, as with the national strategies for innovation. The R&D laboratories will adapt their behavior by intensively using asymmetries compensation/reduction mechanisms in their relationship with the regionally specialized SMEs but also with other SMEs, not regional or acting in other domains. Thus, the regionally specialized clusters (supposing there is more than one present in the same region) will be interconnected through direct collaborations occurring between some of their "provider (R&D labs)" and technology "consumer (technology adopter SMEs)" members. They will also be interconnected with other non-regional clusters. These types of interactions, driven through either Market-Pull or Technology-Push (or Hybrid) approaches, will exchange technology inside and outside their related clusters, with no more monitoring by Clusters Authorities. To upgrade this type of possible multiple embedded innovative system, mainly based on technology transfer between providers and consumers of technology, we consider that smart grids models could be an appropriate approach (Paun, 2010).

IV.3 -Impact at the macro-economic level

The relationships that the SME partners have developed with ONERA allow changes towards sector-based operating rules specific to the innovation assistance structures or to regional development, in relation to professional networks, in the sense of "cumulative causality" (Veblen, 1914) or of "recursive causality" (Morin, 1990). Thus, it has been observed that some of ONERA's SME partners, especially the decisional committees of this type of structure (competitiveness centers, trade associations), proselytize for this new type of tool to collaborate in public research with other members of such committees.

Other national structures grouping various innovation players actively examine some of the collaborative tools developed within the framework of the new SME policy of ONERA. These tools are often the subject of analyses by think tanks made up of these national structures, in order to exchange ideas regarding good practices between their respective members.

The adoption and/or generalization, after the inherent adaptations due to the sector-based specificities of the various parts, of these collaborative tools by these other structures or networks could induce the same positive results as those obtained by ONERA and its SME partners, on innovation at a national scale.

Many authors have identified, in the various studies of the conditions and mechanisms of financial support for innovation and their impact on economic growth, that information asymmetry (Akerlof, 1970; Stiglitz & Weiss, 1992) is one of the major factors influencing the financial risk taken to generate innovations.

The ONERA–SME collaborative tools have shown how their role can lie in the reduction of this asymmetry between these SME (and start-up) partners and their respective investors. Indeed, the fund-raising required for the development of projects by the SMEs became much easier. The generalization of this type of tool will no doubt mean the constitution of a better *Business Angels* culture and *Venture Capital* in France and, especially, the appearance of new investors due to the reduction in financial risk as a result of the reduction of information asymmetry between the SMEs (or start-up partners) and investors. As an example, the *shared risk development contract*, signed by start-up partners with ONERA, proved thereafter to be a facilitator document in the phase of *due diligence* between the start-up partner and its *Business Angels*.

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INFORMATION RESOURCES MANAGEMENT IN ROMANIAN ARMY

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Abstract:*The purpose of intelligence is to provide commanders and staffs with timely, relevant, accurate, predictive, and tailored intelligence about the enemy and other aspects of the AO. Intelligence supports the planning, preparing, execution, and assessment of operations. The most important role of intelligence is to drive operations by supporting the commander's decisionmaking.Even though information has always been an essential element grounding the military decision making process especially during armed conflicts, the current characteristics of contemporary society turn it into a source of power and, hence, into one of the most important defense resources, as argued in our thesis.*

The beginning of the 21st century has witnessed a special stage in the evolution of mankind given the historical major changes that have occurred and led to an information based society that trespasses any frontiers and gradually dilutes any temporal or spatial constraints.

The technological revolution has led in the fields of communications and informatics major shifts that made room for an increase of their importance as a result of the opportunities that had never existed before to collect, refine, store and distribute information.

Modern armed forces pay special attention to the aforementioned aspects since one of the main aims is to win the information battle given the extended role of information technology and of communications means in the battlespace.

Management related processes will no longer be possible outside the usage of information technology and they will become more and more integrated with armament systems,eventually leading to the usage of robots and remote controlled vehicles, extensive usage of intelligent ammunition, as well as of information technology based work methodologies and, hence, to the possibility to unfold military actions while also monitoring the enemy's actions. Modern warfare led by various units will require the collection, elaboration and rapid transfer of information from the whole battlespace. Such a requirement involves the existence of a multitude of semiautomatic and armament systems able to compensate for the human being's physiological limits and for the technical performance of the classical equipment , to accomplish an optimal coordination of various forces and armaments under the constraints imposed by a compressed operational time, and to ensure human force preservation so that the latter can be used when special circumstances ask for it or to consolidate success.

All of the above considered, we have underlined a few aspects related to the terminological delineation of the concepts of information resources management and integrated resources management. Moreover, we have attempted to describe the relationship between the two in a personal manner.

In this respect we have started our investigation from the conclusions formulated

as a result of consulting an extensive literature in the field and that led us to the belief that an "integrated defense resources management" through its main component known as "information resources management" is essential in the management of operationalized units participating in multinational operations.

We advance the idea that the information resource has become one of the main resource categories of modern warfare and that information technology and modern communications systems ensure the possibility to inform in real time, to influence public opinion, to model political action.

Our personal experience in the field of information collection, verification, interpretation and supply to the political and military decision-makers in order to facilitate the decisions related to the protection of national interests and countering current adversaries' actions, made us understand the importance and complexity of the field of information resources management. Moreover, the educational programs attended in accredited institutions have strengthened our conviction that in order to ensure Romanian troops' interoperability with those from NATO member countries participating in multinational missions it is first necessary to align the concepts and phrases, including those describing the field of information resources, and to accomplish a real information interoperability.

Information - as a source of power and as a major element belonging to the art of war, and hence, is a weapon that can prove its effectiveness if efficiently collected, protected, elaborated and managed. As a result of this analysis we have reached the conclusion that the quality and quantity of information available at a certain moment, the capacity to efficiently manage and use it in order to make decisions are a key element in building information power which is a fundamental component of strategic power. The former can contribute to winning a conflict, be that of military nature or not, before the hostilities are triggered at a visible level.

In our opinion that the general acknowledgement of information as the basis of modern society, as well as a resource as much as people or money, has led the emergence and recognition of the concept of *information resources management* that, in its turn, imposed on managers and leaders to use information as a resource. Thus the process of operationalizing the concept of information resource management actually involves the application of the principles of resources management and, hence, the usage and organization of resources, mechanisms, technologies characteristic of information management in a specific structure to be led based on scientific principles.

We also believe that the information resource is one of the most important defense resources and its importance is overwhelming while preparing to conduct warfare, as well as in the postconflict stage. A rich and reliable information resource becomes a force multiplier adding value when intelligently used since it is a well known truth that the one who has the information and knows how and when to use it can be successful. On the other hand, the scarcity and alteration of the information resource can lead to failure.

Romania's accession to NATO and EU has led us to the conclusion that Information for Defense has acquired an international character since it is integrated in a system that contributes to the process of ensuring security within the euro-atlantic area and not only. Moreover, taking into account the features of asymmetrical threats, especially the terrorist phenomenon and the peculiarities of NATO and EU areas of operations, we believe that information assurance is essential in force protection, mission success and in the accomplishment of the military and political objectives of the Romanian state.

In this framework, we underlined the fact that the value of the military information passed on to the Alliance, the way in which the Romanian military meets the latter's requests and the bilateral cooperation with NATO member states have transformed military information into a specialization of the Romanian armed forces and thus has ensured an important niche for the Alliance. Considering the NATO transformation process, the important role of Information for

Defense in the common defense process and the significant contribution with military information structures to the NATO Response Force – NRF, we believe that the military information is an important asset of Romania and that grants the trustworthiness and robustness of our country as a NATO member state.

Open sources (OSINT) represent, from the point of view of the Alliance, the necessary link in ensuring a superior coordination in the intelligence area of the efforts of the member states with a view to establishing the general strategies and policies, as well as to supporting from an informational perspective the decisions made in the theatres of operations and to supporting troops' maneuvers. NATO military experts admit it in an objective manner that open sources cannot be substituted with spies, satellites, technical means or military capabilities, but they grant a strong support to the planning and execution of civil and military operations, starting with those aimed at providing humanitarian assistance and finishing with war.

As for the openness of the decision making factors to the various types of information products (outputs), we have concluded that this varies on a case by case basis. We believe that current information products that sometimes resemble the journalistic style are often criticized as lengthy and superficial. However, the estimations, from our point of view, are mostly criticized especially in the situations in which the conclusions are not based on the frequency of the decision makers, the latter blaming the services for undermining the decision making process.

The experience gained in the field of operational intelligence undertaken within the intelligence/counterintelligence structures supports leads to the conclusion that the process of obtaining information products characteristic of Information for Defense a mechanism generated by a need for information is triggered. Upon the identification and justification of of this need leads to the elaboration of an information project based on which all the stages of the information cycle unfold. We believe that the information cycle built on the principles underlying the intelligence/counter intelligence activity represents the basis of the information process. The latter in its turn represents the foundation of the intelligence,surveillance, target selection, recce –ISTAR- and IPB processes whose components are directly related to the stages of the information cycle.

The analysis of this process leads us to the conclusion that all these procedural stages within the Information Cycle framework can have a greater or lesser influence depending on the nature of the national contribution to multinational missions. The implications generated by the planning of the available resources have a direct impact and trigger the efficiency level in the usage of the human, technical, financial or any other capabilities in the planning, generation and implementation of the national contribution multinational operations in an efficient and feasible manner form a twofold perspective: national and multinational.

Operationalization of the Roamnian armed forces' units involves a lot of effort at all levels given the aim of making them interoperable with those of our allies and of deploying them to theaters of operations.

It is understandable that during the operationalization efforts special emphasis should be placed upon the means of information collection and management since the necessity to undertake such actions in real time alongside with our allies requests information interoperability.

The experience of our troops highly appreciated at NATO level confirms that we have achieved the information interoperability desideratum and allows us to conclude that this is a gain that adds up to those ensuing from the common efforts aimed at supporting democratization processes, upholding human rights in countries where our troops are deployed.

The analysis has pointed out the necessity to operationalize the military structures and made us conclude that Romania's integration into NATO involves not only our country's participation in the main decision-making bodies of NATO, but also other key elements such as the usage of common language in multinational operations, the change in mentality in oredr to ensure the acceptance of the Alliance's values, the accomplishment of the conceptual and technical interoperability, etc.

Given the current characteristics of the contemporary security environment which becomes more volatile, uncertain, complex, ambiguous and fluid as a result of the worldwide crisis and the unfavorable evolution of the current conflicts from Irak, Afganistan in which the forces of the democratic countries participate with a direct result in financial constraints placed upon the military systems, we witness major changes in the military operations characteristics, especially the multinational ones. Despite the difficulties encountered in approaching the features and risks of these operations we have attempted to capture some aspects that are relevant considering all of the aforementioned aspects.

If making international commitments pertains to the political factor, accomplishing them falls to the military leadership. The military decision makers must have at their disposal the necessary forces to be deployed outside the national borders. However, for such missions, a special structure is needed in order to make available some specific capabilities and to meet up area specific expectations or to accomplish each of the mission's goals.

We have concluded that each mission is unique in nature and goals and hence requires a specific structure in this respect. Therefore, the operationalization of a military force is needed for each mission and also a pre deployment stage is required in order to ensure the planning, the endowment, the training, the verification and certification. The military force projected for various missions must have leadership, information and execution structures able to act in accordance with the characteristics of the theatre of operations. Hence, a series of principles, methods, and systemic analysis is needed.

During operations commanders have access to a great amount of information related to enemy, environment and own capabilities awareness. Since information products can stifle the force command an control system special attention must be paid to the selection of the information to reach commandants in order to enable them to make the right decisions. Hence, an operationalized information system is needed to ensure the necessary information in due time. The arguments in favor of such a system ensue from the difficulty of the objectives to be accomplished and from the technical endowment that offers the necessary means to achieve success.

The current military realities have shown a clear transformation of the nature of modern warfare in terms of the integration of information technology and communications and of their usage as a warfare tool. The more and more obvious electronization and digitization of the battle space impose a global interconnection of all information elements, leadership structures involved in multinational operations.

The deployment of operationalized military units in theatres of operations triggers new challenges for the security ans safe usage of the uinformation managed within these. We have outlined the necessity to reconfigure the information system in such a way as to ensure maximum protection of data and data access. In conclusion, in order to ensure a security environment based on an information system of the operationalized units participating in multinational operations without the risk of affecting information, a series of measures and complex procedures concerning various fileds

must be elaborated and implemented. Thus, the confidentiality, availability, integrity of the classified information that is stored, processed or passed on through the information system of the operationalized units can be ensured.

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INFORMATION RESOURCES MANAGEMENT IN NATO

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Abstract: *The beginning of the 21st century has witnessed a special stage in the evolution of mankind given the historical major changes that have occurred and led to an information based society that trespasses any frontiers and gradually dilutes any temporal or spatial constraints. The technological revolution has led in the fields of communications and informatics major shifts that made room for an increase of their importance as a result of the opportunities that had never existed before to collect, refine, store and distribute information.*

Even though information has always been an essential element grounding the military decision making process especially during armed conflicts, the current characteristics of contemporary society turn it into a source of power and, hence, into one of the most important defense resources, as argued in our thesis.

Modern armed forces pay special attention to the aforementioned aspects since one of the main aims is to win the information battle given the extended role of information technology and of communications means in the battlespace.

Management related processes will no longer be possible outside the usage of information technology and they will become more and more integrated with armament systems,eventually leading to the usage of robots and remote controlled vehicles, extensive usage of intelligent ammunition, as well as of information technology based work methodologies and, hence, to the possibility to unfold military actions while also monitoring the enemy's actions. Modern warfare led by various units will require the collection, elaboration and rapid transfer of information from the whole battlespace. Such a requirement involves the existence of a multitude of semiautomatic and armament systems able to compensate for the human being's physiological limits and for the technical performance of the classical equipment , to accomplish an optimal coordination of various forces and armaments under the constraints imposed by a compressed operational time, and to ensure human force preservation so that the latter can be used when special circumstances ask for it or to consolidate success.

We advance the idea that the information resource has become one of the main resource categories of modern warfare and that information technology and modern communications systems ensure the possibility to inform in real time, to influence public opinion, to model political action.

Given the current characteristics of the contemporary security environment which becomes more volatile, uncertain, complex, ambiguous and fluid as a result of the worldwide crisis and the unfavorable evolution of the current conflicts from Irak, Afganistan in which the forces of the

democratic countries participate with a direct result in financial constraints placed upon the military systems, we witness major changes in the military operations characteristics, especially the multinational ones. Despite the difficulties encountered in approaching the features and risks of these operations we have attempted to capture some aspects that are relevant considering all of the aforementioned aspects.

NATO Army forces conduct (plan, prepare, execute, and assess) operations based on the all-source intelligence assessment developed by the intelligence section. The all-source intelligence assessment is expressed as part of the intelligence estimate. *All-source intelligence* also refers to intelligence products and/or organizations and activities that incorporate all sources of information, most frequently including human resources intelligence, imagery intelligence, measurement and signature intelligence, signals intelligence, and open-source data in the production of finished intelligence (JP 2-0). All-source intelligence operations are performed by the intelligence section. They are continuous and occur throughout the operations process and the intelligence process. Most of the products resulting from all-source intelligence are initially developed during planning, and updated as needed throughout preparation and execution based on information gained from continuous assessment.

There is an ever-growing volume of data and information available on the operational environment from numerous sources that commanders can use to improve their situational understanding. Situational understanding enables the commander to better:

- Make decisions to influence the outcome of the operation.
- Prioritize and allocate resources.
- Assess and take risks.
- Understand the needs of the higher and subordinate commanders.

The commander depends on a skilled intelligence officer working to provide sound intelligence preparation of the battlefield (IPB) products; support the intelligence, surveillance, and reconnaissance (ISR) effort; and provide all-source intelligence analysis, including conclusions and projections of future conditions or events needed to accomplish the mission within the commander's intent.

Intelligence results from the collection, processing, integration, evaluation, analysis, and interpretation of available information. This also applies to activities, which result in the product, and to the organizations engaged in such activities.

Using information from all disciplines and available sources, all-source analysts conduct analysis and produce timely, relevant, accurate, predictive, and tailored intelligence that satisfies the commander's requirements. All-source analysis provides an overall picture of the threat, terrain and weather, and civil considerations, as well as other aspects of the area of operations (AO). Thorough and disciplined all-source analysis reduces the possibility of error, bias, and misinformation through the consideration of multiple sources of information and intelligence.

During planning throughout the spectrum of conflict and operational themes, the intelligence staff is responsible for providing well-defined, specific all-source intelligence products and tools. The commander and staff expect and require these throughout planning, regardless of the specific process used:

- Threat characteristics.
- Threat templates and models.
- Threat course of action (COA) statements.
- Event template and event matrix.
- High-value target list (HVTL).
- Weather effects matrix.
- Modified combined obstacle overlay (MCOO) and terrain effects matrix.
- Civil considerations IPB overlays.
- Appropriate civil support products.

The military decisionmaking process (MDMP) combines the conceptual and detailed components of planning. Commanders use it to build plans and orders for extended operations as well as to develop orders for short-term operations within the

framework of a long-range plan. The following discussion is structured around the MDMP steps because most staff members are familiar with them.

The MDMP begins with an analysis of the mission assigned by the higher headquarters. Most intelligence section actions during mission analysis facilitate the commander's situational understanding and contribute to one or more of the following tasks:

- Perform IPB.
- Maintain the intelligence running estimate.
- Update the intelligence estimate.
- Develop the initial ISR plan (in collaboration with the operations section).

Actions required to complete these tasks overlap. Thus, collaboration among intelligence staff members is essential. Additionally, the intelligence section provides intelligence input to other command post cells and elements needed to perform their tasks. Concurrently, intelligence staffs perform parallel and collaborative planning with the higher and lower echelon intelligence staffs. Doing this promotes a common situational awareness among staffs at all echelons.

Generally, the intelligence portion of mission analysis is an evaluation of the following categories of relevant information—threat, terrain and weather, and civil considerations. Additionally, it includes an analysis of the higher headquarters plan or order to determine critical facts and assumptions; specified, implied, and essential tasks; and constraints that affect ISR activities. Intelligence section actions during mission analysis result in the development of an initial ISR plan, the refinement of the commander's situational understanding, and the staff refining staff running estimates based on that same understanding. To avoid misunderstanding and ensure there is a clear and common understanding of what is fact and what is assumption at this point, all-source analysts must tell the commander and staff "what they know and why they know it; what they think and why they think it; what they do not know and what they are doing about it." This promotes critical thinking and generates the staff discussion required to formulate sound COAs for offensive, defensive, stability, and civil support operations.

Mission analysis begins with an analysis of the higher headquarters order. The unit intelligence staff focuses its analysis on determining how the higher headquarters order commander and intelligence staff view the threat. This knowledge helps shape the IPB effort. The higher headquarters order also contains information on that headquarters ISR plan and available ISR assets. This information contributes to ISR synchronization.

The intelligence officer leads the staff through IPB. The other staff sections assist the intelligence section in developing the IPB products required for planning. IPB starts immediately upon receipt of the mission, is refined throughout planning, and continues during preparation and execution based on continuous assessment of operations. The following describes the primary results of IPB that support mission analysis.

- Evaluate Military Aspects of the Terrain;
- Evaluate Weather Conditions and Effects;
- Evaluate Civil Considerations;
- Develop Threat Capabilities;
- Develop Threat Models;
- Identify High-Value Target List;
- Develop an Event Template and Matrix;
- Determine Specified, Implied, and Essential Tasks;

- Review Available Assets;
- Determine Constraints;
- Identify Critical Facts and Assumptions;
- Determine Initial Commander's Critical Information Requirements;
- Determine the Initial ISR Plan;
- Update the Operational Timeline;
- Deliver a Mission Analysis Briefing;
- Derive Input from the Initial Commander's Guidance;
- Issue a Warning Order;

As the threat commander, using the threat situation template as a start-point and the event template and matrix as a guide, the intelligence analyst develops critical threat decision points in relation to friendly COAs, projects threat reactions to friendly actions, and projects threat losses. As the ISR officer, the intelligence analyst—

- Identifies new information requirements.
- Assists the staff in developing PIRs.
- Refines the situation and event templates.
- Develops the ISR overlay and synchronization tools.
- Assists in the development of the high-payoff targets (HPTs) and the DST.

Following an analysis of the COAs, the staff identifies its preferred COA and makes a recommendation to the commander. This usually occurs during a decision briefing presented by the operations officer. During this briefing, the analyst briefs any changes to the current threat situation and any terrain and weather, and civil considerations that have changed since the commander was last briefed.

The staff, led by the operations officer, prepares the order by turning the selected COA into a clear, concise concept of operations and supporting information. The order provides all the information subordinate commands need to conduct their operations. However, this is not the first time subordinate commanders and their intelligence staffs have seen this data. Parallel and collaborative planning involves intelligence analysts at all echelons. They have reviewed each other's intelligence products as they were developed. At this point, they clarify changes and submit requests for additional information and product support. Before issuing the order, the intelligence section conducts an orders crosswalk with the rest of the staff as directed by the operations officer.

INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE OPERATIONS

The ISR process is comprised of a wide variety of intelligence operations: planning and direction; collection, processing and exploitation; analysis and production; dissemination and integration; and evaluation and feedback.

It should focus on the commander's mission and concept of operations. The process is not a linear or even cyclic operation, but rather represents a network of interrelated, simultaneous operations that can, at any given time, be fed by and feed other intelligence operations.

The output of the overall process is actionable intelligence—timely, ccurate, and complete—that supports decision making at all levels of war.

Successful ISR activities depend on timely, relevant, and well-reasoned all-source analysis. Successful ISR activities are not based on advanced technology or intelligence reach. Individually, the Army's array of collection systems, intelligence processors, and network advantages do not ensure the commander's information requirements are satisfied. These are tools that, if used correctly, can enhance a unit's ability to answer questions in a timely manner

1. PLANNING AND DIRECTION

Planning and direction of ISR operations start with the identification of needs for intelligence regarding all aspects of the operational environment.

The President and Secretary of Defense direct JFCs to engage in adaptive planning for the conduct of operations. The JFC should provide the commander's critical

information requirements (CCIRs) to the joint staff and components. CCIRs comprise a comprehensive list of information requirements identified by the commander as being critical to facilitating timely information management and the decision-making process. Intelligence preparation of the operational environment (IPOE) alerts decision makers at all echelons of command to emerging situations and threats

Therefore, preparation of the operational environment is essential to supporting the commander's visualization process, determining (component-level) CCIRs, anticipating critical decision points during operations, and prescribing ROE. IPOE and target development processes identify and assess the adversary's COGs, key capabilities and vulnerabilities, intentions, and potential courses of action (COAs). By identifying known adversary capabilities, IPOE provides the conceptual basis for the JFACC to visualize how the adversary might threaten the command or interfere with mission accomplishment. By identifying specific adversary COAs and COGs, IPOE provides the basis for friendly and adversary COA comparisons, often referred to as wargaming sessions, in which the staff "fights" each friendly and adversary COA. This wargaming process assists intelligence and operations in identifying specific indicators that could confirm or deny a given adversary COA or are otherwise required to support a friendly COA Using knowledge gained via intelligence analysis (IPOE and target development) and the wargaming process, commanders can anticipate when and where action will occur, enabling them to focus on broad friendly, hostile, and neutral force interactions to determine the most effective way to apply Air Force capabilities to achieve desired effects. With this foundation, an optimal ISR strategy designed to sequence ISR operations is derived. ISR strategy is encapsulated in the joint air operations plan (JAOP) and is synchronized with theater and national ISR architectures and strategy. It provides the foundation for development and validation of intelligence requirements, captures the framework for planning and direction of ISR operations, and establishes guidance for the operation of all other elements of the ISR process. Anticipating where and when important events will take place provides a framework in which to orchestrate national, theater, and tactical assets to focus surveillance on specific target elements and guide decisions on how, when, and where to engage adversary forces to achieve the JFC's objectives. Requirements for intelligence to support operations are identified by the commander and the staff. In the course of intelligence planning and direction, intelligence planners identify the intelligence required to answer the CCIRs. Those intelligence requirements deemed most important to mission accomplishment are identified as priority intelligence requirements (PIRs). PIRs are general statements of intelligence need, such as "what is the operational status of the adversary's integrated air defense system?" or "what terrorist groups are active within the area of responsibility/interest (AOR/AOI)?" They provide the framework for prioritization of all ISR operations. PIRs are driven by, and in turn drive, the IPOE process to refine information requirements and support the commander's potential courses of action. The PIRs drive the development of detailed essential elements of information (EEIs).

Over time, as new direction and guidance evolve, ISR planners will develop new requirements or modify existing requirements. Information requirements should e validated before collectors can be tasked to fill the requirement. ISR

requirements are validated by theater collection management authorities embedded in the JFC's staff. Theater collection managers will typically answer the following questions before validating an information requirement: Does the information requirement meet the commander's concept of operations? Has the information already been acquired but not distributed to the requester? Are there other ongoing operations that might satisfy the requirement? If any of these conditions is met, new ISR collection missions may not be necessary. Once validated, an information requirement becomes a collection requirement and the ISR planning process begins. The process for developing and validating ISR collection requirements is essentially the same during peacetime, crisis, and war—only the nature of the requirements and the timeliness in which they should be satisfied varies. Though the process remains the same across the range of military operations, carefully crafted intelligence requirements are essential in an effects-based approach to operations. An effects-based approach to operations (EBAO) is one in which operations are planned, executed, assessed, and adapted to influence or change systems or capabilities in order to achieve desired results. EBAO seeks to understand and exploit the complex connections among individual actions, the effects—direct and indirect—that those actions produce, how those effects influence the states and behaviors of complex systems in the operating environment, and how these effects contribute to the accomplishment of desired outcomes. The process of planning ISR operations begins once requirements have been established, validated, and prioritized. As intelligence collection requirements are aligned with available collection capabilities, the planning process addresses factors such as the availability of ISR assets, platform and sensor capabilities, adversary threats to ISR assets, and timeliness of the ISR response. These factors, when weighed together, affect how ISR assets are tasked and employed. In order to make the planning process more efficient, information requesters should clearly articulate their collection requirements and allow the collection managers and operations planners to decide the best way to meet the requirements.

2. COLLECTION

The collection portion of the intelligence process involves tasking appropriate collection assets or resources to acquire the data and information required to accomplish collection tasking. Collection includes the identification, coordination, and positioning of assets or resources to satisfy intelligence requirements. Collection managers develop collection plans based on the validated intelligence requirements of commanders and decision makers. The collection manager's task is to first verify the requirements have been validated. Once verified, the collection manager:

- Develops and manages a collection plan that integrates requirements with target characteristics.
- Determines the capabilities and limitations of the available organic collection assets and compares them to the collection plan.
- Develops a collection strategy to optimize the effective and efficient use of all available, capable, and suitable collection assets and resources.
- Identifies collection requirements that cannot be met by organic assets and forwards them up the chain of command for validation and tasking of non-organic intelligence resources.
- Directs processing and dissemination of collected data. Collection managers should understand the capabilities and limitations of each discipline and the procedures for ensuring target coverage by the appropriate collection asset and/or resource.

Collection managers keep requesters informed of collection status and capabilities so there are realistic expectations of what can be collected and what level of confidence can be placed in the information. The key to the collection manager's job is selection of the right combination of collection assets for a particular information requirement. Collection managers should focus on a multidisciplinary approach to collection tasking. Collection capabilities complement each other, and the

collection manager should resist favoring or becoming too reliant on a particular sensor, source, system, or technique. Each system's limitations can be mitigated through the capabilities of the others, as different systems provide additional insights into the requirement. While a sensor, source, or system may seem to be an obvious choice to satisfy a requirement, flexibility is the key. Collection managers should match collection resources to the type of adversary activity most likely to be captured by collection operations. Rigid dependence on a single source may result in mission failure, especially if that source becomes unavailable or if the adversary takes measures to counter it. Lack of a multidisciplinary approach may also result in discernible patterns that may play into the adversary's counterintelligence or denial and deception efforts.

3. PROCESSING AND EXPLOITATION

Once the data satisfying the requirements are collected, they undergo processing and exploitation. Through processing and exploitation, the collected raw data are transformed into information that can be readily disseminated, used, transmitted, and exploited by intelligence analysts to produce multidisciplinary intelligence products. Relevant critical information should also be disseminated to the commander and joint force staff to facilitate time-sensitive decision making. Processing and exploitation time varies depending on the characteristics of specific collection assets. For example, some ISR systems accomplish processing and exploitation automatically and nearly simultaneous with collection, while other collection assets, such as HUMINT teams, may require substantially more time. Processing and exploitation requirements are prioritized and synchronized with the commander's PIRs. During processing and exploitation, collected data are correlated and converted into a format suitable for subsequent analysis and production of intelligence. Processing remains distinct from analysis and production in that the resulting information receives only a cursory analysis for time-critical exploitation and has not yet been subjected to full analytical assessment. Relevant time-sensitive information resulting from this step in the process (especially targeting, personnel recovery, or threat warning information) should be immediately disseminated through intelligence broadcasts, secure information workspace or internet relay chat channels, imagery product libraries (IPLs), intelligence databases, or message reporting. Additionally, some information is suitable in its raw form to meet user requirements. For example, joint terminal attack controllers (JTACs) can receive a direct feed via ROVER from a Predator or other full-motion video collection source to provide an invaluable "over the next hill" look to support close air support operations. Raw information should be made available to users with the capability to receive it, the knowledge to understand the information they are receiving, and the authority to take action on it. IPOE provides a disciplined and dynamic framework for processing and exploiting large amounts of data. The knowledge gained as a result of comprehensive IPOE and target development, as well as our capability to anticipate adversary actions, depend on our ability to leverage and fuse all available information. Processing and exploitation architectures should take advantage of network centricity to enable the first part of intelligence fusion—the correlation of multiple source collection into a single, fused report of the operational environment activity. IPOE enables operators and intelligence analysts alike to remain focused on the most critical aspects of the operational environment

and adversary. Incoming information and reports can be rapidly incorporated into critical decision-making processes and provide a convenient medium for displaying the most up-to-date information and for identifying critical information gaps.

4. ANALYSIS AND PRODUCTION

Information is converted into intelligence products through analysis and production, a structured series of actions which, although planned or usually occurring sequentially, may also take place concurrently. These actions include the integration, evaluation, analysis, and interpretation of information in response to known or anticipated intelligence production requirements.

- **Integration.** Information from single or multiple sources is received, collated, and entered into appropriate databases by the analysis and production elements of intelligence community organizations, the theater joint intelligence centers or equivalents, or subordinate joint force elements like the ISR division. Information is integrated and grouped with related pieces of information according to predetermined criteria to facilitate the evaluation of newly received information.
- **Evaluation.** Each new item of information is evaluated by the appropriate analysis and production element with respect to the reliability of the source and the credibility of the information. The reliability of the source and the credibility of the information should be assessed independently of each other to avoid the possibility of one factor evaluation biasing the other.
- **Analysis.** During analysis, deductions are made by comparing integrated and evaluated information with known facts and predetermined assumptions. These deductions are combined and assessed to discern patterns, links or recognized events.
- **Interpretation.** Interpretation is an objective mental process in which the significance of information is judged in relation to the current body of knowledge, covering both adversary and friendly forces, and existing information and intelligence. This mental process involves the identification of new activity and a postulation regarding the significance of that activity.

Taken together, these actions enable intelligence fusion—the synthesis of multiple event reports into an assessment of the nature of ongoing operational environment activity; the extrapolation of all operational environment activity into a predictive assessment of future activities; and the shaping of ongoing ISR operations to refine these assessments. To enable this level of fusion, analysts should work in collaborative environments which provide access to recognized, and often geographically separated, subject matter experts. Through collaboration, intelligence analysts are able to share information, discuss opinions, debate hypotheses, and identify or resolve analytic disagreements. Net-centric connectivity and access greatly enhance an analyst's ability to share, compare, and assess information. Intelligence analysis organizations at all echelons make unique contributions to analysis and production.

Battlespace awareness products provide the foundation for the commander's estimate process as well as a baseline for long-term analysis essential to understanding the multidimensional aspects of the operating environment. The daily demand to support immediate decision-making needs often exceeds existing analytic capabilities, particularly in the forward area. Resources, therefore, should be carefully allocated and made available for the long-term analysis required to sustain operations. The necessary degree of predictive awareness can only be achieved through full participation of our joint, interagency, and multinational/coalition partners in a collaborative environment linking all command echelons and

coordinating different functional nodes (e.g., reachback to analytic centers of excellence). In addition, every level of command should define and document the information it requires to build battlespace awareness, creating a deliberate information flow that is responsive to the commander's requirements.

PRODUCE

The produce step involves combining analyzed information and intelligence from single or multiple sources into intelligence or intelligence products to answer known or anticipated requirements. The intelligence officer integrates evaluated, analyzed, and interpreted information from single or multiple sources and disciplines into finished intelligence products. As with collection operations, the intelligence officer must ensure the unit's information processing and intelligence production are prioritized and synchronized to support answering the CCIRs (PIRs and FFIRs).

Production also involves combining new information and intelligence with existing intelligence to produce intelligence in a form that the commander and staff can apply to the MDMP and supports and helps facilitate situational understanding. During the produce step, the intelligence staff exploits information by

- Analyzing the information to isolate significant elements.
- Evaluating the information to determine accuracy, timeliness, usability, completeness, precision,and reliability.
- Evaluating the information to determine if it is relevant, predictive, and properly tailored.
- Combining the information with other relevant information and previously developedintelligence.
- Analyzing or assessing the information to predict possible outcomes.
- Presenting the information in a format most useful to users.

5. DISSEMINATION AND INTEGRATION

Dissemination of ISR products continues the process by giving the user information required for application in a timely manner. Dissemination may take the form of electronic transmission, hardcopy annotated imagery or maps, direct threat warnings, oral and written reports, or briefings. The dissemination process requires continuous management. Without effective management, communications paths can become saturated by information from single sources being retransmitted by many intermediate collection agencies, resulting in "circular reporting." Advances in technology are also affecting dissemination. Computers and modern communication systems have reduced the information–to–production timeline for delivering ISR products. Likewise, some collection systems are capable of disseminating collected information to requesters on a real- or near real-time basis, vastly increasing their responsiveness. This is especially important for those collection operations supportingongoing military operations in which the situation may be evolving rapidly and perishable information may lose its usefulness within a matter of minutes or seconds. Implementing new "information profiles" technologies and capabilities puts power in the hands of the warfighter to obtain only pertinent information exactly when and where it is needed. Ancillary to the discussion of classified information dissemination is the need to expedite dissemination of declassified information. Commercial technology that enables continuous live media coverage of military

operations may require expedited declassification and public dissemination of intelligence products in order to counter enemy propaganda or support other operational objectives. ISR planning should include local procedures for rapidly coordinating public release of select intelligence. This expanding collection capability makes network centricity all the more important because real-time planning and targeting systems depend on tailored intelligence information. Requesters integrate the intelligence into their decision-making and planning processes, and technical barriers to rapid integration, such as system incompatibility or security barricades, complicate operations. Information superiority requires the timely integration of intelligence with operations in an easily understood format that facilitates decision-making at all levels while at the same time maximizing the amount of relevant information available. In the case of threat warning alerts essential to the preservation of life and/or vital resources, such information should be immediately communicated directly to and acknowledged by those forces, platforms, or personnel identified at risk so the appropriate responsive action can be taken. More generally, the integration of intelligence and operations on a continuous basis allows commanders and all operational planners access to the most current information available, thereby optimizing intelligence support to operation planning, preparation, execution, and assessment functions.

6. EVALUATION AND FEEDBACK

After receiving the ISR products, the user evaluates the products to ensure they satisfy the requirement. The user then provides feedback to ISR planners, collection managers, and analysts to ensure the process continues to satisfy the requirement. It is imperative that intelligence personnel and consumers at all levels honestly evaluate and provide immediate feedback throughout the intelligence process on how well the various intelligence operations perform to meet the commander's intelligence requirements. All operations in the intelligence process are interrelated and should be evaluated to determine the degree to which they facilitate each other and ultimately succeed in meeting the customer's requirements. For example, planning and direction establish the groundwork for all other intelligence operations, but they are also dependent on the results achieved by other operations in the intelligence process. The collection manager evaluates collection reports, ensures the appropriate requesters receive a copy, and determines, in conjunction with the requesters, if the requirements have been satisfied. Requester feedback establishes customer satisfaction and frees collection assets and resources to be redirected to satisfy other active requirements. Processing and exploitation and analysis and production are evaluated based on the degree to which customers are satisfied that the resulting information or intelligence answers their requirements. Intelligence personnel and consumers at all levels evaluate the quality of intelligence products relative to all the attributes of good intelligence. These attributes include the degree to which intelligence anticipates the needs of the commander, and is timely, accurate, usable, complete, relevant, objective, and available. Finally, intelligence and operations personnel jointly evaluate how well intelligence is disseminated and integrated with operations, and make changes as needed to improve the overall intelligence process.

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THE CULTURAL EFFORT OF *INFORMATION SHARING* IN THE *KNOWLEDGE-BASED SOCIETY*

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Abstract: *Knowledge is the most precious power of human society and the fundamental unit of knowledge is information. The knowledge-based society is shaped by information. It develops systems of values consolidating its basis, the information culture. The culture of the knowledge-based society consists of knowledge values accumulated in systems of value giving consistency to this type of society. Information plays an important part both in shaping the architecture of the knowledge systems and marring it. The information-based power is, in fact, knowledge-based power having as main characteristics stability and security. Within the framework of the information age, technology can influence and change the future rapidly. Information sharing is more than technology, being based on the responsibility culture of delivering information. It stands for the information exchange among information collectors, analysts and end users. Its main aim is the national security. The Information Sharing New Model offers a new vision interweaving the Shared Information, the Deeper Knowledge and the Improved Security. The 21st century war is also known as the information war. The new face of the modern war is highlighted under the impact of modern technology without diminishing the role of the human factor as an interface between technology and battlefield. In the context of the information warfare, information security represents the protection of data against unauthorized access and alteration of the information content. The knowledge-based society is founded on the information society. It represents more than the information society due to the major role played by the knowledge-information within society.*

Keywords: *cultural effort, information sharing, knowledge-based society, power, stability, security.*

1. INTRODUCTION

Knowledge is man's most precious capacity as well as the most important power of human society. The basic unit of knowledge is information.

Information stands for the reason to be of the communicative act. There is no information in itself, only information about something, related to something.

It is very important to measure the quantity of information of a certain event. Information is often identified with the novelty brought in the communicative act which supposes an interaction. The receiver stands for the information consumer and the sender is the information generator.

The concern for the study of *intelligence* has never been as significant as in the early 21st century.

The terrorist attacks of 9/11, the media scandals regarding the Gulf War, the military interventions of Afghanistan and Iraq as well as the change of the security paradigms in the

field of national and international security have produced major transformations in approaching *intelligence.*

Information, under all its aspects, is part of the arsenal of the new asymmetric conflicts.

2. INFORMATION CULTURE

The main feature of human society is knowledge. According to Alvin Toffler [11], knowledge is one of the traditional elements of power, besides power and money. Within the framework of this type of society, information represents the essential force as it assures the process of knowledge. This type of society is based on the knowledge culture, that is, on knowledge as process and system of values and on knowledge science, that is, epistemology.

The knowledge-based society is modelled and patterned by information due to the fact that it receives, consumes and generates information, thus developing systems of values and consolidating the information culture.

The fundamental concept of civilization is culture and the basic concept of culture is value. The role of information is very important in shaping the systems of value, of knowledge. Information gives substance to the act of communication. It represents an essential condition of the decision.

3. INFORMATION AND *INTELLIGENCE*

A correct decision can be taken only according to precise and complete information. Information must be interrelated with other data and introduced in an information system. The utility of information is very important in adopting the political line of the decision factors, in conflicts, treaties, in the fight against all the actions targeting at the national security.

Intelligence represents the way to know information, to turn it to good account, to give it value.

According to Herbert E. Mayer, *intelligence* represents the set of operations of collecting, filtering, analyzing the data and disseminating the intelligence products having value and satisfying the needs of a specific consumer [5].

Intelligence aims at operating with information, at assessing the connections and effects of the information process. The *intelligence* product stands for the *summum* of the information activity, which can be found in the philosophy of power. It stands for a strategic product, for the art of operating with information.

According to Stephen Marrin [4], knowledge does not mean power. Knowledge, by itself, lacks power. But power facilitates the ability to change the behaviour of a certain person.

The scientific knowledge of information is the first condition of an information architecture based on effects. The information-based power is, in fact, knowledge-based power being constructive, sustainable and beneficial for knowledge. Stability and security are the main characteristics of the knowledge-based power.

4. COMMUNICATION IN THE FIELD OF *INTELLIGENCE*

The most frequently used forms of communication within the framework of the process of communication among the specialists and researchers in the field of *intelligence* are direct and indirect communication.

Direct communication approaches issues of great interest for the field of *intelligence* from an interpersonal perspective within the framework of certain common activities, such as: conferences, symposia, workshops, research grants, etc. This type of communication has certain advantages. It offers both mutual information as it is consistent including updated information and explicit information regarding the models, norms, values, policies, binding together different specialists and researchers belonging to various institutions having common interests in the field of *intelligence*.

Indirect communication covers the needs of information concerning the research studies without maintaining a real relation with the research environment. It is conducted by

written means, such as: newspaper articles, reports, etc. and by electronic means, such as: television, radio, Internet, videoconferences, etc.

Communication, among the *intelligence* specialists and researchers, aims at developing contacts, elaborating professional standards, encouraging social communication.

5. *INFORMATION SHARING* CULTURE

The present-day threats to security impose reunited formulas of response. Concerning *information sharing*, the relation cause-effect can be summarized as follows: the new threats require that the action of security, through intelligence, should be that of a complex of continuously improving information networks possessing proactive and reactive sources of information, having an accelerated flow and a high level of precision. In keeping with the changing rhythm of present-day threats, it is recommended for us to accelerate these types of actions within the information community.

In the information age in which we live, technology can influence and change the future rapidly. *Information sharing* is more than technology, being based on the responsibility culture of delivering information in *intelligence.*

Within the framework of the US *Intelligence* Community, information sharing can be defined as the act of information exchange among information collectors, analysts and end users in order to strengthen national security.

The promotion of *information sharing* has been increased after the terrorist attacks of 9/11. Thus, the information sharing, as a means of adapting to the contemporary security challenges, has represented one of the main recommendations of the 9/11 Commission turning into the landmark of the American strategy to reshape *intelligence*.

According to Jones Calvert, those who collect information should achieve a synthesized and multidimensional *intelligence* [1].

The role of *information sharing* in the *intelligence* American community can be compared with the role played by the nervous system in a human body.

6. A NEW PERSPECTIVE ON *INFORMATION SHARING*

In 2008, DNI elaborated the *Information Sharing Strategy* [13], the first strategy of information sharing among the intelligence communities, issued in order to strengthen the US national security.

The previously mentioned document highlights the ways of removing the institutional and technical barriers so that the federal government should have the authority to take decisions of vital importance for the national security.

The strategy offers a new perspective on *information sharing* rendering a model of applying this vision. It supposes an interconnection within the framework of the intelligence community between the information exchange, achieving an in-depth knowledge and an improved security by interweaving the *Shared Information,* the *Deeper Knowledge* and the *Improved Security.*

The new model of *information sharing* is completely different from the period prior to the 9/11 attacks and it supposes the adoption of a dominant behaviour in *information sharing* which should characterize the entities involved, being based on the responsibility to offer necessary information. Thus, there is a clear-cut distinction between the *responsibility to provide* and the *need to know*.

The agencies should belong to an extended institutional complex of the *enterprise* type and the information sharing should take place in this large context: between agencies with various partners and along the international borders. Thus, there should be made the distinction between *enterprise-centric* and *agency-centric*.

The cooperation should be a dynamic one, based on a rapid adaptation to the needs, which are continuously changing, taking into account the possibility of including new partners in the process of information sharing.

Security should be shaped within the data bases, that is, *security-in-depth*. The access should be based on attributes beyond the classification levels according to missions, environment or affiliation.

7. REASSESSING THE *INTELLIGENCE CYCLE* PARADIGM

The *intelligence cycle* is one of the few theoretical paradigms concerning *intelligence*. Theoreticians have tried to suggest new formulas corresponding to the changes that have taken place lately. The concept of *intelligence cycle* is one of the few paradigms, which has survived after the end of the Cold War.

The Occidental countries have passed through different stages, from *containment*, through *détente* towards *globalization* whereas the US army has shifted from the active defense to the *Airland Battle* doctrine and the network doctrine.

In the new context, the political and military decision factors need sophisticated *intelligence* products supporting the modern doctrines of fighting the war.

According to Kristan J. Wheaton [12], as long as an information agency does not theorize a new model, adapted to the present-day requirements of fighting the war, it is unlikely to eliminate the old paradigm.

8. INFORMATION WAR AND INFORMATION SECURITY

The 21st century war is also known as the information war. The new face of the modern war is highlighted under the impact of modern technology without diminishing the role of the human factor as an interface between technology and battlefield.

The information technologies are coupled with the energy components of war. The decisive energy actions, the mobility and precision will be interwoven with the information war techniques and methods in an extremely intelligent dynamic configuration.

According to W. Schwartau [10], the information war consists in those actions carried out in order to protect, corrupt, reject or mar information or information resources, which aims at obtaining an advantage, reaching a certain goal or gaining an important victory against the enemy.

Dumitru Oprea [6] considers that both information security and the defensive information war are included in the concept of *information assurance*.

The information wars do not involve only computer networks, but also information under any form as well as the way in which the information is conveyed.

In the context of the information warfare, information security represents the protection of data against unauthorized access and alteration of the information content.

9. CONCLUSIONS

The knowledge-based society is founded on the information society. It represents more than the information society due to the major role played by the knowledge-information within society.

Under the conditions in which the world moves towards the service-oriented system, everything is changing, thus new action areas are generated.

It is estimated that new opportunities will be developed, thus rendering new services which allow a rapid *information sharing*.

The *intelligence* services have been repatterned according to the new characteristics of the information society. They must redefine their objectives, policies and doctrines in order to identify the new threats and the means to fight against them.

The immediate effect of the security paradigm shift at both internal and international level has consisted in transforming the role of *intelligence* in the decisional process, the political action being more and more based on the quantity and quality of the *intelligence* products.

According to Alan Collins, *'from time immemorial, tribes, clans, empires, and nations have collected information about other groups in order to make more informed decisions when dealing with them. This information is called intelligence and its collection may well be the "second oldest profession" in the world. As from the beginning, modern nations believe that the collection, analysis, and use of good intelligence will enhance their security in an anarchic world'* [2].

Since the early 20th century, most global powers have had military and civilian *intelligence* agencies which have operated during peacetime as well as wartime.

According to John Keegan, a well-known British military historian, *intelligence* does not win wars [3], but it uses the courage and skills of certain persons to achieve this thing.

The modern security environment, marked by terrorism, proliferation of mass destruction weapons, drug trafficking, generated against the background of globalization, has imposed more intense intelligence activities as well as concerns regarding the consequences of the intelligence activities.

When the *intelligence* process is conducted appropriately, the *intelligence* services contribute to the national security of each state. When this process does not function normally, national security can be weakened and the *intelligence* activities of the foreign reactions generate a type of sophisticated diplomacy increasing the international tensions.

Future work should be focused on the impact of globalization on security, the influence of culture on *information sharing* as well as the mechanisms of recovery after the recent global crisis.

For a better understanding of the impact of globalization on the states' security, a transvaluation is needed, a repatterning, a redimensioning, a new approach according to which the actors of international relations should adapt the political instruments of the integration of present-day and future relations.

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THE *GREAT DEPRESSION* AND THE CONTEMPORARY GLOBAL ECONOMIC CRISIS. A COMPARATIVE APPROACH

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Abstract: *The present society has had its share of misfortunes of natural, social and ideological nature. However, one of the greatest fears within the human mind in the contemporary world is the economic crisis and this is because the idea of 'money' has gained a spectacular power. Once again we face this danger. Many solutions have been suggested in order to overcome the situation and many have failed. Therefore, there is high time for an in-depth analysis of the real causes regarding this event and this can only be achieved by looking back in time to a quite similar issue, that is the 'Great Depression'. This comparison between the two might offer us not only a greater knowledge and a better understanding of this phenomenon, but also a 'bullet-proof' solution, exactly what the world is searching for at present. Certainly, there are both similarities and dissimilarities between the two, but the thouroughgoing study might offer us new views upon the previously mentioned topic. The economic development in society, before and after the crisis, the steps followed in both cases, the real causes that have led to depression, all these are important aspects which should be taken into consideration when dealing with this comparative analysis. A diachronic approach, history itself might help us to identify the answers we are looking for.*

Keywords: *society, economic crisis, causes, results, historical approach, solutions.*

1. INTRODUCTION

The present society has found itself in a rather difficult situation since 2007 and there still are some countries that are struggling in their attempt to overpass the current state. This danger has a name and it is called the economic crisis.

Many theorists called it the modern crisis, but we have to disagree, because we believe that there are not so many surprises between today's crisis and the *Great Depression* and we will try to demonstrate this point in the present paper.

Certainly, society has a nature that is in a continuous change and there are many factors that could determine an entirely different development of the crisis, but it seems that there are more similarities between the two happenings than there are differences. In our attempt to identify these elements of resemblance, the most important aspects taken into consideration will be their similar nature and development.

2. SIMILAR ELEMENTS

2.1 Origin

At this particular moment, the world needs to be aware of the fact that society itself may very well be the main cause, the origin of this problem, both now as well as in 1929-1933.

It is a well-known fact that society develops in an economic system, the two cannot be separated and they influence each other to the same extent. This idea is important because there were many economists who agreed on the fact that we can certainly name both the modern economic crisis and the *Great Depression* capitalist crises.

Thus, the main fault is that of the economic system. The idea is quite accurate, if we take into consideration the fact that capitalism was found at a starting point in both cases.

While in 1929 capitalism was making its way inside the American economy, being on the verge of changing the entire perspective from which we understood the economic system, thus society was gaining a new dimension, at present capitalism is changing into what we can call now the global version of capitalism.

Therefore, the economic crisis, according to many experts in this domain, appears in such moments, as a natural stage in the implementation of the new concept. Capitalism was not well-viewed upon from the very beginning, being considered as a superficial and problematic system.

But a question still remains: Why did we continue in adopting the capitalist system, if we saw the effects? The answer is rather simple: because we lack an alternative, because no one has identified a stronger view upon economy so far.

According to Krugman [2], this situation will not last forever and certainly, there will appear new ideologies, new dreams; and this will happen soon, rather than later if the current crisis persists and deepens. For the time being, capitalism reigns unchallenged in the world.

2.2. The Global Nature of Both Events

The global aspect of the two crises is the same in effect, but different in cause. Once an economic crisis overpasses the borders of a specific territory, it is more difficult to keep it under control.

Therefore, it is preferred that this kind of problem is taken care of as quickly as possible. The causes are truly distinct. In 1929, we could not talk about global society, the concept of a global economy could not even be imagined, but there was a certain aspect that seemed to lead in this way, that is, *the gold standard.* This is up to a certain point the ancestor of the globalization instruments. The countries that gave it up, recovered from the crisis more rapidly.

On the other hand, America defended the system and endured one of the strongest crises in the economic history. The *gold standard* means that bills in circulation are covered by an amount of gold. The gold would leave the United States of America in case dollars were used outside the country. Because the problem began in America, the amount of dollars used abroad diminished considerably.

The present crisis developed in a different setting, but with the same effect. The danger of this event spread rather quickly because we are dealing now with a global economy, a global society and any wrong decision, taken in America for example, can affect Germany or France or even smaller countries like Romania. This only led to the worsening of the economic situation, transforming a moment of economic downturn into a tragedy.

Indeed, the instruments were definitely not the same, the context in which the two events occurred is not similar.

What is more interesting is that there can certainly be identified here a clear difference between the two. But what is important is the effect, which is identical. From a *'garden crisis',* it turned into a global tragedy.

2.3. Similar Development

According to Hrebenciuc [1], by studying the crises throughout history, we can notice that all of them follow the same pattern, the only significant difference being that almost every time we find a new support or asset on which to overbid.

The *Great Depression* surprised the entire world with its power and tremendous force

and it turned from a common economic downturn to a true tragedy. Society did not learn much from this, because the same happened in 2007 when, even though there were some that had foreseen the crisis, the world was totally surprised by the event. This could be also the cause for the fall of many businesses, which appeared to be doing well.

If in 1929 the problem regarded the uncoated stocks, in 2007 the property frenzy seemed to fit perfectly the role of the speculation bubble. In both cases, we are dealing with a speculation bubble, a quite severe one. After the fall of these markets, the share market as well as the property market, the development of these events seemed to be almost identical, leading to another similarity.

It all began in that well-known historic moment, the *Black Thursday*, on October 29, 1929, when 12 million stocks were put on sale. It is worth to mention that in that period of time, many people in search of a quick gain usually bought these shares with loans secured by a fraction of shares. Therefore, the price dropped considerably.

The banks were strongly affected by this happening, the first impulse of many being serious withdrawals. Actually, the starting point of the entire tragedy was the bankruptcy of important and apparently safe businesses like the General Bank, followed by 'Bercovici' Banks.

From that point on, all the other domains felt a powerful decrease in the level of production. And of course, the domino effect led to unemployment, poverty, despair and eventually social crisis.

Analyzing the year 2007, the 'zero' moment in the current crisis, it can be noticed that the steps seem to be perfectly copied.

There is the speculative bubble, the basic need for a property, which soon managed in becoming a luxury for many, due to the high prices encountered on this market. Even though we are dealing with another type of temptation, there is something of a great importance that is worth to be mentioned. The way in which many properties were purchased was based, just like in 1929, on a loan culture. This means that the person who wanted that particular object did not have the necessary amount of money to acquire it, thus the bank offered a loan. In both cases, when the bubble burst, the banks would suffer the most.

This type of crisis usually takes advantage of one of man's greatest defects, greed. This is why in the end we managed in building certain bubbles and the system that we created helps us in these times, only later to realize the terrible consequences of our actions.

Another aspect worth mentioning once again proves that people never learn from their past mistakes.

Before the crisis in 1929, changes had been made by economists, who speculated the earnings of a loaning company. The conditions for granting a loan were less harsh.

In 1999, through the Graham-Leach-Bliley Act, the same thing happened, thus setting the perfect context for a crisis of such a magnitude to develop properly.

2.3. Solutions

Trying to identify the perfect solution would manage to end the misfortune. This is exactly what happened in the case of the *Great Depression*. Besides the fact that America had a complex program, the *New Deal*, which addressed the problems accurately, there is another aspect that represents the key in this

matter. The Glass-Steagall Act refers to the crisis from a different perspective, that of a banking crisis. Therefore, for the society to recover, the banking system had to be reformed. The two congressmen who sponsored the act tried to fight problems, such as interest rates, combined economic activities realized by the same banking institution and so on.

The Banking Act of 1933 made a huge change in the way in which banking activities were performed. Before this act, America chose the German banking system which allowed a bank to engage in two very different areas of expertise, commercial and investment banking.

The Glass Steagall Act built the reform on this particular change, passing over to the English model, which separated the two, considering the association as being risky and dangerous. It is still considered as one of the most important financial acts, even though the banking community manifested a negative attitude towards it.

Because the banks had access to the deponents' money, they invested considerable sums in the commercial activities, such as: insurance business or shares. In a moment of crisis, people panic and their first reaction is to withdraw their money, but once they are invested, the banks find it difficult to satisfy the demands of their clients. It is now when a financial crisis begins. This danger can be avoided only if a bank chooses its status. It can either deal with deposits or investments.

Because of this reform, the entire financial system recovered from the depression and it is worth to mention that this act enforced the system, keeping the society away from similar dangers.

However, in 1999, through the Gramm-Leach-Bliley Act, sections 16 and 17 were taken out of the Glass Steagall Act, the action being motivated by the fact that this was keeping the American economy from growing and also that many other countries have a combined banking system. The next thing that happened was the present economic crisis.

The connection is relevant because the Obama administration, being in the middle of the disaster, was forced to find a strong remedy, looking back in time. Due to this analysis, a new act was made, which is very similar with the Banking Act of 1933 (The Glass Steagall Act). It is called the Dodd-Frank Law.

According to the Dodd-Frank Wall Street Reform of 2010, '*the failures that led to this crisis require bold action. We must restore responsibility and accountability in our financial system to give Americans confidence that there is a system in place that works for and protects them. We must create a sound foundation to grow the economy and create jobs'* [5].

What the act really does is rather simple. It mainly restores the powers of the two very important sections of the former Glass Steagall Act, 16 and 22, which forbid the association of commercial and investment activities, performed by a single banking institution. It also deals with problems concerning consumer protection, ends the famous *'too big to fail'* bailout and it sets up an advanced warning system.

This idea - *'too big to fail'* - is another aspect that the banking system has inherited from the *Great Depression*. It is actually an attitude towards strong banks, or at least apparently strong, which having serious problems are saved from bankruptcy by the state. This happened in 1929-1933 and in 2008.

It is worth to mention that the Banking Act of 1933 and the Dodd-Frank Law stand as a proof of the resemblance between the two economic scenarios. They represent very accurately the solution to the same problems.

2.4 Other Similarities

Throughout the paper, the major common aspects have been identified, but beside them, there are other smaller points in which we can find the importance of such a comparative analysis. For example, the most obvious one is the geographical setting of this disaster: the United States of America. It is not a coincidence, the American economy is one of the strongest economies in the world, if not even the strongest one, it is one of the largest countries and with the largest population. It is understandable why the effects of this crisis as

well as those of the *Great Depression* could have such a powerful effect.

Also, both crises developed from a financial one to an economic one and managed in producing several social crises, unemployment, poverty being one of the most appropriate contexts of such problems.

It is a known fact after all that an economic crisis is very much connected to a conflict and in this case it can be discussed the importance of World War I, the 1920 America being a postwar country, the Cold War, the multiple terrorist attacks in modern America.

The most important consequence, the economic crisis in general, is a clean rather safe, healthy new economy, because a powerful crisis can easily wipe out any dysfunctional businesses. *The Great Depression* set the first examples much as it could, because the system felt necessary to rescue some banks that were not at all 'healthy', not many. Still, the new economy proved to be safer than before the crisis, as the next similar tragedy came 75 years later. It is much too early to observe the new economy, there are certain signs that point in the same direction. It might be even safer, due to the Dodd-Frank Law perspective.

It is worth to take into consideration the means of propaganda because they can increase a disaster, panic the public and even worsen the actual situation. In the case of the *Great Depression*, these steps were properly followed. The newspapers increased the fear of the population leading them to major withdrawals, bringing banks in bankruptcy.

Nowadays, there are many economists who believe that the current crisis might not even be as strong as we might expect. This could be, in their opinion, the work of different journalists, having clear purposes. In our modern society, there is another instrument used in the manipulation of minds, the Internet, having an incredible speed, information traveling very fast, almost uncontrollably.

3. CONCLUSIONS

According to Hrebenciuc, the evolution of mathematics, physics, chemistry and the social-economic and political studies can create the illusion that man can control all the phenomena existing in nature and society. In reality, this is only an illusion, which might turn into a dangerous one.

Dangers increase at the same pace as society and technology evolves. It is without question that knowledge and the good use of it remains man's priceless power.

The interest for the economic crisis has moved to a larger group, made up not only of economists, but also of common people, who have realized that any negative change inside economy affects us.

Knowledge remains in this sense the most important power that man holds, only with the use of it, we can identify the true problems inside our system and solve them once and for all.

History has given us the raw material, the connections are still to be made. This is why an analysis of the two crises is welcome and even encouraged.

With further investigations in this area, appropriate solutions may be found. It is a proven fact that by searching the nature of a phenomenon, many alternatives to solve it can be found.

The *Great Depression* and the current crisis are still a serious source of information for those who are interested.

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CORRELATION AND EVOLUTION OF ROMANIAN TOURISM

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Abstract: *The purpose of this paper is studying the link between the touristic accommodation capacity and the number of foreign tourists arrivals in romanian tourist structures. Data were analyzed from 1998-2008. There are applied statistical and econometrical methods such as the graphical method, the regression function , the correlation coefficient and the dispersion analysis.*

Keywords: *correlation, regression, touristic accommodation capacity, foreign tourists arrivals*

1. INTRODUCTION

Tourism as an economic and social activity is characterized by flexibility and adaptability to different economic situations, social, environmental. Tourist activities are in a permanent existence, just change its intensity, direction, volume. Tourist activities depend on a number of factors: the level of household income, the tourist infrastructure, comfort, discomfort.

Contemporary tourist activities are a component of the vector quality of life, are a consequence of real savings market. The interdependence of the market economy (Anglo-Saxon, Western European market paternalistic, social market, Nordic-European oriented and dependent on outside) tourist activities in some way are directed. Romania, with over 2,000 years experience in tourism activities is improving its present forms of tourism, tourism infrastructure and adopting a strategy in front of tourist activities, taking into account the experience of advanced scientific elaborations of the major universities and academic.

Romania has universal scope, specific, unique tourism development. Romania can not (and should not) take a model developed and used in other countries. Romania has its own scientific potential and practical strategy to base its own, entirely original, which means to apply also fully specific. Such an orientation can not be explained only by historical experience or originality geography, climate, traditions, customs, arts, culture, etc.

2.ANALYSIS OF THE CORRELATION BETWEEN THE TOURISTIC ACCOMMODATION CAPACITY AND THE NUMBER OF FOREIGN TOURISTS ARRIVALS IN ROMANIAN TOURIST STRUCTURES

The independent variable is the touristic accommodation capacity which is defined as X and the dependent variable is the number of foreign tourists arrivals in Romanian tourists structures denominated as Y

Table no.l: The evolution of the touristic accommodation capacity (x_i) and the number of foreign tourists arrivals in Romanian tourists structures (y_i) between 1998-2008

Year	x_i	y_i
1998	53.16	0.81

1999	51.28	0.80
2000	50.20	0.87
2001	51.88	0.92
2002	50.75	1.00
2003	51.63	1.11
2004	53.99	1.36
2005	54.98	1.43
2006	56.5	1.38
2007	57.14	1.55
2008	59.19	1.47
Total	590.7	12.70

Source: Statistical Yearbook 2009, Tourism

Noting that the data in the table have similar values and almost constant evolution, we can assume in a first stage that the connection between the two variables follow the linear model.
Linear model adjustment equation is:

$$\hat{y}_i = a + b \cdot x_i \; \forall i = \overline{1,n} \; . \qquad (1)$$

The values a and b are determined using the method of least squares, which will result in the normal equations system:

$$\begin{cases} n \cdot a + b \cdot \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} y_i \\ a \cdot \sum_{i=1}^{n} x_i + b \cdot \sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} x_i \cdot y_i \end{cases}$$

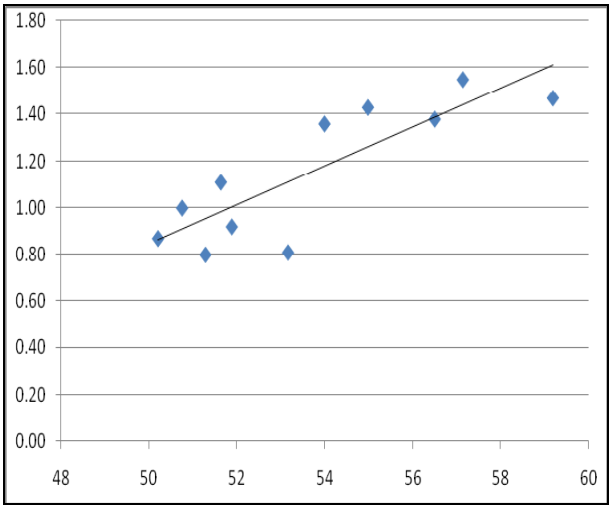

Figure no.1: the graphical representation of the relationship between the touristic accommodation capacity (x_i) and the number of foreign tourists arrivals in Romanian tourists structures (y_i) between 1998-2008

Table no. 2: Data processed to calculate the parameters of the regression function

Year	x_i^2	$x_i \cdot y_i$	$\hat{y}_i$
1998	2825.9856	43.0596	1.108664
1999	2629.6384	41.024	0.952812
2000	2520.04	43.674	0.86328
2001	2691.5344	47.7296	1.002552
2002	2575.5625	50.75	0.908875
2003	2665.6569	57.3093	0.981827
2004	2914.9201	73.4264	1.177471
2005	3022.8004	78.6214	1.259542
2006	3192.25	77.97	1.38555
2007	3264.9796	88.567	1.438606
2008	3503.4561	87.0093	1.608551
Total	31806.824	689.14	12.687730

Using the Excel Data Analysis submenu we obtain the values shown in the table below:

Table no. 3: Summary of indicators values

Correlation Report	R=0.8446
Coefficient of determination	R^2=0.7134
Standard error	S_e=0.1626
The parameters of the regression function	a= -3.2983 b=0.0829

Studying data from the above table it is found that between the two variables there is a direct, strong intensity relationship (R = 0.8446). The coefficient of determination (R2 = 0.7134) indicates that a variable percentage of causal influence on the result is 71.34%, which means that the variation of the touristic accommodation capacity in function affects 71.34% of the variation of the number of foreign tourists arriving in Romanian tourists structures, given that other factors remain

constant. Note that the standard deviation of error is close to zero (Se = 0.1626) which means that most points are placed closer to the regression line.
Next we study the bond strength between the two variables using the coefficient of association and contingency coefficient.

Table no. 4: Association table

Y / X	under 1.15	1.15 and over	Total
under 53.7	6	0	6
53.7 and over	0	5	5
Total	6	5	11

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \Rightarrow \bar{x} = \frac{590.7}{11} = 53.7$$

$$\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n} \Rightarrow \bar{y} = \frac{12.7}{11} = 1.154 \approx 1.15$$

$$Q_a = \frac{6 \cdot 5 - 0 \cdot 0}{6 \cdot 5 + 0 \cdot 0} = 1$$

$$Q_c = \frac{6 \cdot 5 - 0 \cdot 0}{\sqrt{6 \cdot 5 \cdot 6 \cdot 5}} = 1$$

Coefficients of association and contingency show that between the two variables analyzed there is a direct, very strong relationship.
Confirmation of correct choice and use of unifactorial linear regression model is completed only after the following steps:

1) Testing the significance of the linear regression model parameters and establishing the confidence intervals

Table no. 5: Items required for testing parameters of the regression model (data obtained using Excel, Data Analysis menu)

Elements for parameter a	Elements for parameter b
t calculat= -3.50165	t calculat= 4.733796
t theoretic=0.006706	t theoretic= 0.001068
The confidence intervals	
-5.4291<a<-1.1675	0.0432<b<0.1225

Analyzing data from the above table it is found that theoretical values for the two parameters are lower than 0.05 which meant that they are statistically significant at α = 0.05 significance level.

2) Testing the linear model validity using ANOVA method

Table no. 6: ANOVA Table

Regression Variance	$\Delta^2_{Y/X} = 0.592934$
Rezidual Variance	$\Delta^2_e = 0.238139$
Total Variance	$\Delta^2_Y = 0.831073$
Corrected Dispersions	$S^2_{Y/X} = 0.592934$ $S^2_e = 0.02646$
F calculat=22.40883	F theoretic=0.001068

The hypotheses used to verify the validity of the linear model are:
H_0: linear model is not valid
H_1: linear model is valid

Since F theoretic < 0.05 => the H_1 hypothesis is accepted which means that the linear model is valid.

3.CONCLUSIONS

Among the tourist accommodation capacity and the number of foreign tourist arrivals in tourist structures between 1998-2008 it was identified a direct correlation of strong intensity. The link between the two variables is linear, as demonstrated by ANOVA method and testing parameters of the regression model. Thus, knowing the amount of tourist accommodation capacity in operation at a time, one can predict the number of foreign tourists who will arrive in Romania.
In the terms of sustainable development of tourism in our country it is asked to maintain the best ratio between the capacity of accommodation and the number of tourists because the evolution of one in an opposite direction quickly disturbs the evolution of the other. We can speak of the best ratio in the conditions of an offer that includes a capacity of accommodation at a high standard of quality with prices that more social categories can afford and a high number of tourists.

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SWOT ANALYSIS OF A RETAIL COMPANY

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Abstract: *In the transition to the market economy, the approach of environment and the interdependencies between them and the organization is a very important issue in which strategic management has a decisive role. The SWOT Analysis gives a detailed knowledge of the multitude of exogenous and endogenous variables that influence the organization and also provides its efficient functionality in a competitive environment of increasingly fierce.*

Keywords : SWOT Analysis, strategic management, retail company

1.ORGANIZATION'S ENVIRONMENT

At the beginning of the third millennium, it is found that the dominant feature that characterizes the organization's environment is intensifying competition with the effect of customer diversification, increased market demands, increasing costs of research and development and the need for new modes of production approach based on flexibility and productivity. It requires a new approach to development management company if one takes into account some significant changes in the environment:

- Displacement ratio of power from producer to consumer;
- Existence in almost all cases of a higher offer than the demand;
- The existence of an environment characterized by uncertainty and risk and with very little certainty;
- Rapidly changing environment characteristics;
- Increasing competition among manufacturers, along with the emergence of competitive alliance relationships between participants in the production chains that meet specific market segments.

Reduce the negative impact of these mutations, which can maximize the opportunities that occur require a new type of management in which anticipation of the environment and evolution are essential. [1]

In terms of competitive economies, the organization is insufficient to merely identify the needs of consumers. To make progress, it must identify their competitive advantages and disadvantages compared with other organizations, and constantly comparing products, prices, distribution methods and communication with those of competitors. To know their competitors, the organization must answer the following questions: Who are the competitors? What strategies adopted competitors? What are their goals? What are the strengths and weaknesses? Apparently, identifying competitors is easier when it comes closest competitors. But real competition is much bigger. Ignoring potential competitors is a major danger for the organization. It is not easy to predict who could be potential competitors, but in general they could be identified by:

- The organization's major customers or suppliers who may resort to strategies for integrating downstream or upstream;
- Companies that are outside the scope of activity but could overcome the obstacles set input;
- Companies for which an entry in the field of activity will provide a significant synergy effect;
- Companies compete for a job in that field of activity represents an extension of their core strategy . [2]

Taking into account the consequences that result from the entry of new competitors in the sector, existing enterprises should provide the danger that can represent them and take a series of measures to limit access by new competitors such as:

- raising of entry barriers in the sector and the barriers out of the old sector, to discourage potential competitors;
- response measures to the entry of a new competitor in the sector.

2. SWOT ANALYSIS- A TOOL OF STRATEGIC MANAGEMENT

In the modern economy, companies are key strengths of progress, development, are those that ensure your company's survival. Companies are divided in two categories: ones that get considerable success, prosper and grow continuously, and others who fight hard for financial survival or register modest economic performance. To examine the factors that determine success or failure of organizations have developed specific methodologies for analysis and diagnostics company. Strategic management involves the elaboration, implementation and control of the firm's strategy to increase performance and achieve organizational goals.

In essence, the specific of strategic management is the continuous analysis of the external environment on the one hand, to anticipate or timely notify the changes therein and on the other hand, the internal situation analysis to assess the company's ability to successfully cope with change . The method used in this sense is generically called SWOT acronym representing the words:

- Strengths are skills that give the organization competitive advantages compared with similar organizations;
- Weaknesses are weak points that generate competitive disadvantages;
- Opportunities are occasions, situations and are a combination of favorable external elements that cause significant benefits under terms of its particular course of action;
- Threats are hazards, adverse situations and are a combination of the organization's external elements that cause significant damage in terms of keeping their course of action.

SWOT analysis can be carried throughout the company or the shaping of deepening the investigation and analyze more detailed conclusions on the functional areas within the company: marketing, sales and distribution, production, research and development, financial department, personnel department. SWOT analysis has a highly quality nature allowing development of a diagnosis of past and current condition of the Company or its functional areas and outlines the prospects for long-term evolution of the firm and the respective areas.

For an efficient use of SWOT analysis is necessary to know its limitations both theoretical and practical. It is interesting that the last edition of the successful textbook, for example Lynch (2000) or Wheelen and Hunger (2006) highlights the criticism that bring this strategic management tool. SWOT analysis as Lynch's criticism (2000):

- Is not pervasive;
- Contains long lists of factors, but they are not logical;
- Use lists and sequences of factors in order to avoid dangerously their analysis;

According Wheelen and Hunger (2006) SWOT analysis shows disadvantages:

- Contains long lists of factors;
- Does not realize a reflection of priorities;
- Place a factor in two opposite categories;
- Is reduced to a single level of analysis;
- does not make a logical connection with the implementation;
- Uses vague or ambiguous terms.

Going by the critics, SWOT analysis must be set in a socio-economically realistic context. All particular forms of SWOT analysis are based on one of two models: the qualitatively or quantitatively model. The quality model develops lists of items with certain characteristics such as: listing the main internal factors that constitute the forces of the organization, listing the main internal factors that constitute the organization's weaknesses, listing the main external factors that constitute opportunities for the organization, listing the external factors that constitute threats to the organization, generating strategies. Quantitative model is to use a scoring system for internal and external environment factors, which will result from the aggregation of a pair of coordinates that will determine the company's position in a space of possible strategic combinations. [3]

3. SWOT ANALYSIS OF METRO CASH & CARRY COMPANY

Metro Cash & Carry opened its first store in Romania in 1996. In later years it focused on expanding the network reaching a total of 30 centers.

Internal environment analysis involves evaluating of the firms resources, of its potential in order to identify the strengths and weaknesses of it.

The strengths of the organization are:

- the international and national reputation of the concern;
- Price and promotion policy is an advantage that is sustainable with customers shaping now, the practice has contributed to low rates to attract customers;

As weaknesses are highlighted:

- In some cases providers fail to comply with the conditions and terms of delivery of products;
- Company faced with the inability to meet customer demands through the formation of stocks to be produced with lower demand or by lack of stocks with high demand products;
- Greater flow of employees in a short period of time beyond what affects communication and customer satisfaction.

Another step in the SWOT analysis is the study of the external environment.

Opportunities:

- Geographic location of Metro Cash & Carry stores at the exit of the cities, on the main road favors a large commercial gravity and a migration of the demand from both inside and outside the city;
- Populations consumption growth trend of allocating a large part of income on food and non-food products; the company offers customers a wide range of goods which contribute to increased sales and increased customer satisfaction;
- Effective information systems of the organization through the customer database system, payment by card, check or bank transfer, audio / video systems to monitor the activity, the software which oversees stock rotation gives the company efficiency but also meets customer needs.

Threats are external factors, negative for the company, situations or events that may adversely affect their ability to achieve business objectives, leading to lower profits. Among these:

- Incomes of the population have reduced substantially due to economic crisis which manifested by bankruptcy of many companies and increasing unemployment;
- Inflation rate has increased: in 2010 inflation rate was 7.96%, a level almost double that recorded in 2009. VAT increase and last year's rises were the basis for this growth;
- VAT and price increase negatively affects purchasing power, rotation stocks

speed becomes slower leading to the danger of inefficient excess.

SO strategies use organization's forces to take advantage of environmental opportunities. They are aggressive and aimed at creating edge over competitors.

ST strategies use organization's forces to reduce the threat of adverse situations. Threats and risks of a single industry or business are avoided or impacts are mitigated by the diversification strategies. The question is to choose the right direction for diversification.

WO strategies are used to improve the opportunities for internal features or to avoid weaknesses. They are characterized by reorientation and redirection of resources to create a new product requirements of good times.

WT strategies are used to avoid the threat environment in conditions that are prevailing weaknesses. The position is unfavorable and defensive strategy that aims to take the fight for survival and reduce losses. [3]

As most organizations have characteristics that can generate combinations in all four modes, will result in strategies that have created all the categories mentioned above. Resultant strategy will be a combination of more efficiency. Even if there is a preponderance of one of the strategies, along with its characteristics is observed other characteristics of the other families. The organization will adopt strategies that will fit best with elements of internal environment as well as with the external environment.

Among the strategies adopted by the company Metro Cash & Carry are:

- Developing its own brand portfolio (ARO, Fine Food, Sigma);
- Remodeling existing stores;
- Organization of events dedicated to gastronomy industry specialists and small traders;
- Offering customers a wide range of products with the best quality-price ratio;
- Metro continues to expand by opening stores that are smaller than the existing surface, specially designed to support resellers and customers in the gastronomy industry (Metro Punct);
- The possibility of buying goods through preorder;
- Flexible range, adapted to the specific area and potential customers;
- Strengthening customer orientation strategy combined with high productivity and efficient management of costs;
- Significant improvement of logistics processes;
- Developing customer loyalty programs in an efficient business .

4. CONCLUSIONS

Increased mobility of market phenomena, embodied in the specific dynamics of the modern economy and unprecedented, rapid and unpredictable changes in demand for goods, the supply-demand ratio and the price level, companies require full and immediate involvement in the market mechanism. Systematic study of internal and external markets, implementation of specific investigation methods and techniques of the market, to adapt to its requirements and its influence can not be performed without the use of management methods and techniques.

Although the strategy is an important part of strategic management process, strategies will not have the desired effect, if they are not properly implemented. Putting into practice the strategy includes all activities necessary for its operational, tracking progress, that strategic control and, ultimately achieving goals. Alternative strategic choice is made with consideration of all factors that may directly or indirectly influence the future status of the organization. A decisive factor is the initial state of the company's internally defined as a sum of distinct characteristics of their business, and externally as a sum of positions of these businesses in the context of the competitive environment. SWOT analysis can be perceived not only as a static analysis tool, but as a procedural approach to a strategy.

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MODELS OF FOREIGN DIRECT INVESTMENTS. STUDY CASE ON ROMANIA

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Abstract: Economic growth, foreign direct investments and sustainability are basic issues in contemporary economies. Theoretical aspects on sustainability were developed especially after '80's, when debt rate as percent in GDP increases dramatically in developed countries. One question difficult to answer is that foreign direct investments (FDI) must be included in current account deficit sustainability level. FDI is more stable than financial flows due the fact that foreign investors have long term contracts. FDI also increase exports and improves external balance. In transition countries, dynamics of fiscal processes affected consumption, internal and foreign investments and growth.

In this context, there is interesting to study the relationship between foreign direct investment and economic growth in transition countries, especially in Romania. There are different models that analyze relationship between growth and FDI. Lucas' model (2003) shows that it is possible to lose welfare on short term due on unexpected shocks, but on long term we find consumption increased level. Martin and Roger (1997) and Blackburn (1999) models also shows how technological shocks affects growth and FDI.

To analyze the effects of FDI on Romanian growth we use a neoclassical model with Cobb-Douglas production functions. Our basic results show that Romanian economic growth was positively influenced by fiscal policy, FDI and also by adhesion to EU. Using Bohn reaction function we find also that economic growth are positively correlated with public debt level and FDI and negatively correlated with unemployment rate and Romanian political cycles.

Key words: FDI, growth, unemployment, consumption

1. INTRODUCTION

Economic growth, foreign direct investments and sustainability are basic issues in contemporary economies. Theoretical aspects on sustainability were developed especially after '80's, when debt rate as percent in GDP increases dramatically in developed countries.

One question difficult to answer is that foreign direct investments (FDI) must be included in current account deficit sustainability level. FDI is more stable than financial flows due the fact that foreign investors have long term contracts. FDI also increase exports and improves external balance. In transition countries, dynamics of fiscal processes affected consumption, internal and foreign investments and growth.

In this context, it is interesting to study the relationship between foreign direct

investment and economic growth in transition countries, especially in Romania.

Central and Eastern Europe countries are looking for FDI as a critical component to solving capital deficit problem. Consequently, economic research identifies two different types of analysis: studies focused on growth financing capacity and studies focused on global impact of FDI on growth. Various results argued that FDI is a direct result of growth but other studies shows that FDI generate economic growth. It is a reality that countries with extended rates of FDI/ GDP had greater growth rates. Also, resources efficient allocation increase economic growth.

To analyze different advantages and disadvantages of foreign capital and banks on national economies we need to detect transmission channels of there activities on Central and East Europeans economies.

2. CHANNEL EFFICIENCY

Generally, banks efficiency gains at microeconomic level depend on managerial efficiency and on scale efficiency. FDI can increase managerial costs or profit efficiency by transferring banking managing systems from outside to national representatives or by transferring new banking technologies and products. At macroeconomic level, efficiency gains results from risks diversification, reducing transaction costs, efficient allocation and utilizing of financial resources, all this increasing banking system welfare and stability. An efficient banging system exists with a low profit rate depending on interest, so it is possible to intensify investments and increase economic growth. Central and East Europeans financial markets indicates high levels of foreign proprieties (Domanski, 2005) that crucially influence FDI and domestic banking structure. But it is obvious that "foreign" does not reflect necessary a greater efficiency. Bonin (2004) argue that privatized banks by endorsement was less efficient that other banks privatized by another methods. Domestic banks had competitive advantages due on local clients' previous contacts. From economies of scales foreign banks are not more efficient than domestic ones. That depends on modernizing expenses necessary to make viable purchased banks. Cost reduction will be effective only after a shortest or longest period.

Drakos (2003) shows that after Central and East European's institutional reforms start a competition between national and foreign banks. Generally, new investors represent new competitors, so banks acquisitions increase competition by new policies applied by new owners. In national banks can resists to foreign banks competition then domestic market efficiency will be improved (Claessens, 2001). A negative effect of this type of competition is an increased level of financial market concentration. Mamatzakis (2005) shows that an increased countries monopolistic financial market from Central and East European's (in 1998-2002 period) reduce efficiency growth. External shocks had also a negative effect on financial efficiency, especially due on restriction of foreign operations (contagious effect). Eller (2005) shows that privatization and foreign proprieties in Central and East European's Countries improve capital allocation efficiency. If these gains are transmitted to clients by lower prices for products and services then interest rate will decrease and investments will increase. Following Levine (1997) greater financial sector efficiency will reduce transactional costs. If it is possible to quickly obtain reduced cost capital then companies increase development and growth.

Any case, FDI can improve financial market efficiency. Entire financial environment must improve efficiency, so interest rates decrease and national and foreign investments increase.

External financial flows increase especially after 1990's. For examples, in 2003 for CEE's -10 we find a FDI mean level at 19% in GDP.

There exists a paper Mencinger (2003) that shows a negative relationship between growth rate and FDI level for some Central and East Europeans countries. Even his result is incorrect, that shows it is possible to obtain for some periods a not increasing effect of FDI on growth for Central and East Europeans Countries.

3. THE MODEL

We start with a standard neoclassical production function in perfect competition and constant return to scale:

$$Y = AK^{\alpha}H^{\beta}L^{1-\alpha-\beta} \quad (1)$$

where: Y is production level (GDP level), A is a total productivity index (or an index of global productivity), K represent physical capital, H is human capital and L is used labour force, α represent capital elasticity and β represent human capital elasticity. We can rewrite equation (1) by intermediary of labour productivity, $y = Y / L$, capital-labour ratio, $k = K / L$ and human capital-labour ratio, $h = H / L$:

$$y = Ak^{\alpha}h^{\beta} \quad (2)$$

Using a cross intertemporal section and first difference logarithmical equation we found equation (3) (i is country index and t is time index):

$$\Delta \ln(y_{it}) = \Delta \ln(A_{it}) + \alpha \Delta \ln(k_{it}) + \beta \Delta \ln(h_{it}) \quad (3)$$

But how is possible to include FDI in equation (3)? We have three theoretical points of view describing relationship between growth and FDI. First one include FDI in physical capital, K (positively or negatively, depending on flows direction). Second one includes FDI in human capital due on new knowledge added by foreign capital. Third one argues that global productivity, A, is positively influenced by FDI.

We suppose FDI influences global productivity especially, because financial capital does not affect directly physical capital or human capital. We suppose to have an exogenous component, (γ_{A0}) and also a direct influence of FDI:

$$\Delta \ln(A_{it}) = \gamma_{A0} + \gamma_{A1} \Delta \ln(FSFDI_{it}) \quad (4a)$$

$$\Delta \ln(A_{it}) = \gamma^{p}_{A0} + \gamma^{p}_{A1} FSFDI_{it} \quad (4b)$$

Replacing (4a) and (4b) in (3) we obtain two equations than can be tested. Equation (5a) describes FDI's temporal efficiency growth and equation (5b) describes permanent efficiency influence of FDI.

$$\ln(y_{it}) = \gamma_{A0} + \gamma_{A1} \ln(FSFDI_{it}) + \alpha \ln(k_{it}) + \beta \ln(h_{it}) \quad (5a)$$

$$\ln(y_{it}) = \gamma^{p}_{A0} + \gamma^{p}_{A1} FSFDI_{it} + \alpha \ln(k_{it}) + \beta \Delta \ln(h_{it}) \quad (5b)$$

Other instrumental variables that can be used to analyze growth are public sector dimension, inflation rate or trade openness.

Public sector dimension will be estimated by government consumption ratio in GDP (GC). Following Barro and Sala-i–Martin (1995) government consumption are a good proxy to estimate political measures and also direct effects of unproductive public expenses. Other studies show that government consumption had a negative relationship with economic growth. But there are a paper of Bassanini and Scarpetta (2001) showing that tax control and public investment control have a positive effect on growth.

Including inflation as conditional variable depend on Okun's law (that suggests an inverse relationship between growth and unemployment rate, or a direct and positive relationship with inflation). Other authors argue that transition economies are characterized by higher levels of inflation that negative influences growth, especially on restructuring debut. Higher inflation affects long term financial contracts so we obtain a negative relationship between inflation and growth. Khan and Senhadji (2000) and also Wachtel and Rousseau (2002) show that there exist a limit level of inflation that influence relationship growth-financing. As a consequence, empirical studies on finance-growth in transition economies include inflation and FDI flows as control variables

(Mamatzakis, Cottarelli, 2005) (relationship (6a) and (6b) :

$$ln(y_{it}) = \gamma_{A0} + \gamma_{A1} ln(FSFDI_{it}) + \alpha ln(k_{it}) + \\ + \beta ln(h_{it}) + \phi_1 ln(GC_{it}) + \phi_2 \pi_{it} \quad (6a)$$

$$ln(y_{it}) = \gamma^{p}_{A0} + \gamma^{p}_{A1} FSFDI_{it} + \alpha ln(k_{it}) + \\ + \beta ln(h_{it}) + \phi_1 ln(GC_{it}) + \phi_2 \pi_{it} \quad (6b)$$

These relationships represent our model's theoretical base. We expect γ, α, and β to be positive coefficients, ϕ_1 negative and ϕ_2 with ambiguous sign (due on fact that FDI's effects are lagged).

Efficiency and budget constraint

Previous models presents accumulation rate depending on trade goods sector profitability. In our model we consider the relationship between accumulation rate (*I/K*) and saving rate (depending on capital stock, *S/K*) and also on current account deficit.

$$I/K = S/K + TD/K \quad (7)$$

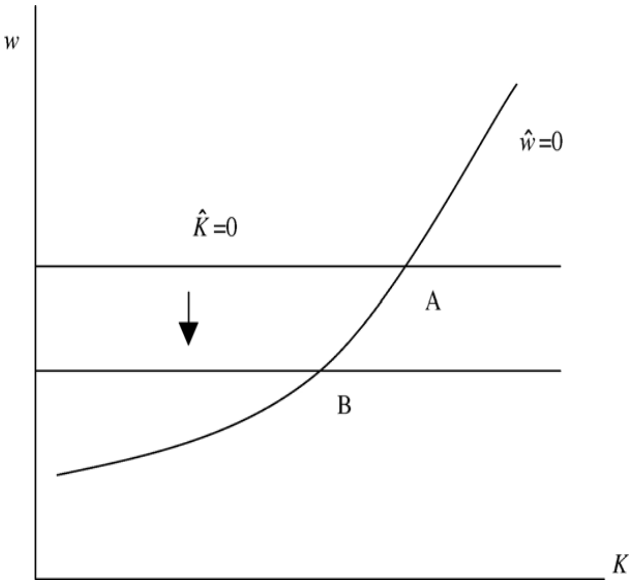

Figure 1. Currency overvaluation and equilibrium line.

A contraction of monetary policy over evaluates currency and equilibrium line goes down, with a reduction of capital stock growth rate. We obtain a reduction of export level and an increasing import level. As results, we obtain an increased trade deficit and a devaluation of exchange rate. Equilibrium line $\hat{K}=0$ goes down and equilibrium level indicates salaries and capital reduction rate (see figure 1).

4. FOREIGN DIRECT INVESTMENTS IN ROMANIA

IMF, WB, OECD or UNCTAD consider *control* and *long term interest* as key word in FDI's evaluation and as source of foreign portfolio investments differentiation. One possible definition of FDI is:

"*FDI represent a long-term investment relationship between a resident entity and a non-resident one; it usually implies a significant degree of influence from the investor on the management of the direct investment enterprise in which he/she invested.*"

Conceptually, foreign direct investment supposes tangible or intangible actives internalization with some restrictions:

- Economic agents are from different national spaces: investor are from origin country and direct investment is made in host country;
- We found a long term interest of investor;
- Investor controls his investment.

There is not a common practice about FDI content. But, almost all authors and international organisms consider FDI flows the following: paid-up capital and the reserves related to a non-resident investor owning at least 10 percent in the subscribed share capital of a resident enterprise, the loans between this investor and the enterprise he/she invested in, as well as the reinvested earnings. So, FDI is not only from transnational companies, there are physical persons, investment founds or firms that are contributing to FDI flows. But transnational companies realize the majority of foreign direct investments especially by international mergers and acquisitions.

FDI's liberalization helps transnational expansion and increase industrial production in whole world. In this case FDI represents a market integration mechanism and also a link between national productive systems.

In Romania, in 2005 FDI's level was at 5213 billions Euros, 51.6% represent social capital investments. There are especially money transfers (99.5%) and a reduced 0.5 % in nature. Also, credit level of foreign investors was at 1670 billions Euros in 2005. In Bucharest - Ilfov region was 60.6% level of total FDI, follow by South-East region (due on Constanta, Galati and Braila harbors).

Industry represents 48.8 % in total investments (in metallurgical industry 77.3% level). Investments in services sector represent 20% in total, 14.5% in Insurance and financial intermediation sector. (see Figure 2.)

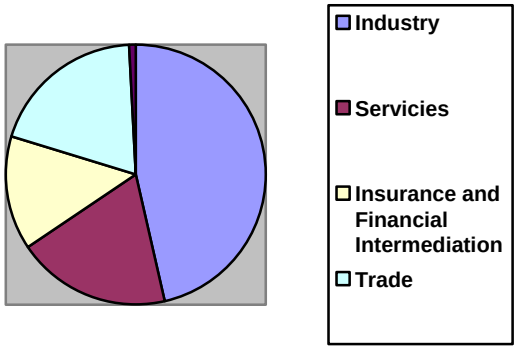

Figure 2. FDI's structure in 2005 year

The statistical survey conducted by the National Bank of Romania and the National Institute of Statistics in 2006 shows an increasing amount of FDI. Net FDI flows amounted to EUR 9,059 million, up 74 percent year on year, of which: equity stakes were worth EUR 4,159 million, accounting for 46 percent of net FDI flows; net reinvested earnings in amount of EUR 2,673 million, making up 30 percent of net flows; net credit received from foreign investors ran at EUR 2,227 million, holding 24 percent of net FDI flow.

The FDI stock at end-2006 reached EUR 34,512 million, up 58 percent year on year, of which: equity stakes in amount of EUR 27,016 million, making up 78 percent of the stock; net credit received from foreign direct investors was EUR 7,496 million, i.e. 22 percent of the stock.

By economic activity (according to NACE Rev. 1), the bulk of FDI went to manufacturing (34.2 percent of total investment), with metallurgy (8.3 percent), food, beverages and tobacco (5.5 percent), oil processing, chemicals, rubber and plastics (4.5 percent), and transport means (4.1 percent) holding significant weights (see figure 3) .

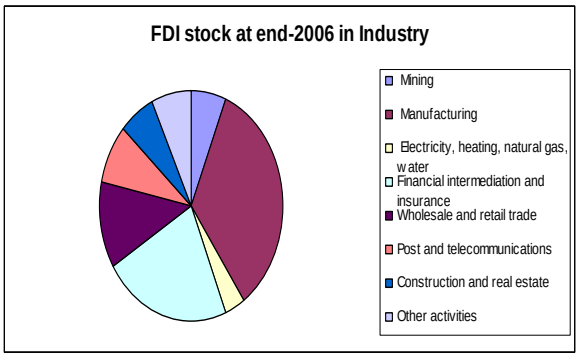

Figure 3.

Significant FDI was channeled into financial intermediation and insurance, banking and insurance included (22.2 percent of total FDI), wholesale and retail trade (12.2 percent), telecommunications (8.2 percent), construction and real estate (6.4 percent), and services rendered to enterprises (4.1 percent).

Tangible and intangible fixed assets, with a stock of EUR 17,174 million at end-2006, accounted for 50 percent of total FDI, thus inducing a considerable degree of foreign investment durability.

Substantial FDI in tangible and intangible fixed assets was recorded in: industry (28.9 percent of total FDI), namely manufacturing (22 percent of total FDI, special mention deserving metallurgy on 5.5 percent of total FDI), wholesale and retail trade (6.4 percent), telecommunications (4.8 percent), which largely overlap the fields benefiting

from most of FDI.

EUR million

	Exports (FOB)		Imports (CIF)	
	Foreign direct investment enterprises	% of total economy/ sector	Foreign direct investment enterprises	% of total economy/ sector
TOTAL, of which:	**18,733.8**	**72.5**	**23,767.9**	**58.6**
Industry, of which:	16,999.9	75.9	15,895.8	76.3
• Manufacturing	15,839.7	75.2	14,914.6	76.3
Wholesale and retail trade	1,437.7	52.8	5,788.8	42.7
Other activities	296.3	41.8	2,083.3	33.8

Table 1. Exports and imports based on FDI enterprises

Turnover of foreign direct investment enterprises totaling EUR 74,309.9 million took 43.2 percent of turnover reported by Romanian enterprises. The activities that were accountable for the highest turnover figures were industry, namely manufacturing (55.4 percent and 59 percent respectively of the sector's turnover), post and telecommunications (77.5 percent), trade (39.9 percent) and services rendered to enterprises (36.9 percent).

The activity of foreign direct investment enterprises as a whole has a favorable impact on Romania's trade balance, its contribution to exports and imports being 72.5 percent and 58.6 percent respectively (see table 1).

The distribution took into account the country of origin of the direct holder of at least 10 percent in the resident foreign direct investment enterprises' share capital on an "immediate country" basis.

The top-five countries in order of their weights in FDI stock as at 31 December 2006 were the following: Austria (23 percent compared with only 15.4 percent a year earlier), the Netherlands (17.1 percent, down from 19.5 percent in 2005), Germany and France (10.1 percent and 8 percent respectively, staying flat on a year earlier), and Greece (7.8 percent, down slightly year on year).

	Mn. Euros	%
TOTAL, of which:	**34,512**	**100.0**
Austria	7,942	23.0
The Netherlands	5,887	17.1
Germany	3,473	10.1
France	2,766	8.0
Greece	2,680	7.8
Switzerland	2,372	6.9
Italy	2,322	6.7
Cyprus	1,674	4.8
Hungary	663	1.9
United States of America	628	1.8
Other	4,105	11.9

Table 2. FDI's distribution took into account origin country

From a territorial perspective, FDI went mainly to Bucharest-Ilfov region (64.3 percent); other development regions receiving significant FDI inflows were the SOUTH-EAST region (7.7 percent), the CENTRE region (7.4 percent), the SOUTH region and the WEST region (on 6.5 percent and 5.6 percent respectively).

In 2008, FDI growth up to 92,2% at the end of April, at 3.21 bilions Euros. Current account deficit from the first trimester was covered 66.5 % from FDI flow.

5. FDI AND ROMANIAN ECONOMIC GROWTH

Mathematical model starts with a neoclassical Cobb-Douglas production function:

$$Y = AK^{\alpha}H^{\beta}L^{\delta} \qquad (1)$$

Where: Y is production level (GDP level), A is a total productivity index (or an index of global productivity), K represent physical capital, H is human capital and L is used labour force, α represent capital elasticity, β represent human capital elasticity and δ represent labour elasticity.

Data set covers the period 1990-2009 and the values are comparable, being expressed in 1990 prices.

Physical capital (K) is represented by tangible fixed assets, human capital (H) is represented by Romanian population, labour force (L) is represented by average number of employees, FSFDI is foreign direct investments, GC is government consumption and Y is GDP level.

Estimating production function (using E-views program) we obtain:

$$Y = 32.02 \cdot K^{-9.199} \cdot H^{0.114} \cdot L^{1.111}$$

So, labor and human capital contribution to GDP dynamics are positives ones, but unexpected, capital contribution is negative. This result is based especially on reevaluation of physical capital in analyzed period. We can observe also the most important influence on GDP evolution is labor contribution, with 1.11 %.

Second estimated relationship is:

$$ln(y_{it}) = \gamma_{A0} + \gamma_{A1} ln(FSFDI_{it}) + \\ + \alpha ln(k_{it}) + \beta ln(h_{it})$$

Estimated equation is:

$$ln(y_{it}) = 6.69 + 0.082 \cdot ln(FSFDI_{it}) + \\ + 0.131 \cdot ln(k_{it}) - 1.004 \cdot ln(h_{it})$$

Analyzing results we can observe that FDI and labour endowment are positively correlated with GDP evolution, but human capital/labour ratio is negatively correlated with GDP evolution. This result depends especially on Romanian population reduction in analyzed period.

Third estimated relationship is:

$$ln(y_{it}) = \gamma_{A0} + \gamma_{A1} ln(FSFDI_{it}) + \\ + \alpha ln(k_{it}) + \beta ln(h_{it}) + \phi_1 ln(GC_{it})$$

Estimated equation is:

$$ln(y_{it}) = 2.425 + 0.078 \cdot ln(FSFDI_{it}) + \\ + 0.0477 \cdot ln(k_{it}) + 0.2004 ln(h_{it}) + 0.7168 \cdot ln(GC_{it})$$

In this equation all factors are positively correlated with GDP evolution. Government consumption had a positive influence on GDP growth with 0.716 percent, the greater influence on all factors. Unexpected, FDI's influence on GDP is small, with only 0.078%.

All equation are significant, t-tests are relevant with a 95% probability.

Prognosis

Using previous equations we conduct a three-scenario prognosis to evaluate future GDP evolution. The three scenarios are an optimistic one, a pessimistic one and a medium evolution scenario. Main hypothesis regarding our scenarios are described in table 3.

In optimistic scenario we suppose that population follow trend line in last 20 years and decline by 1%, physical capital rise with 15%, labour rise with 6%, FDI rise with 10% and government consumption rise with 5 % every year.

Scenario	Variables (growth ratio)				
	Human Capital (H) %	Phisical Capital (K) %	Labour (L) %	FDI %	Government consumption (GC) %
Optimistic	- 1	15	6	10	5
Medium	-1	4	1	5	2
Pessimistic	-.5	2	-2	-1	-1

Table 3. Variable values from prognosis horizon

In medium scenario we suppose that also population follow decline by 1%, physical capital rise with 4%, labour rise with 1%, FDI rise with 5% and government consumption rise with 2 % every year. In pessimistic scenario we suppose that population decline by .5%, physical capital rise with only 2%, labour decline with 2%, FDI decline with 1% and government consumption decline with 1 % every year.

GDP evolutions for three analyzed models are depicted in Table 4.

We can observe that all three models offer practically same evolution of GDP.

Year	Model 1			Model 2			Model 3		
	OS	MS	PS	OS	MS	PS	OS	MS	PS
2011	8,75	5,8	1,33	7,12	2,29	0,29	8,12	4,51	0,80
2012	10,9	5,28	2,57	7,55	3,88	0,40	8,75	4,71	0,61
2013	8,80	4,80	3,79	6,98	4,16	0,79	7,96	4,78	1,11
2014	8,71	4,66	1,56	7,87	3,83	0,34	8,62	4,33	0,37
2015	8,57	5,95	2,33	8,27	4,47	-0,18	8,02	4,17	0,77

Legend: OS = Optimistic Scenario, MS = Medium Scenario, PS = Pessimistic Scenario

Table 4. GDP dynamics in 2008-2012 periods (percent)

In optimistic scenarios we can observe GDP mean growth rates between 8 and 10%, with a peak in 2009 and practically stabilized levels in 2010-2012 periods.

Mean scenarios shows GDP mean growth rates at 4.5 percent, with variations between 2.29% and 5.8%.

In pessimistic scenario GDP growth is a disappointing one, with only a 1.12% mean rate, but it is possible to obtain even decreasing levels of GDP.

5. CONCLUSIONS

Foreign direct investments are a dynamic source of GDP growth in emerging countries and an important source of financial support.

Most countries developed faster and better based on cash-flows and direct foreign investments, but also due on new technologies, restructuring national sectors and increased productivity and efficiency. FDI can constitute at this moment a possible way to develop emerging countries and to reduce differences between developing countries and developed ones. Capital flows are influenced not only by country risk, but also from global and international factors. Actual financial international crisis have a negative influence on global economy. We expect to find a reduction of foreign direct investments in any country and any possible way to invest.

Our models suggest importance of labor, capital and FDI flows for Romanian economy. Our scenarios shows that it is possible, due on bad national and international conditions, to reduce GDP growth rate to a disappointing 1% level after 9 years of development. If political and economical decisions will be appropriate ones, then it will be possible to obtain for next 5 years a 4.5 % GDP rate increase.

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PROACTIVE MANAGEMENT AND INTERNAL AUDIT PROCEDURES IN AIRPORTS USING BI SOLUTIONS

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Abstract: *The paper presents the benefits of implementing a BI system in an airport, on the management and internal audit levels. Airport BI solutions include business performance management and internal audit tools, as well as aeronautical statistics and business planning, simulation and budgeting, and imply a good understanding of the airport environment, operations and documents flow, security standard application, reporting requirements, internal control and audit procedures. The deployment of BI integrated solutions create a proactive management, being involved in the business decision making processes and by embedding internal audit modules, they are bringing greater transparency and efficiency for continuous assurance, risk assessment and management.*

Keywords: *airport BI, internal audit, pro-active management, ERP, AODB*

1. INTRODUCTION

The availability of reliable information anytime and anywhere is one of the major requirements in airport operations today. Numerous parties - internal departments as well as partner companies, humans as well as devices - depend on exact real-time information to perform their tasks in the integrated airport business processes. The main objective of a BI solution is the assurance of availability and integrity of operational data and of controlled access to the right information for all concerned parties.
Due to the dynamic nature of air traffic, continuous increase of the air traffic volume, and therefore data, the growing number of business partners requiring identical information in a timely manner, and the fact that airports need to use limited resources more efficiently, a high degree of flexibility and overall business requirement coverage within a single solution are important features for any airport IT systems.

2. PROACTIVE MANAGEMENT

Being proactive in management is a must in businesses where changes are frequent and is always a challenge to increase or maintain market share. A performant management involves constant study of the market place in order to adjust to trends before they occur helping meet customer demands before they're fully materialized. Implementing proactive management means

changing protocol, updating marketing materials, updating the storefront or adding services or products prior to customer asking.

A proactive airport management requires an ongoing expense for research in the form of customer surveys, data mining, and general market research as well as any expense associated with implementing the change.

The managerial revolution is connected both with the change of management and with the management of change. Change of management refers to identifying methods and techniques to organize the sharing, exchange and use of knowledge (Takahashi and Vandenbrink, 2004). This implies management through learning, emphasis on processes, excellence and not relative quality, networking and interdependence, transparency, and promotion of discomfort that leads to creativity (Moss Kanter, 2006). Management of change, as Moss Kanter (2006: 14) states, may be put into practice on three levels: (1) change projects, which are meant to solve a particular problem or need; (2) change programs, which are interdependent projects meant to strongly influence the organization; and (3) change (learning) organizations, which create the capacity for innovation and continuous improvement, through the desire of change. In such organizations, learning, innovation, collaboration and change are the main drivers of their activity.

Knowledge is the fundamental source of competitive advantage within the knowledge-based society and the core driver for innovations in service organizations. It is brought about by the transformation of information, by making sense of data. Thus, information becomes really important for both service organizations' managers and their clients, as it allows them to make relevant, coherent and fast decisions. Furthermore, the speed of information exchange, the accessibility of information, the search possibilities and storage of information are significant factors that contribute to a rational decision-making process. However, information overload may fail to influence the decision-making process in a positive way, due to the abundance of irrelevant details. Therefore, it is important to carefully and effectively manage information by taking into account perceptions of the value of information (Dubosson and Fragniere, 2008). If the information is perceived as being valuable we may assume that the response to that information will be prompt. This will result in an amplified innovation capacity, flexibility and adaptability to market requests. The periods of time needed for innovation and dissemination of innovation have become increasingly condensed due to the speed of knowledge, products and technology renewal and due to the contemporary instantaneous connection possibilities to new information.

Development of information and communication technologies has created the premises for better collaboration and communication between service organizations, on one hand, and between them and their clients, on the other hand. It has facilitated the delivery of global services and thus, service providers perform in a global environment, confronting new opportunities for profit while facing world-class competitors (Cunningham et al., 2004: 421).

Information and communication technologies can offer the degree of flexibility and adaptability of services to the clients' needs. Moreover, if effectively integrated in the service process, new technologies could actively support the development of strategies related to innovation, collaboration and value co-creation, playing a key role in providing competitive services (Zamfir, 2010).

3. PROACTIVE INTERNAL AUDIT

Progress of every company decisively depends on the efficiency of use of her own human, natural and financial resources. Internal controls are put in place to keep the company on course toward profitability goals and achievement of its mission, and to minimize surprises along the way.

Obtainment of a growing profit may be guaranteed by reduction of incertitude and risk assumed in the economic activity. If incertitude should not exist all elements that

lead to profit achievement would be known, the economic companies will have the certitude that incomes are higher than expenses. This will lead to an increase in offer in comparison with the demand thus assuring an equilibrium between incomes and costs, making the profit null.

In reality the incertitude generates profits and risk existence and they do not become null due to competition. As in a world without incertitude profits and losses would not exist, we may consider that profit or loss are a consequence of incertitude.

Internal auditors play an important role in evaluating the effectiveness of control systems, and contribute to ongoing effectiveness. Because of organizational position and authority in an entity, an internal audit function often plays a significant monitoring role.

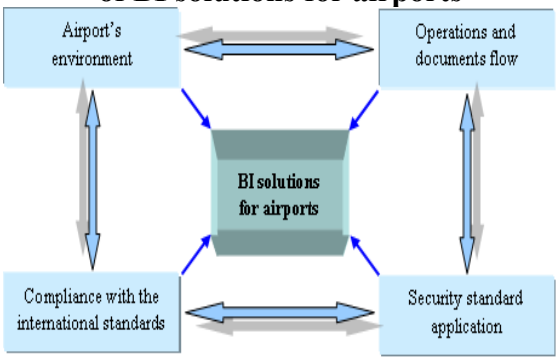
A proactive internal audit programme will be focused on corporate and business unit goals, strategies and risk management processes, will identify risk areas and continuously monitor the company's risk profile.

Internal auditors do not just audit control activities, they also monitor a company's risk profile and play a key role in identifying areas to improve risk management processes. How the company manages the business risk from all the changes required by the proactive management is critical to success.

4. BI IN AIRPORTS. CASE STUDY SKY-BASE BY SAP® ERP

A powerful BI solution will include business performance management and internal audit tools, as well as aeronautical statistics and business planning, simulation and budgeting. Setting up the technical specifications for development of a BI solution for airports, implies a good understanding of the airport environment, operations and documents flow, security standard application, reporting requirements in assuring compliance with the international standards for generating real-time information, internal control and audit procedures (figure 1). Most software developers divided that technical information in operational and management information, generating specific software solutions.

Figure 1 **Factors affecting the development of BI solutions for airports**



The operational system is referring to the airport operational database (AODB). The ***Airport Operational Database (AODB)***, is a central information source which can be shared among many applications and be distributed to other users.

The operations managed by AODB refers to: Communication, Navigation and Surveillance (CNS), Collaborative Decision Making (CDM), Digital Audio and Radar Recording and Playback Systems, Aeronautical Information System (AIS/AFTN), UHF/VHF Communications, Voice Communication systems, Integrated Display Systems, Display Server & Graphics Visualization, High Bright LCD Displays, ATC Services, Training and Simulation Systems.

The Airport Operational DataBase (AODB) is a determinant factor for the business success of an airport, providing accurate real-time information to all customers and business partners, particularly in the aircraft traffic sector.

The management system is reffering to the airport business processes and data and is represented by the ***Enterprise Resource Planning systems (ERP)***. ERP systems integrate internal and external management information, facilitating horizontal and vertical integration of business processes across an organization via a synchronized suite of software applications (Hunton et al., 2004).

Depending on the integration level between operational (AODB) and management system (ERP), there are two main strategies in building BI solutions for airports.

An integrated solution allows uploading flight data from an AODB and making the data available for pricing, invoicing, audit and reporting. It is vital that the software solution can offer flexible functions for the modeling quantitative variables of the airport operations and management (charges for landing, passenger, luggage, parking, infrastructure, movements, passengers, destinations, flight data, ground handling agreements) and processes. The main software solutions available offer statistics application module reporting results, capabilities, traffic variables, and historical events, both for internal and external official users, in real-time and on a detailed level.

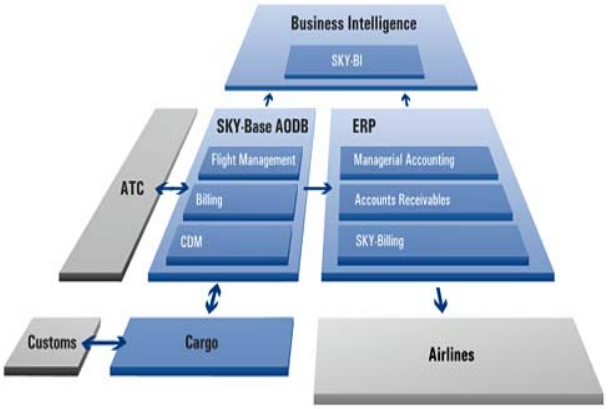
The embedded ERP module include tools for financial processes, billing, financial and managerial accounting (cost center, profit center, product costing for airport services and ground handling and profitability and ratio analysis), and internal audit.

The internal audit IT solutions goals are bringing greater transparency for continuous assurance and performance and their success is dependent upon the effective use of technology tools. The solutions achieve their goals by 1) monitoring a system's global configuration settings, access controls, and rules that define the parameters of how an event or transaction can be initiated, processed, and recorded, 2) creating rules and tests run against the actual flow of transactions, identifying exceptions, anomalous patterns and trends, or other outliers that represent risk or are contrary to expected measures of performance such as key performance indicators (KPIs), and 3) providing historical or emerging trends evaluation within risk and performance areas, allowing management to increase business performance (Sabau et al., 2011).

The software solution presented in this study is SKY-Base by SAP® ERP ("Powered by SAP NetWeaver").

The SKY-Base system, using the SAP® standard functions and based on an Oracle database, is developed on two different applications AODB and ERP, offered separately and also as an integrated solution (figure 2). The integrated solution is currently and successfully used by Copenhagen Airports A/S (a multi-airport operator managing Copenhagen and Roskilde airports), Stuttgart and Baden airports.

Figure 2 **Airport BI ecosystem**



(*Source*: ISO Software Systeme GmbH, n.d.)

It allows operational, management, statistical, audit, and controlling tools in the real-time distribution and reception of all relevant information to and from external systems. The particularity of the integrated suite of modules is the **SKY-Connect module**, used for exchanging information with other software systems in and around the airport. The module supports virtually 100 interfaces to 3rd party systems of the airport operators, to external business partners or to public information platforms and can be individually

customized for an airport to the local requirements. The **SKY-Connect** may interface with **SITA-Server** (sending, receiving and processing of standardized IATA message formats via SITATEX), with various Flight Information Display Systems **- FIDS** (offering up-to-date information for passengers and airport staff), Resource Management System – **RMS**, Airspace Monitoring System – **AMS**, Extended Airline System Environment – **EASE**, **XML4aero** (supporting electronic billing and setting standards for the electronic exchange of business data between airports and airlines) (ISO Software Systeme GmbH, n.d.).

Many providers consider that implementing various modules of different software will not increase quality and efficiency of the operations and management, but only will multiply interface issues.

5. CONCLUSIONS & ACKNOWLEDGMENT

The deployment of BI integrated solutions creates a proactive management allowing to easily forecast and evaluate different scenarios (best case / worst case / most probable case), and increasing performance. By offering a suite of tools for planning and budgeting airport charges and revenues using historical data (seasonal flight schedules and anticipated seat load factors), BI solutions are also involved in the business decision making processes

Progressing from various, complex and separately IT systems to a fully integrated suite of business applications supported by a single database is already providing numerous benefits both for the airport employees, and for the customers, being considered „the key to supporting business growth successfully" (Šebánek, 2008).

Implementation of an integrated BI solution in an airport will save time and reduce operational costs, maintain excellent levels of customer service, streamline information flows and enhance efficiency, productivity, and competitiveness.

Correlating the organization's needs, goals and strategies with a matching comprehensive suite of IT tools is the key for implementing proactive management and internal audit procedures, for achieving business performance and protecting the organization's exposure to liability and litigation.

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AN ECONOMETRIC APPROACH OF ACTUAL FINANCIAL CRISIS[1]

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Abstract: *The paper is structured on 4 levels: the first level presents the actual financial crisis: nature, genesis, global context, chronolog.y. The second level presents the role of the Basel II Agreement in the stimulation of the risk management along the financial crisis. The Basel II Agreement has obliged banks and other authorized financial institutions to communicate at the beginning of each day the daily estimated risk to the nearest monetary authority using one or more models of Value at Risk. The third level emphasizes risk management at the level of the banking system. The model shows the most adverse expected loss for a certain time horizon, a certain level of confidence and various methods used to calculate the Value at Risk. The fourth level is dedicated to the prominence of the prudential regulations at macroeconomic level – actions to come out of the actual financial crisis.*

Keywords: *crisis, financial market, econometric analysis, Basel II Agreement, Value at Risk.*

1. Actual financial crisis: nature, genesis, global context, chronology

The actual economic crisis was generated, as it is widely known, by the downfall of the American mortgage industry, which started in the summer of 2007.

At the beginning of the fall of 2008 the crisis passed through a new phase of acceleration and development. The successive downfalls like a domino of the stock markets and the serious problems of the banking system remember the year of 1929.

Among the causes that have generated the American crisis, are mentioned:

- the U.S. economy had the experience of a reduced interest rate;
- an inflow of capital from the exterior, especially from the Asian countries, but also because the U.S. Federal Reserve had a relaxed policy regarding the interest rate.

The Asian countries had bought American assets both to diminish their own exchange rates, but also to protect themselves against a depreciation of their currency in comparison to the dollar, a lesson learned along with the Asian crisis at the end of the 90's. On this background, the U.S. households saving's rate diminished almost near zero. Moreover, most of the consumption growth in U.S. was financed from the current account deficit. It can be spoken also about a funding liquidity, an indicator that can describe the ease with which investors could obtain funds.

Consequently, the credit expansion, recorded mostly in U.S. and Great Britain, was the result of the structural modification of the expected revenue redistribution, an expression of neo-liberal capitalism.

Such it has been recorded a reduction of the salaries, emphasizing a deflation generated by salaries, while corporation profits reached levels that have never been seen, than before the Great Depression in 1929.

While the average salary had risen significantly until 2006, the median salary had not recorded improvements, but reductions in certain American states.

If credit expansion had not existed, this would have lead inevitably to economic stagnation, with demand restriction. Mistake or not the credit expansion has been preferred especially in the mortgage sector.

The financial turmoil of 2007 and 2008 was generated by the growth of defaults on subprime mortgages, loans made to borrowers with weak credit histories. The severity of the crisis is demonstrated by unprecedented interventions of Federal Reserve and other governmental institutions on financial markets during this period.

1.1.The hosing and mortgage markets – main causes of the actual financial crisis

For several years through 2005, the U.S. housing market has experienced a significant boom, through the increase in the volume of home constructions, sales and prices.[1].

The factors that fuelled this boom:

- a low level of interest rates;
- some buyers apparently thought that home prices would continue to grow and bought houses hoping to increase their wealth via speculative buying and selling;
- a surge in subprime mortgages[2].

Rapidly rising house prices encouraged many borrowers to refinance their mortgages quickly, leading to an increase in their equities, improving credit worthiness and allowing them to borrow on better terms. As a sequel

- until the middle of the period, house prices reached high levels, making the housing market less attractive;
- Federal Reserve began to raise short-term interest rates in 2004, leading to an increase in mortgage rates;
- the volume of the sales of homes started to decline and the number of unsold houses rose sharply relative to sales;
- house prices decelerated sharply in 2006 and started to decline;
- with house prices decelerating, borrowers with a high loan – to – value ratio could not refinance anymore their credits;
- delinquency rates on subprime adjustable rate mortgages rose sharply in 2006;
- by early 2008, more than a quarter of the loans were at least 90 days delinquent or in foreclosure;
- delinquency rates for the "Alt-A" adjustable rate mortgages[3] began to rise sharply in 2007.

Over the past 70 years, the mortgage market has changed radically from one in which local depository institutions make loans to one that is centred in the major Wall Street banks and securities firms, which employ the latest financial engineering to repackage mortgages into securities through credit derivatives and collateralized debt obligations[4].

The symptoms of the crisis have manifested also in Romania through:

- the exacerbated growth of house prices and lands;
- the exaggerated encouragement of consumption credit.

All these aspects and others, lead to the growth of the number of creditors and also of those that can not pay the outstanding rates.

Regarding the Romanian exchange market, it can be appreciated that it fell in 2008 in the number and volume of the transactions. Related to this aspect it has been recorded also a downfall of the price of the listed assets. It can be mentioned that during approximately one year home prices fell with almost 20 percent for hoses recently constructed and with almost 30-40 percent for the old ones.

---

[1] Krohn G.A., Gruver W.R., *The Complexities of the Fianancial Turmoil of 2007 and 2008*, October 2008.

[2] a benefic result of the housing boom was that by the year of 2005 the home ownership rate had reached the highest level of all times of 69 percent.

[3] "Alt-A" mortgages are a mix of prime, almost-prime and subprime mortgages.

[4] Dodd R., *Subprime: Tentacles of a Crisis*, Finance&Development, December 2007.

We believe that in present time, regarding the actual financial world crisis, in Romania the psychological and not the real manifestation factors are dominating. We also believe that the real financial crisis in Romania will be triggered after the presidential elections in autumn, when it is expected that the Romanian state will not sustain anymore the banking system with the help of the policy of the National Romanian Bank (see the measures adopted in the first part of the year 2009 in this direction: the reduction of mandatory deposits of the National Romanian Bank etc).

1.2.The chronology of the actual crisis

The chronology of the genesis and evolution of the actual financial crisis has developed into a global pattern (see **Figure 1**).

The low economic growth in the euro area is due to:

- a rigid monetary policy imposed by the Central European Bank;
- the zero-inflation target imposed, also, by the Central European Bank;
- the overcapitalization of euro in connection to the dollar has costed only the French economy almost 0,6 -1 percent of the Gross Domestic Product;
- Germany is adopting the neo-mercantilist model, and a characteristic in this period is that most factories that produce subassemblies are moved in the countries that are recently members of the European Union (see the factory for mobile devices that has moved in 2008 in Romania);

The Central European Bank, through its policy, has extended the turmoil on the international monetary market, contributing thus fully in the development of the actual monetary and financial crisis.

The actual financial crisis has affected the real world through a series of channels like: the downfall of the credits has lead to the downfall of the prices both for speculative assets and for real ones; the mechanism used to extract housing assets lead to a significant reduction of consumption.

So it is imperious to adopt a new global monetary order, in order to strengthen both the monetary and financial systems based on new principles characterized by stability, dynamic flexibility and adaptability.

Regarding the role of the Central European Bank, its status should be completely redefined, following financial stability, inflation reduction, the work force problem, the security of the work places etc.

Since in the last 6 to 9 months the Central European Bank has been "bombed" with numerous toxic assets (those with an overvalued price), the governments in the euro area have the task to support the process of recapitalization in the next period at the level of the Central European Bank.

2. The Role of the Basel II Agreement in the stimulation of the risk management along the financial crisis

The Basel II Agreement has forced banks and other authorized financial institutions to communicate at the beginning of each day the daily estimated risk to the next most nearby monetary authority using one or more models of Value at Risk (VaR) measurement.

The Basel Agreement determines the following:

- The Value at Risk (VaR) in the day t is given by

$$VaR_t = \hat{Q}_t - \alpha_t \cdot \hat{\sigma}_t$$

- The daily capital modification (ΔK) is given by

$$\Delta K_t = \max\{-VaR_{t-1}; -(3+k)\overline{VaR_{60}}\}$$

where:

VaR_{t-1} - Value at Risk in day *t*;

$\hat{Q}_t$ - the estimated revenue in day *t*;

α_t - the critical value of a percent of the estimated revenue in day *t*;

$\hat{\sigma}_t$ - the estimated risk (the square root of the volatility) in day *t*;

ΔK_t - the capital modification in day *t* in comparison to day *t*-1;

k - the penalty value of the Basel II Agreement breaching, with $k \in [0,1]$.

So, the daily capital modification must be determined at the highest level of the Value at Risk (VaR) from the previous day or at the average VaR of the last 60 days, multiplied with the penalty factor of 3+*k*.

3. The management of the banking system

On the basis of the data given by The Bank[5], we will consider a portfolio with two foreign currencies, the American dollar and the euro. We assume that the currencies are not correlated. Also, the considered portfolio is formed by several types of credits:

- Credits given to juridical persons and local public authorities;
- Credits given to physical persons:
- hosing and mortgage credits;
- credits for car procurement.

The Romanian banking system formed and consolidated after the 90's, the effective legislation and the macroeconomic context have fostered strategic options for the global profile. Bank involvement in the financing of a restructuring economy, effects felt in the hyperinflation, budget and commercial deficits, currency devaluation, consumption of goods and services contraction, has determined a standing tightening of the business climate and the aggravation of the risks involved in current activities.

The large number of new banks has contributed to the increase and development of banking services and also to the improvement of their quality in a climate of sustained competition, making banks to adopt a careful policy of risk quantification in order to obtain acceptable revenues.

Among the banking services offered, the lending activity has experienced a rapid growth.

The lending activity organization represents a complex process, so in order to perform it banks have to mobilize monetary resources temporarily available and spread them according to their credit policies.

As the lending activity implicates risk assumption by the Bank it is necessary to pay a special attention in the lending activity to the analysis of the client worthiness, and also to the general evaluation of the lending risk.

The model studied in this paper is Value at Risk, and it shows the most adverse expected loss for a certain time horizon, a certain level of confidence and various methods used to calculate the Value at Risk.

The essence of the VaR model consists in the prediction of the biggest expected loss for a given portfolio. Also, the Value at Risk instruments, like the marginal VaR analyzed and calculated in the application, are very important for the management of the lending risk. The marginal VaR can be very useful in the portfolio diversification and also in the reduction of the risk met.

4. The prudential regulation at macroeconomic level. Actions to come out of the actual financial crisis

The Basel II Regulation is based on the most comfortable measure of risk, namely the Value at Risk (VaR) which emphasizes only the individual bank risk.

A measure of risk which focuses on the contribution of a financial institution at systemic level is CoVaR[6].

CoVaR at the level of an institution is defined like VaR at the level of the financial

[5] so the bank analyzed it will be generically called The Bank.

[6] Brunnermeier M.K., *Financial Crises: Mechanisms, Prevention, and Management*, http://fmg.lse.ac.uk/upload_file/1197_BrunnermeierPaper.pdf

sector, depending on the in-going of the institution in the process of improving the situation. The percentage difference between VaR and CoVaR emphasizes the degree in which a private institution contributes to the risk of the financial system.

The greater the contribution of a financial institution to the risk of the financial system is, the greater the capital demand, Pigovian[7] taxation or the mandatory insurance prime should be.

Among the actions that can be adopted to come out of the actual financial crisis, can be numbered:

- the liquidity regulation of the financial system;
- non-cycle measures;
- the coverage with swaps;
- state acquisition of the debts at market price;
- nationalization and prompt corrective action;
- partial nationalization and the injection of public funds;
- the guarantee of a minimum price for assets;
- state acquisition of toxic assets;
- home price adjustment through the mortgage subsidizes – besides the introduction of the refinancing schemes to minimize the number of lost homes, the government can try to reduce mortgage rates and thus increase home prices. This can be done with the support of the Central European Bank directly buying long-term mortgage goods or accepting them as collateral for uncertain loans;
- crisis management – needs a certain form of recapitalization or restructuring of the banking sector through the government. The recapitalization of a limited sector like the banking sector can be done on the expense of the (i) debtors and/or (ii) tax payers.

[7] this grows along with the CoVaR growth at bank level and along with other measures of systemic risk.

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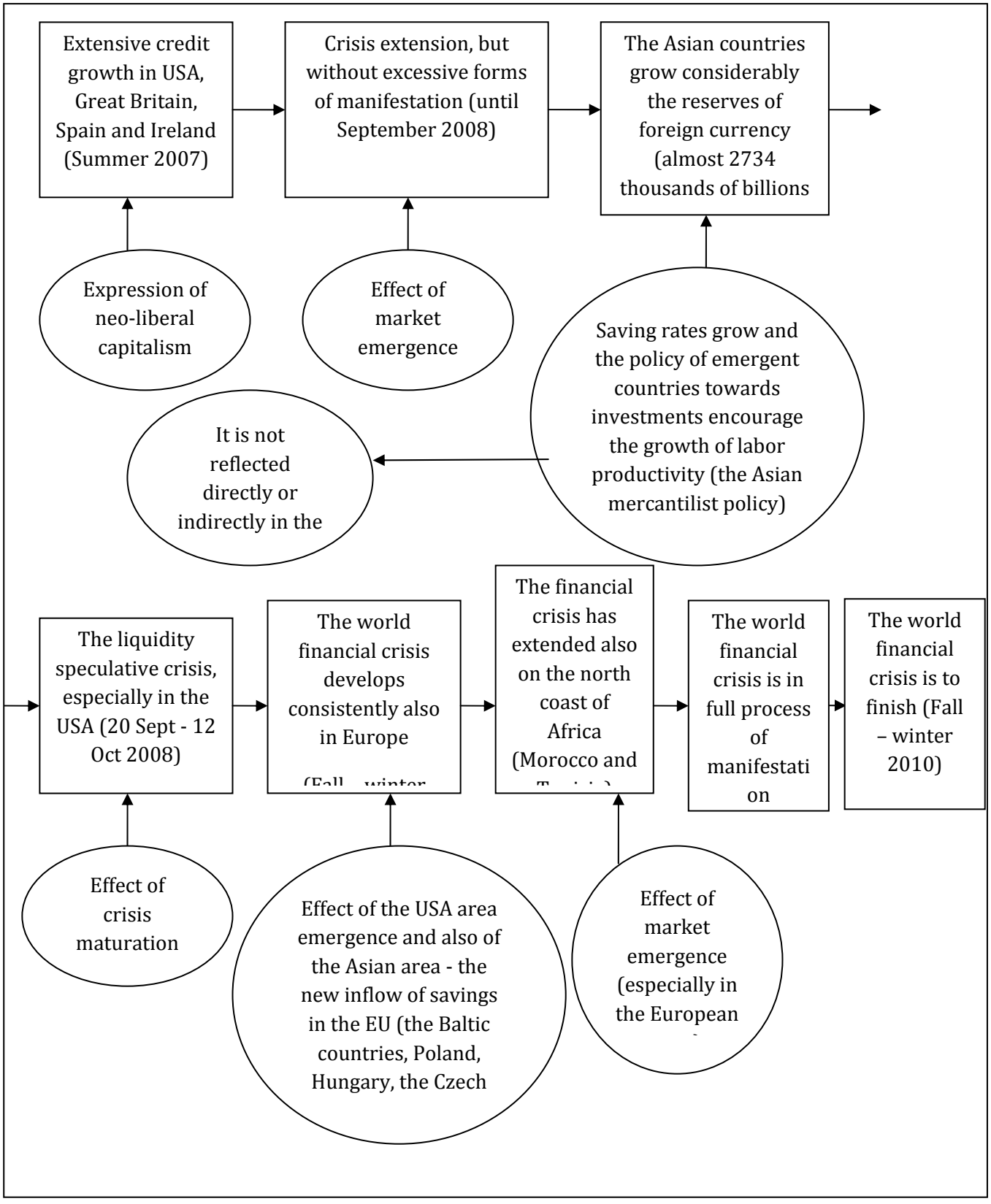
Figure 1



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RISK AND UNCERTAINTY IN THE CHOICE OF AN OPTIMAL PORTFOLIO ON THE ROMANIAN CAPITAL MARKET[1]

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Abstract: *The financial system represents one of the most important components of a country's economy, with a well defined function in the capital resources mobilization from those who own them (the investors) towards those who need them (the beneficiaries - public or private entities).*

The modern financial theory has formalized a complex objective – the optimization of the correlation between return and risk – in order to determine the portfolio's strategy (which weight of the total available amount should be invested in each asset).

Value at Risk (VaR) is considered to be one of the most important measures of market risk and it has been widely used for financial management by institutions including banks, regulators and portfolio managers.

In the Markowitz model it is suggested that the process of portfolio selection should be approached from the angle of the probable estimations of the future returns of the bonds. The analysis of these estimations in order to determine a set of efficient portfolios and the selections made from this set of portfolios which correspond to the investor's preferences represent the value of his theory. The Sharpe model starts from the Markowitz theory with the intention to simplify the method of bond selection in the portfolio.

Through the comparison of the achieved results from the application of these two models on a national portfolio constituted from three stocks quoted on the Bucharest Stock Exchange Market, it can be concluded that the model developed by Markowitz leads to the best results, optimizing the financial placing decision from the angle of the efficiency criteria return-risk.

Moreover it is also taken into consideration the correlation between these aspects and the area intensely linked with them represented by e-business.

Key words: *portfolio, financial bonds, optimality, VaR , return, risk, model testing, Markowitz, Sharpe, market indexes*

[1] Această lucrare este rezultat al Proiectelor de Cercetare PN2 - 32-143/2008 şi 82-094/2008, Coordonator Proiecte - Universitatea Ştefan cel Mare Suceava, Partener în proiecte Academia de Studii Economice Bucureşti.

1. Introduction

Modern portfolio theory relies on the study developed by Markowitz (1952). Rubinstein (2002) appreciated that Markowitz's research represents the first mathematical formalization of the diversification concept of investments, emphasizing the fact that even though diversification reduces risk, it can not eliminate it completely. So, through diversification risk can be reduced without having any effects on the portfolio expected return. Thus, investing in different classes of financial securities and in different industrial sectors enables investors to improve the performance of their portfolios (Aloui, 2010)

The financial system represents one of the most important components of a country's economy, with a well defined function in the capital resources mobilization from those who own them (the investors) towards those who need them (the beneficiaries - public or private entities). The risk and return criterions represent the foundation of the financial investments made by asset owners, the well known portfolio management models being the ones that establish the principles of the investment behavior.

Due to the fact in the last years there has been noticed a growing inclination to adopt financial trading automated systems, the context of this paper sets out to present an electronic trading model, as well as other aspects linked with the modern portfolio model analysis. The modern portfolio theory is based on two categories of models: normative models and positivists models. The normative model category includes the basic modern portfolio theory models: the Markowitz Model and the Single Index Model of William Sharpe. Despite their apparent perfection, these models have continuously been reformulated, new hypotheses being added, or the ones that have been rejected by the market corrected.

The conclusions of this paper highlight the essence of the issues approached, being pointed out that the models approached and tested in this paper are efficient and viable on the Romanian Capital Market.

2. Value at Risk (*VaR*)

Value at Risk (*VaR*) is considered to be one of the most important measures of market risk and it has been widely used for financial management by institutions including banks, regulators and portfolio managers. Since the risk management group J.P. Morgan developed the RiskMetrics model for *VaR* measurement in 1994, this model has become a benchmark for measuring market risk (So,Yu, 2006). A crucial factor for the accuracy of the *VaR* estimates relies on the underlying measure of volatility (Moosa, Bollen, 2002). Therefore, the problem that arises in the estimated *VaR* is finding a suitable performance measure that has the capacity to evaluate the performance of the estimates correctly.

The Basel Committee on Banking Supervision (1996) at the Bank for International Settlements imposed banks and other authorized financial institutions to communicate at the beginning of each day the daily estimated risk to the closest monetary authority using one or more models of Value at Risk (*VaR*) . These models have become a very popular tool for measuring the market risk of a portfolio of financial assets. By definition *VaR* represents an estimate of the maximum potential loss in the value of a portfolio of financial assets with a given probability over a certain time horizon, or, in other words, it represents the decline in the market value of an asset or a portfolio of financial assets that can be expected within a given time horizon with a given probability. In order to define the concept of *VaR* of a portfolio of securities, we must first define the daily returns of the portfolio (Moosa, Bollen, 2002):

$$r_t = \ln(p_t) - \ln(p_{t-1}) \qquad (1)$$

where r_t represents the continuously compounded return of the portfolio at time t, p_t represents the price of the portfolio at time t.So:

$$r_t = \ln\left(\frac{p_t}{p_{t-1}}\right) \qquad (2)$$

$$e^{r_t} = \frac{p_t}{p_{t-1}} \quad (3)$$

$$p_t = p_{t-1} e^{r_t} \quad (4)$$

Let r_t^c be the critical portfolio return such that the observed return on day t is less than or equal to the critical level with a given probability. Thus, for a probability of 1% we have:

$$P(r_t \le r_t^c) = 0.01 \quad (5)$$

The critical portfolio value p_t^c that corresponds to a probability of 1% implies the fact that the observed return on day t will be less than or equal to r_t^c and it can be obtained by combining equations (4) and (5). Therefore:

$$p_t^c = p_{t-1} e^{r_t^c} \quad (6)$$

For a portfolio whose market price is p_t, the VaR represents the loss in the value of the portfolio with a 1% probability. Thus:

$$VaR_t = p_t - p_t^c$$

By combining equations (5) and (6) we obtain:

$$VaR_t = p_t - p_{t-1} e^{r_t^c} \quad (7)$$

We know that $e^x \approx 1 + x$, when x is very small, so equation (7) can be written as:

$$VaR_t \approx p_t - p_{t-1}(1 + r_t^c) \quad (8)$$

An important hypothesis of the VaR model is the fact that the portfolio returns are normally distributed, therefore the critical return for a 1% probability will be:

$$r_t^c = -2.326\sigma_t \quad (9)$$

So the value at risk can be calculated as:

$$VaR_t = p_t - p_{t-1}(1 - 2.326\sigma_t) \quad (10)$$

where σ_t represents the volatility of the portfolio on trading day t.[2]

[2] The volatility of the portfolio can be measured using the variance of the portfolio or the portfolio standard deviation.

3. Optimal portfolio selection models on the Romanian Capital Market

3.1. Financial electronic trading model

Suppose there are M agents, N financial risky assets and a market that works like a double-auction automated system. Agents, trading to reach their own target portfolio, enter the market sequentially. At each time step k within a trading day t is randomly extracted, with replacement, one agent to enter the market.

The agent will enter the market, and he will post his orders, if P is greater than a random number drawn from a uniform distribution over the [0,1] interval. The probability P is an increasing function of the total imbalance between the target and the current portfolio.

The activation function P reflects the urgency of trading for the candidate agent. Agents will be more impatient to trade the more distant their current wealth allocation will be from their target portfolio. Correspondingly, the filtering device P will make the effective probability of entering the market dependent on portfolio's imbalance.

When a trader enters the market he faces an exchange book with orders to buy and to sell. Agents will be able to trade immediately at the current quotes placing market orders, or submit limit orders that will be stored in the exchange book and that will be executed if matching orders will arrive before the end of the trading day.

At each moment in time during the day, the exchange book, divided in a buy side and a sell side, shows all the orders that have been issued up to that time and that have not found a matching order. For each order, the order size, the limit price, and the posting time are reported.

The limit price is the maximum price that an agent is willing to pay to purchase the registered quantity in the case of a buy order, and the minimum price that an agent is willing to accept to sell the submitted quantity in the case of a sell order. At the end of the trading day all orders will be canceled.

Agents will trade on this market to rebalance their portfolio. That is, at each moment in time they will trade to adjust their portfolio according to their optimal target allocation.

3.2. The Harry Markowitz Model

Markowitz's paper "Portfolio Selection" published in 1952 is considered to be the beginning of a new type of research and analysis in the investment field. In this paper investors were presumed to have risk aversion, meaning that they preferred to take the smallest risk possible for a given level of expected return. Moreover, an investor that held a bond portfolio was not so preoccupied with the bond's risk, but for the risk of the portfolio itself. According to this quantification of the risk, the construction of risk-return based models was possible and their goal was to give the potential investor the optimal portfolio bond choice and guarantee him the biggest return according to his willingness to take risks.

In order to determine the risk-return outline the investor had to design the minimum variance curve of all the placement possibilities at a given expected return rate. Being given the expected return, standard deviation and covariance for all the risky bond combinations the minimum variance portfolio was obtained.

Testing the Markowitz Model on the Romanian Capital Market

Starting from the fundamental hypotheses of the Markowitz Model we have made an attempt to determine the minimum variance portfolio on the Romanian Capital Market, using two stocks from the financial investment sector: SIF Banat-Crisana S.A.(SIF1) and SIF Oltenia S.A.(SIF5) and one stock from the pharmaceutical sector Zentiva S.A.(SCD).

With these stocks we have computed a data base that contains the closing prices of the transactions made in the following period: 01/05/2001-10/20/2008 (1790 observations). This data base leaded to the calculation of the daily bond returns with the formula:

$$R_i = \frac{p_{t+1}}{p_t} - 1$$

(dividends were not taken into consideration).

These historical series conducted to the calculation of the daily expected average returns (like a mean of the daily values), variance and standard deviation.

In order to determine the minimum variance portfolio we have started with the following bond weights in the portfolio: 33% SIF1, 33% SIF5 and 34% SCD with the purpose to minimize the portfolio standard deviation, this type of scenario being characteristic for the investors that have a strong risk aversion.

Using the "Microsoft Excel Solver" we have optimized the financial results taking into consideration the following restrictions: an asset portfolio is considered to be efficient if it offers the smallest risk for a given expected return, the sum of the bond weights has to be equal to 1 and short selling is not allowed, meaning that all bond weights have to be ≥ 0 .

Thus, we have obtained the portfolio with the absolute minimum variance of 0.11% which gives the bond combination that offers the smallest risk of 3.32% for an expected return of 0.08%. We have concluded that the following bond weights in the portfolio are optimal: 27.66% SIF1, 35.28% SIF5 and 37.06% SCD.

3.3. The Single Index Model (Sharpe)

In 1963, William Sharpe has tried to bring changes to the fundamental portfolio selection model. These changes implicated not only the reduction of the information level needed to set up the portfolio selection model, but also supplemental information regarding diversification as a method to reduce risk.

Sharpe included the market fluctuations in the return and risk of each bond calculations, considering a linear dependency between the bond return and the market index return.

So, this model measures the "surprise" return correlated with the "surprise" market index return and the expected gain under the materialization of the firm specific risks, which can be eliminated through diversification. An important implication is that the need to estimate a huge number of covariances is eliminated.

Testing the Single Index Model on the Romanian Capital Market

The development of this model has had as a starting point the previous stocks in order to ensure data comparability. We have considered the mean market return given by the evolution of the BET index as the macroeconomic factor of the model.

With the help of "Eviews" we have estimated with the Ordinary Least Squares Method the regression equations for each bond with the purpose to determine the volatility coefficient. The results obtained lead to the following observations:

- There is a significant linear dependency between the stocks quoted on the Bucharest Stock Exchange Market and the market return because the slopes of the regression lines are > *0*, and the stocks are little volatile because their volatility coefficients have values < *1*;
- According to the values of the determination report: *58.57% of the variance of the SIF1 return, 57.87% of the variance of the SIF5 return and 45.08 of the variance of the SCD return* is explained by the movements in the market return;
- For a 5% significance level according to the *Fisher-Snedecor Test* from Eviews we have tested if the three regression models are correctly specified. According to the test's probability (<*5%*) the models are correctly specified and their coefficients differ significantly from 0;
- The *Durbin-Watson Statistic* computed for the regression models that there is no first order autocorrelation present.

We have calculated the systematic and non-systematic risk of the portfolio. The market linked risk (systematic risk) refers to factors such as inflation, recession or interest rates, which affect al businesses alike and their effects can not be eliminated. The company risk (non-systematic risk) is caused by the success or failure of the marketing programs, the win or loss of major contracts, and other events that take place in a company. Due to the fact that these events have a random nature they can be eliminated through diversification. The results computed for these two indicators lead to the conclusion that the non-systematic risk is the one that has greater significance in the total portfolio risk so it can be eliminated in case the diversification decision is taken.

In order to determine the minimum variance portfolio we started from the scenario used for the Markowitz Model. The portfolio optimization was done again with the help of "Microsoft Excel Solver" being taken into consideration one additional restriction in comparison to the previous model: the portfolio volatility coefficient equals the multiplication between the portfolio bond weights and their volatility coefficient.

We computed the minimum variance portfolio of 0.94% which gives the bond combination that offers the smallest risk of 9.68% for a given return of 0.09%. Thus the optimal bond combination is: 33.08% SIF1, 32.91% SIF5 and 34.02% SCD.

4. Conclusions

On the speed century's background when people show great interest for technological development, information, e-resources and their efficient usage, the optimization of the financial decisions represents a priority.

This paper sets out to "walk through" the modern methods of portfolio construction on the Romanian Capital Market describing in the beginning a financial electronic trading model that gives investors with limited resources the possibility to interact without having them resort to financial intermediaries.

The next step in our paper was to test the two normative portfolio management models that are believed to be the core of today's financial theory.

Through the comparison of the results obtained we have concluded that the model Markowitz developed lead to the best results, optimizing the financial placement decision from the risk-return efficiency criterion point of view.

Thus, the minimum variance portfolio is the one given by the Markowitz model: 27.66% SIF1, 35.28% SIF5 and 37.06% SCD with a variance of 0.11%, 3.32% risk and 0.08% expected return.

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MONETARY POLICY AND INFLATION CONTROL

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Abstract: *- One of the main goals of state intervention is to maintain price stability. There is no doubt that active use of monetary policy instruments (exchange rates, money supply, interest rate) has a significant effect on inflation. The most important monetary instrument for stopping inflation is money supply and its control. Therefore, interventions to increase liquidity in the economic circuit must be made with great caution. In this context, in this study we sought to achieve the most important problems related to inflation rate that exists in Romania.*

Key-Words*: - inflation rate, monetary policy, money supply, inflation control, stability price, policy instrument.*

1. INTRODUCTION

When starting the process of transition to market economy, the Romanian economy was characterized by strong imbalances, both in structural terms, but in the main macroeconomic variables, representing the main destabilizing factor in the application that generated inflation transforming moment-right - structural inflation, cyclical. Given that all other economic levers were practically impossible to use monetary policy has proved to be only able to give the stabilization measures.

Under these conditions, the National Bank's monetary policy was oriented towards ensuring price stability. It should be borne in mind that gradual liberalization has reduced the time transition costs, but long-term effects were felt acutely in maintaining the purchasing power of currency. Lack of confidence in national currency reduced the demand for currency.

This reduction was accompanied by an increase in money supply, banks are interested in providing a lot of credit for the economy, according to the event "the illusion of cheap money." Lack of efficient management of resources of banks (rather scarce at the moment of starting the reform process) led, non-existence amid the interbank market, at the request of the system of refinancing resources to cover overdrafts. Thus, through these mechanisms, the National Bank has fueled the economy with excess liquidity quantity, highlighting, in fact, the transition from a restrictive to an expansionary monetary policy and vice versa, the overall situation in the first row of poor coordination between monetary policy and the rest components of macroeconomic stabilization policy. What was supposed to make money in the plan was to

restore confidence in its own currency, given that the economy is in transition, most often confronted with a strong dollarization.

Although it was considered as core stabilization policy should be represented by monetary policy, its effectiveness was influenced (obviously in the negative sense) the factors that were subject to the monetary authorities.

Experiences gained in terms of macroeconomic stabilization policy in the event of a powerful phenomenon inflationary conditions, shows that the efficiency of macroeconomic stabilization policy is driven by respect for the two essential conditions:
- Setting priority to a fundamental objective of macroeconomic stabilization policy, its going to be around other objects shape;
- Award of monetary policy the specific role of market economies, namely to ensure the stability of general price level.

In fact, these two conditions may overlap, meaning that the central objective of macroeconomic stabilization policy should be price stability, its central role in ensuring monetary returns.

One of the main goals of state intervention is to maintain price stability. It is no doubt that active use of monetary policy instruments (exchange rate, money supply, interest rate) has a significant effect on inflation.

2. MONEY - MONETARY POLICY INSTRUMENT

In Romania, control inflation through monetary phenomenon is complicated by acute demonetization of the economy which occurred in the years 1990 to 1993. At that time, because the practice of negative real interest rates and due to collapse of production, there has been a dramatic drop in money demand, as manifested by increasing the rotational speed of money to 8.6 rpm./year in November 1993.

In other words, because of distrust in the national currency, it had to cover more than 12% of GDP, while none of central European countries, this ratio had fallen below 30%. In late 1993, when it was decided to relaunch confidence in national currency, while the problem was put remonetisation economy, meaning the money supply rising faster than inflation, currency until you get to cover again, about 40-50 % of GDP.

This process is quite complicated because remonetisation not turn into additional inflation just as long as GDP increases sensitivity and improves the demand for money in turn. Starting with the second quarter of 1994, money supply growth has outpaced the price rise, showing virtually ended the phenomenon of demonetization and began a reverse process, which means regaining public confidence in national currency. For example, in 1995, increasing the money supply by about 71% did not lead to an inflation of the same magnitude, but only about 30 percent inflation, precisely because of GDP growth by around 7% and decrease their speed by nearly 20 % (from 5.6 to 4.5 revolutions per year rotations per year). In 1996, noted a certain stabilization of rotational speed (4.9 revolutions per year). Manage monetary policy in 1997 to dampen inflation significantly.

Price liberalization undertaken in early 1997 was the last major phase of liberalization, as expected, continued to be sensitive to price fluctuations due to smaller and ever more structural factors. The robustness of monetary policy has been uneven, both over 1997, and shorter time horizons. Being the main anchor of the stabilization program, monetary policy has strengthened the early months of 1997, maintaining a strong character restricted to the beginning of the second semester.

Counting on calming inflation (inflation rate decreased from 30.7% in March from 0.7% in July) and assuming continuation of recovery in money demand, monetary policy has undergone a certain relaxation in the second half. This decision proved to be premature, given the general relaxation of macroeconomic policy, which stopped the return of confidence in the currency and even damaging.

In 1998, the economy continued remonetisation's growth far ahead of monetary inflation. Favorable signals suggest restoring confidence in national currency shall be made, however, questioned the conduct of people,

whose economy surged at a rate lower than those recorded by the money supply as a result of the downward trend exhibited by interest rate and depreciation of domestic currency in real terms against the dollar.

Monetary policy is a basic component of state economic policy with the objective of ensuring a stable currency. Achieving this objective is through intermediary that broad money (monetary aggregate, in general), the exchange rate or interest rate. Overcoming the phase transition to a market economy in which they engage the countries of Central and Eastern Europe, Romania needs and thus achieve economic programs to conduct structural transformation of the economy and macroeconomic stabilization, which means the balance of payments and reducing inflation.

Among the strategies currently pursued monetary policy by central banks, inflation targeting has proved to be the best solution, compared to targeting a monetary aggregate (monetary growth) and the exchange rate. be taken into account that monetary policy has a diffuse and delayed impact on the economy. Inflation in Romania is strongly influenced by inertial forces. But expectations can not generate inertial inflation unless monetary policy is always accommodating these expectations. In Romania, expectations have a mixed nature, adaptive and rational; it was only now learning the transition from the public about monetary policy rules, however, having an amplitude distortion phenomenon in the economy.

Even if the central bank is politically neutral, any decision is taken at the central bank in an economic and political context has a political, macroeconomic decision are extremely complex processes involving several institutions, stages and methods of application.

Without controlling inflation at levels lower than the growth rate of broad money (M2) is widening recession, as happened in Romania with the exception of the years 1994 to 1996.

But money supply growth as a measure to mitigate the decline in production is not an option for sustained long-term changes in monetary growth and reducing inflation monetary dynamics maintains real recession. This is one of the reasons why monetary policy should be restrictive.

In Romania, however, a restrictive monetary policy needed to combat high inflation in recent years affecting the private sector more than the state, although the main causes of inflation is the latter, and private sector development is the only way to overcome stage societies.

The year 1997 confirmed that the monetary and fiscal policies must take account of external imbalances and the danger that developing countries should adopt an exchange rate policy very "flexible" to reduce the risk of speculation. Thus, restrictive monetary policy in 1999 will try to reduce inflation through exchange rate depreciation followed by a gradual stabilization of it, Quantitative objective for the annual inflation rate in 1999 was proposed by the Monetary Authority of 34.7% using the monetary base as operational tool. Inflationary process which accompanies the phase transition to a market economy in Romania is not a phenomenon uncaused, which is why his rule is complicated.

It is important that economic policy, monetary policy implication, to act consistently on the root causes by providing the public a convincing message. Attempts to stabilize the economy only through monetary levers, without a real

economic reform are ineffective and even dangerous in the long term (1994-1997).

In terms of a traditional deficit with foreign loans in 1999 returned $ 5.2 billion and approximately $ 1.5 billion in 2000, must be tested while still a shock-type approach can support the real economy. The solution can be sudden depreciation of the leu exchange rate, its nominal anchor to reduce inflation as is done by rigorous control of money supply in circulation.

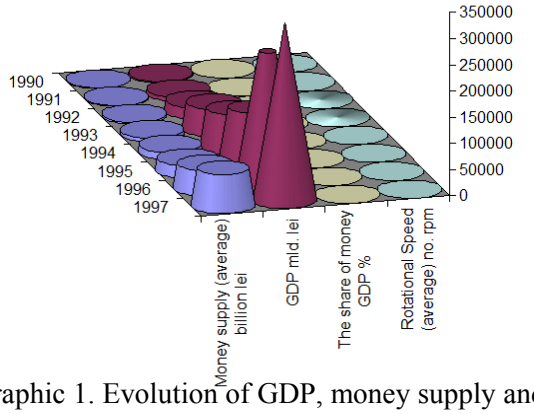
Given the situation in Romania, it is clear that currency depreciation leads to an appreciable improvement in the trade deficit. This impairment although it should be in line with inflation to avoid inflationary shocks corrective (which happened in February-March 1997 and March 1999) should not be delayed because it can lead to additional pressures on the exchange rate due to agents' preferences keep their savings in foreign currency and not in. Besides sparing agents induced pressure there will be a pressure generated by speculators.

I tried to find an answer to the question whether such monetary inflation in Romania. In the long term is safe, no major inflation can occur without a rapid increase in money supply growth and this will cause rapid inflation. Any policy that remains firmly lower money supply growth rate will subsequently lead to a low inflation rate. In Romania, however, inflation is largely structural in nature (technological, behavioral), low productivity, wage and price rigidity, normal for a country in transition.

To summarize, the causes of inflation in Romania is closely related to the real economy, its unrestructured leading to lack of competitiveness, hence the low quality of Romanian products reflected in reduced exports and imports massive, generating a vicious circle of inflation and exchange rate.
In late 1993, money supply represented only 13.8% of GDP, which corresponded to a rotation speed of 7.25 money, the money supply at the end of 1995 represented 18% of GDP, w Evolution of GDP, money supply and rotational speed which corresponded to a rotational speed of 5,5.

Year	Money supply (average)	GDP	The share of money GDP	Rotation Speed (average)
UM	billion lei	billion lei	%	no. rpm
1990	478,0	857,9	55,71	1,79
1991	603,5	2203,9	27,38	3,65
1992	1209,6	6029,2	20,06	4,98
1993	2764,4	20035,7	13,79	7,25
1994	6652,2	49773,2	13,36	7,48
1995	13107,7	72135,5	18,17	5,50
1996	22219,5	108390,9	20,49	4,90
1997	45116,1	249750,2	18,06	5,55
1998	70212,3	338670,0	20,7	4,82

Table 1. Evolution of GDP, money supply and rotational speed



Graphic 1. Evolution of GDP, money supply and rotational speed

If a delay between the time when money supply growth and output growth in the real sector, the growth of broad money goes entirely to the price that will be found in a rise in inflation.

3. MODEL OF INFLATION FOR MACROECONOMIC STABILIZATION

The main assumption in this part of the proposed model, as is applicable in the case of Romania, is that monetary policy is established and managed by the central bank, which has so full independence of the instruments used - being free to choose without interference from government policy (Article .2 of the Statute of the NBR). Appropriate setting a target level, and hence of optimal central bank contract (Svensson,

1997), which has operational independence, rather than independence objectives (freedom to set monetary policy goals). This delegation of monetary policy may be interpreted as a primary commitment (society)-agent (central bank).

The central bank considers monetary policy based on a loss function where it will take decisions, this function is of the form:

$$L^{BC}=1/2[w\ \pi_t^2+(Y_t-sY_t^*)^2] \quad (1)$$

Where π_t is the inflation rate during t (month) t, Y_t is the level's output, Y_t^* is the desired output level (at equilibrium), w is a stochastic parameter with mean 0 and dispersion constant w> 0; w is the relative aversion to deviations of inflation's output. If w is smaller, so there is a greater tolerance against inflation. At the limit, a central bank that cares's output level (s = 1), will produce zero inflation. Report a/w is the aversion to inflation, and hence will be as big. s is an output parameter that indicates's permissiveness to change the equilibrium level, s> 0.

The condition is that the central bank to minimize this loss (LBC) in line with inflation.

The study by M. Bruno and W. Easterly (1998) concludes that an annual inflation rate of over 40% (Inflation crises) lead to drastic cuts in output growth site, which will be recovered quickly, however, after stabilization. Moreover, the econometric results by two economists argue that the stabilization of high inflation does not involve loss of output. Estimated Regressions for 12 Latin American countries (known for high rates of inflation) over a period of 30 years (1950-1985) showed that halving the rate of inflation has led to GDP growth by 0.4%.

Monetary policy impacts on output and employment in the short term but not long term, real economic contribution is needed here. Monetary policy is thus a combination of an inflation target set ex-ante and a discretionary response to certain shocks. These shocks are those where the central bank may respond before the private sector to adjust its business. After numerous changes in the relationship described by Phillips in 1958 on the existing negative correlation between inflation and unemployment, it was also finding an inverse correlation between output and inflation, but only short term. We write so conventional after Lucas supply function, using rational expectations:

$$Y_t=Y^*_t+h(\pi_t-\pi_t^e)+\varepsilon_t \quad (2)$$

Where π are the expected inflation for period t and ε_t is the supply shock (or a modification of terms of trade shock to productivity). ε_t is not observed by individuals when forming their expectations, but the authorities before it can be observed to determine policy. Thus, inflation may offset the shock.

You must keep in mind however, that rational expectations are unrealistic during a transition period when there is learning about monetary policy rules, however have a magnitude events distorted the economic. Be so kind as having mixed expectations: being both adaptive and rational:

$$\pi_t^e=\nu(\pi_{t-1}-\pi_{t-1}^e)+\gamma\pi_t \quad (3)$$

making an extrapolation of inflation:

$$\pi_{t-1}^e=\pi_{t-2}$$

we obtain:

$$\pi_t^e=\nu(\pi_{t-1}-\pi_{t-2})+\gamma\pi_t \quad (4)$$

It remains to determine the equilibrium level of May's output, which is found in the IS-LM model (Hicks-Hansen) for an open economy: Equilibrium in the goods and services (IS):

$$Y_t=k'\ [A_t+(\beta-\alpha)E_t-gr] \quad (5)$$

Money market equilibrium (LM)

$$L_t=La_t+l_1Y_t-l_2r=M_t$$

Where E_t is the average exchange rate (real) in

period t and M_t is real money and k'=1/[(1-c)(1-t)+m], c is the propensity to consumption tax rate is t, m is the marginal propensity to import, α, β are sensitive export and import to change the exchange rate, g is the sensitivity of investment in relation to interest rate, l_1, l_2 are the sensitivity of money demand in relation to income, ie interest rate; α<0; β, c, t, m, g, l_1, l_2 >0. By replacing the interest rate (r) in the second equation is obtained first:

$$Y_t^*=[kA_t-(gk/l_2)La_t]+k(\beta-\alpha)E_t+(gk/l_2)(M_t) \quad (6)$$

where k=1/[(1-c)(1-t)+m+gl_1/l_2] or simplified writing

$$Y_t^*=a+b\,E_t+d\,M_t \quad (7)$$

where a= $kA_t-(gk/l_2)La_t$,b= k(β-α) and d=gk/l_2 (b>0, d>0).

The central bank may choose to conduct its monetary policy program for the control of inflation between use as an operational objective of monetary aggregate (M2 or the monetary base M0) or exchange. You can set so that the anchor or exchange money in the first case the exchange rate will be kept stable or allowed to fluctuate in a band in the second case is similar producing monetary dynamics.

Inflation control via control unit assumes the stability of M2 velocity of money. Estimates have shown that output growth is significantly correlated with the element's money. But as between the change in the level of money supply and inflation changes is a lag, during this period of time can produce a change and the elements determining the speed of rotation of money, especially confidence in the ability of monetary authority to practice anti-inflationary policy.

Monetary control involves the control of its components, the difficulty is that in an economy in transition, changes in variables can not be known beforehand, the functional relationships described are not stable and the disturbance affecting the financial market does not follow a normal distribution law. CB loss function can now write place:

$$L^{BC}=1/2\{w\,\pi_t^2+[\,Y^*_t+h(1-\gamma)\pi_t-h\nu(\pi_{t-1}-\pi_{t-2})+ +\varepsilon_t-s(a+bE_t+dM_t)]^2\} \quad (8)$$

By minimizing the current period we get:

$$\partial L^{BC} / \partial \pi_t=0$$

$$\Rightarrow w\pi_t+h(1-\gamma)[\,(1-s)(a+bE_t+dM_t)+h(1-\gamma)\pi_t-h\nu(\pi_{t-1}-\pi_{t-2})+\varepsilon_t)]=0 \quad (9)$$

Target level of inflation will be:

$$\pi_t=\rho_1(\pi_{t-1}-\pi_{t-2})+\rho_2E_t+\rho_3M_t+\rho_4 \quad (10)$$

where $\rho_0=h(1-\gamma)/[w+h^2(1-\gamma)^2]$, $\rho_1=h\nu\rho_0$, $\rho_2=(1-s)b\rho_0$, $\rho_3=(1-s)d\rho_0$, $\rho_4=[(1-s)a-\varepsilon_t]\rho_0$.

If there is a target level of inflation and it is known ex ante by the economic subjects (they account for a likelihood ratio to reach the stated goal of the policymaker), then the credibility of monetary policy is maximum tolerance level when actually of inflation during the period from its target level is minimal.

In specific circumstances the period of transition, monetary policy impact on certain factors is small, so the monetary authority's ability to control a certain level of inflation is limited to operate only in the short term. Monetary policy is subject to the influence of a variety of exogenous factors, so any prediction it has a high degree of uncertainty. However, the monetary authority may propose specific targets (lower inflation, stable exchange rate of national currency) and to shape policies in a manner to achieve them. Because prices respond with a lag to any economic shock, the objective of price stability implies an interest rate increase immediately after a shock and not to expect prices to rise.

Continuous attention should be paid to the three elements in particular, possible monetary policy instruments:

1.Interest rate to be positive in real terms, it influencing short-term exchange rate (the interest rate is higher as compared to inflation, the country's currency is requested, so determined),

2.Money it to grow faster than the inflation rate leads ceteris paribus - slowing down the rotation of money up to a level considered "normal" 3-4 turns per year, and

3.Exchange rate. Central bank decisions should cover two aspects:
-How to control money supply and interest rates and
-Whether to fix the exchange rate or let it float.

Therefore, a monetary policy rule should be made based on:

- identify operational instruments - interest rate or monetary base;
- end point;
- loss function which can add a cost for larger deviations from the target. For example, it may be important for the central bank to slow the rate of change reputedly discounts without large movements and sharp turns to avoid creating uncertainty in financial markets.

Policy makers must also be familiar with lags, to estimate future values of the variables in the absence of monetary policy actions, to know what external shocks may hit the economy and their impact will be.

4. CONCLUSION

The most important conclusion is that the most important monetary instrument for stopping inflation is money supply and its control. Therefore, interventions to increase liquidity in the economic circuit must be made with great caution. Deterioration (for increasing) rate of money and the negative evolution of production (the downside) but may weaken or even undermine the ability of monetary policy to control inflation. Monetary policy must take into consideration the manner in which control or reduce the amount of money in circulation affects the speed of rotation of money and especially the production and supply of goods on the market.

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DIRECT INFLATION TARGETING IN ROMANIA

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Abstract: *The article proposes to offer a clear and suggestive image of the stage the economy of Romania is from the prospective of the policy of direct inflation targeting, to outline the main achievements of the Romanian economy and to emphasize the unbalances existing at the macroeconomic level, by studying the interaction between the National Bank and the private sector, offering solutions concerning economic stability. In the context of an unstable economic environment, one of the reasons for choosing this theme is the need to understand and acquire the mechanisms related to monetary and fiscal policy measures to be taken to ensure price stability. The subject proposed is framing into an extremely actual field of research and with large perspective of analysis in the future too, regarding the role that National Bank plays in keeping the inflation under control and implicitly in assuring the macroeconomic balance.*

Key words: direct inflation targeting, monetary policy, macroeconomic equilibrium

1. INTRODUCTION

In the last decade, the problem facing the world economy was the generalized increase in prices, which generated pressures in the plan of monetary. This imbalance affects economically powerful private sector decisions regarding investments, savings and even increasing production, the final effect materialized as reducing production levels. This is why, in recent years economies have shifted towards achieving macroeconomic fundamental objective of macroeconomic policy represented by price stability.

This objective can be based on different strategies of monetary policy strategy as highlighting their contribution to creating favorable conditions for reducing inflation and ensuring financial stability.

The paper is organized as follows:

First paragraph include theoretical monetary policies, the 2nd one presents aspects of the literature on the stability of inflation and monetary policy strategies, 3rd paragraph presents the main macroeconomic developments in Romania during 1990-2010 and into the 4th paragraph we present conclusions derived from synthesizing information presented in this paper.

2. LITERATURE SURVEY

The ultimate objective of macroeconomic policy and hence monetary policy is the price stability. This objective can be based on various monetary policy strategies, strategies that are geared towards the establishment of intermediate objectives: monetary aggregates targeting (such as monetary base, M1, M2 or M3) or exchange rate targeting.

These intermediate targets are links between the actions performed by the operational tools of monetary policy and the real economic activity and inflation. Regarding the use of monetary aggregates as intermediate target of monetary policy, they require the application of restrictive monetary policy to consider controlling the growth rate of monetary aggregates in order to eliminate excess liquidity in the economy.

With the adoption is going on based on targeting the exchange rate regime, the central bank tries to ensure the nominal exchange rate stability through the use of its instruments aimed, on the one hand, changes in interest rates, and secondly based on direct interventions on the FOREX market interventions designed to support the exchange rate.

The theoretical and practical debates in recent years, inflation targeting monetary policy strategy that has proved most effective strategy in achieving the ultimate objective of monetary policy. This approach requires a commitment that inflation targeting is the main objective and mission of the institution.

The concept emerged from the theoretical point of view through the '80s and the first country to implement this scheme was New Zealand. Widely used in industrialized countries in the 90s, the strategy of direct inflation targeting became an attractive alternative for emerging economies.

Strict inflation targeting implies that the central bank pursues the objective of minimizing inflation and inflation deviation from target only, without taking into account the effects this may have on gross domestic product and economic growth.

Inflation targeting strategy has the following defining characteristics:

- Price stability (understood in the form of low and stable inflation rates) as a single objective or priority of monetary policy either by constitutional or by public commitment of monetary authorities.

-Quantifying the objective of monetary policy as inflation rate to be achieved over a time interval, the target being set by government and empowered the central bank, established jointly or independently indicated by the monetary authority.

-Central-bank independence in the instruments used to achieve the targeted rate of inflation, implying a greater degree of central bank independence in monetary policy management

-Transparency and accountability of the central bank configuration process development and implementation of monetary policy

Romania has adopted an explicit monetary policy of inflation targeting in August 2005. Popa and Isarescu (2005)[1] underlines the fact the requirements and criteria which condition the effectiveness of this strategy are satisfied:

- bringing the annual inflation rate to single-digit levels;
- earning and strengthening central bank credibility;
- a relatively more flexible exchange rate of the domestic currency and diminishing the Romanian economy's vulnerability to exchange rate movements;
- the soundness and strengthening of the banking system and a relatively higher degree of banking mediation;
- greater transparency and accountability of the central bank and more effective communication with the public and financial markets, including the presentation of various aspects related to the inflation targeting approach and the preparatory steps for its adoption;
- better insight into macroeconomic behavior patterns and economic mechanisms in order to identify and enhance the effectiveness of monetary policy transmission channels

National Bank of Romania considers that inflation targeting strategy is appropriate macroeconomic conditions that are Romania. Father points out that the criteria were satisfied and that makes the effectiveness of

[1] Isarescu. M., Preparations and Prerequisites for the Introduction of Inflation Targeting in Romania, Conference “Inflation Targeting: International Experience and Romania’s Prospects”, Bucharest, 2005

this strategy: lowering the annual inflation rate below 10 percent, the relative flexibility of leu exchange rate and reducing the vulnerability of the economy to fluctuations in this variable; clearer shape macroeconomic behavior and functioning of economic mechanisms necessary to identify and increase the efficiency of monetary transmission channels.

Constantinescu C. (2007) presents six basic inflation measures (core measures), built as being those components expressing the persistent sources of the inflationary pressures in an economy (three measures obtained by the method of exclusion of certain components from the Consumer Price Index Basket, trimmed mean optimum (19 per cent), median and Edgeworth index). All these measures present a lower volatility in comparison with the total inflation, but the most representative inflation measure, according to the tests carried out in this work, was proven to be the 19% trimmed mean. The inconvenient of using this measure is however given buy the complexity of the determination method, becoming difficult to be accessed by the large public.

Aristide O.[2](2007) carries out an empirical assessment of the following aspects: determinants of the salaries evolution, interdependence among the salaries in the private and public sector and the incidence of the labour force cost upon the inflation and commercial deficit. The results presented show that despite the high increase rate of salaries in the economy coexisted with a sustained process of disinflation, these increases involved however macroeconomic costs. For the entire period, the empiric analysis of the impact of gross salaries upon the inflation and the commercial deficit emphasizes that these exercised an influence on both variables, the appreciation of the exchange rate being the one determining the occurrence of more visible effects upon the commercial deficit, at the same time improving the negative effect upon the inflation.

Isărescu (2008)[3] the need of approaching of a flexible manner the inflation targeting, having in view the following aspects: perspective of a feasible disinflationary trajectory on medium term; sustainability of the disinflationary earnings achieved; accentuating upon the risk management at macroeconomic level and of the financial stability when implementing inflation targeting; avoiding worsening the existing unbalances without transforming the related macroeconomic variables in monetary policy targets; monitoring the effective fastening of the inflationary anticipations without changing the disinflationary trajectory announced; the role needed played by the other components of the policies mix in managing the aggregate request and assuring the macroeconomic stability.

Thus, a sub-optimum combination existing in the last few years (a lax budgetary and salary policies, or a very "tighten" monetary policy, respectively) will be possible to be replaced with an optimum combination where all the policies (budgetary, salary and monetary) have a similar restriction degree and to straighten the economic activity towards work and productivity. The enhanced restrictiveness of the monetary policy cant compensate on short term the lack of support of the structural reforms, of the fiscal – budgetary policy and of the income policy only, and the situation resulting would be sub-

[2] Aristide O- Occasional Paper no.24 , BNR, December 2007

[3] Isărescu M. "Evolutions and Challenges. Monetary Policy in the new Global Economic Context", The Seminar on Monetary Policy ,April 2008

optimum from the perspective of the real convergence. The fiscal-budgetary policy holds a key-role in assuring keeping the external unbalance at a sustainable level. It is also recommended, according to his assertion, to restrain the public sector, in order to offer a more extended handling space to the private sector, avoiding thus a pro-cyclic conduit also. At the same time, the policy of revenues must remain cautious from similar considerations and to transmit not improper signals for setting up the salaries in private sector.

The important role of the direct inflation targeting policy in keeping the economic stability is underlined by Patrik Artu (2008) that suggest the combat against inflation is efficient, under the conditions of globalization, by a coordination of the Central Banks actions.

The global financial crisis implies new approaches of the direct inflation targeting policy.

Dăianu (2008) asserts that at the origin of the crisis one can count also the finding that one did not learn enough from the crisis episodes of the last two decades: and these crises were exulting periods, of massive (forming the so-called "bubbles"), of relaxing cautiousness and greedy standards without measure.. These warning regarded especially a certain type of financial innovations- on the ground of loans securing (that is their transforming in transactional bonds) – creating a huge uncertainty and accentuated the systemic risks. „The causes of the financial crisis are deeper" appreciates Isărescu (2009), they being „both of macroeconomic and of microeconomic type". These two types of causes inter-conditioned the start of crisis. The deep cause of the financial crisis was the plentiful liquidity created by the main central banks of the world (FED, BOJ) and the desire of the petrol and gas exporting countries of limiting the appreciation of the currency.

In the context of the actual crisis, Isărescu (2009) draws the attention upon the occurrence of the delicate problem of the compromise between the objectives of the monetary policy: assuring monetary stability and assuring financial stability. The experience of Romania shows that financial stability presents a special importance for the prices stability. With good reason, Romania was criticized for delays in disinflation. These were due to insufficient structural reforms. Our country achieved a 5.8% average rate of disinflation during 2000-2007, in parallel with keeping the stability of the financial system. If the National Bank of Romania (BNR) would replace this deficit of reforms by more abrupt increases of the interest rate, the financial status of the companies and of the households had been deteriorated. Thus, the financial stability of the banking sector would be deteriorated. At the end, the rhythm of disinflation itself would probably have been lowest than the achieved one. The lesson to be learn is therefore, on long term, the inability of keeping financial stability can lead only to a re-inflammation of the inflation (Isărescu, 2009). Concluding, we can affirm that an accurate macroeconomic diagnosis is needed – an emotional approach of the crisis may lead to proper measures given the increase of the non-guaranteed stimuli in the internal demand. A mix of coherent policy is essential for a calm restoration of the macroeconomic balance. Romania must maintain its calendar announced previously for EURO adoption as national currency, specifying that the entry on 1 January 2012 in the ERM-II mechanism of the exchange rate and crossing the minimum mandatory period of two years in the interior of this mechanism is conditioned by the need to make many reforms, proper and competent reforms, until 2012, in Romania.

3. 3. ANALYSIS OF MACROECONOMIC INDICATORS FOR DETERMINING INFLATIONARY PROCESS

Romania's transition to a competitive market economy was a slow process, characterized by low growth and high inflation rates and unstable. After 1990, price liberalization has been extended. Most prices were liberalized in November 1990, in April 1991 and July 1991, but the last major round of liberalization has been delayed until 1997Since 1991 inflation has been on an upward slope. Maximum being reached in 1993 when consumer prices were 256.1

percent annual variation from other countries (Hungary, Czech Republic, Bulgaria) the inflation rate was below 50%. Rising prices in this period was due to their gradual liberalization, but also other measures (fiscal reform or exchange rate). In 1994, amid the resumption of growth and timing of price increases, inflation was calm, immediately after registering a downward trend. In 1995 he passed the first 3-digit level in a two-digit level, so that in 1995 there was an inflation of 32.3%. In 1997, following the latest round of price liberalization (especially in sectors agriculture and energy) average annual inflation increased again, reaching a value of 154.8%. Since then, inflation was in a downward trend, dropping below 10% in 2005 (when annual average inflation was 9%) and 5% in 2007 when annual average inflation was 4.84%).In 2008, following the global economic crisis the annual inflation rate rose to 7.85%, following that in 2009, to register a decrease in its value by 5.59%. Crisis started in late 2008 required the adoption of a vision of fiscal policy has been accompanied permanently of a restrictive monetary policy, whose effects were reflected both in lower income population adversely influenced consumption and production, and a non-governmental credit loss as a result of active interest rates increase leading to a reduction in the level of investment, all these reflected a sharp contraction of economic growth.

Figure 1 contains a comparison of expected inflation, that is forecast in the draft State Budget Law and actual inflation.

Great differences are observed up to 70 percent in 1990-2000, when price liberalization and economic situation had resulted in an unstable inflation rate and major fluctuations. Differences between the two inflation rates have decreased in recent years as inflation has become more stable.

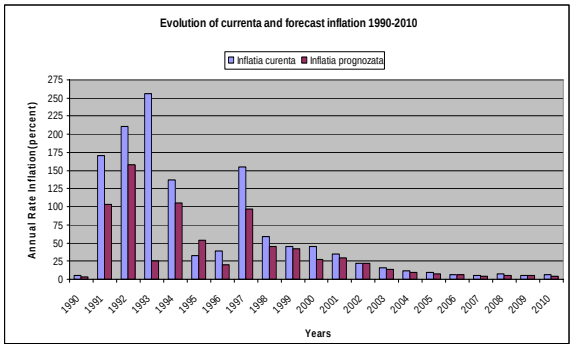

Fig 1: Current inflation and forecast inflation in Romania from.1990 to 2010

No inflation dynamics can be analyzed without taking into account exchange rate and its effects.

Figure 2 presents the real exchange rate ROL / USD and GBP / EUR in period 1990-2009. Recent data on the actual rate registered in Romania were collected from the site of the National Bank of Romania, excluding the value of 1990, which was used for the recorded value of the ECU. Figure 3 is noted that exchange rate was similar to inflation but not so fluctuating. Exchange rate depreciation had a maximum in 1992. In the period 1996-1997 has been depreciated since early 1997 has been the liberalization of the exchange rate, with the last price liberalization. In 1998 we wanted to avoid depreciation of the leu to reduce inflation. In late 1998 and in 1999 to restore external competitiveness followed by a depreciation of currency. Since 1999 the lion entered a process of real appreciation against major currencies, while registering and low inflation. The two phenomena may be related, low inflation can be explained by currency appreciation.

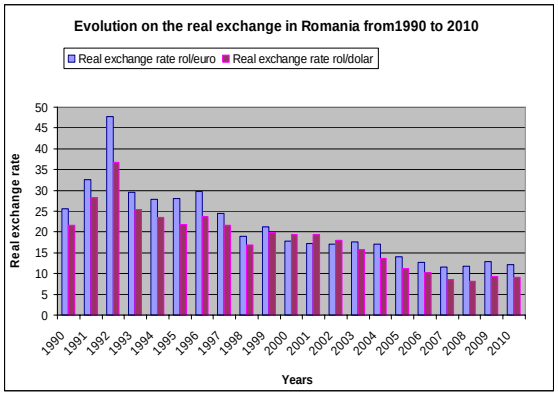

Fig 2: Real exchange rate in Romania in 1990- 2009 period

In Fig. 3 we present the evolution of real wages in our country during 1990-2009. Calculations were made in comparable prices.

It may be noted that in the early years of transition real wages increased fluctuations presented, with peaks around the years 1996 and 2008. Value of real wage in 1990 was exceeded only in 2005, when Romania adopted the strategy of monetary policy, inflation targeting. In recent years, real wages showed obvious upward trend, reaching a value of 5642.36 GBP in 2008. In 2009 there was a decrease in net salary, this value reached 5137.3 ROL.

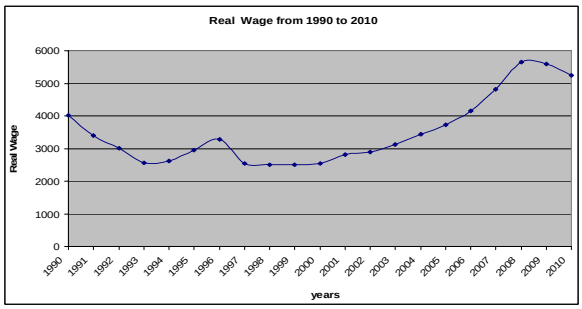

Fig. 3: Evolution of real wage in Romania in 1990-2009 period

Fig.4 shows the evolution of gross domestic product of Romania during 1990-2009. GDP is expressed in comparable prices in 1990. Data on GDP are taken from the Statistical Yearbook, during 1990-2009, National Statistical Institute. We can see that the evolution of real GDP has a slightly upward trend, with an average of 793.332 billion ROL. Minimum was reached in 1992 when it registered a real GDP 681.1726 ROL billion and the maximum was reached in 2006, reaching a figure is at 1031.099 billion ROL. Since 1999 real GDP shows a steady upward trend.

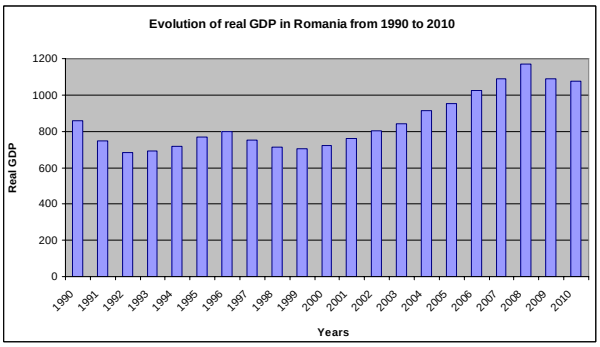

Fig. 4: Evolution of real GDP in Romania in 1990-2009 period

Central banks to apply inflation targeting strategy, as is the case of Romania, are concerned with growth and development especially of GDP deviation from the potential. In Fig 5 is presented the comparative evolution of real GDP and the potential during 1990-2008

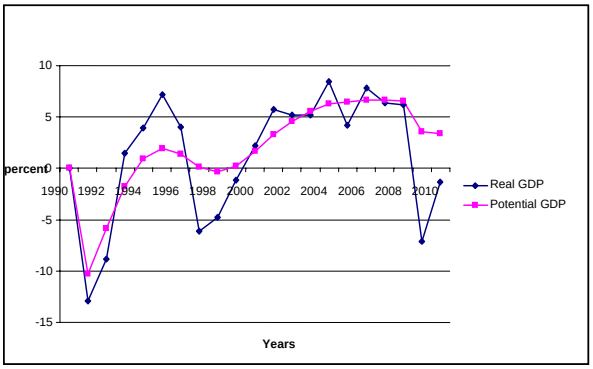

Fig. 5: Comparative evolution of the real and potential GDP from 1990 to 2008

Based on the data obtained we can see that the values of the two outputs are similar, with small fluctuations around the years 1992, 1996 and 2000. This is due to two economic cycles: the years 1990-1991 was a recession, after which, around the year 1992 was a period of depression. The period 1993-1996 was characterized by an economic pick-up, followed by a recession for the next two years. 1999 was characterized by economic depression, and then the next year we are dealing with a period of economic expansion, with the peak in 2008. In 2009, amid sharp

global economic crisis, real GDP registered a decline, hovering around the value of 2007.

In the context of current economic crisis, the assessment of European Commission is highly straightforward. Romania needs to implement its structural reforms program, mainly focused on macroeconomic stability through strict control, of inflation, reduction of bureaucracy and a more efficient administration. Moreover, a global policy concerning the labor market correlated with education reform is needed.

Setting a favorable environment in Romania, among others, the implementation of a sustainable and credible strategy for fiscal consolidation can contribute to diminishing the demand-side inflation pressures and macroeconomic disequilibria. Concurrently, credit expansion, current account significant deficit, and its funding need to be closely monitored. Although creating new workplaces needs to be stimulated by adjusting fiscal systems and of aid allocation, it is required that a decrease of taxes to be accompanied by constrained expenditures, and this process needs to be sustained by higher efficiency of budgetary expenditures, among others. Adopted measures to increase quantity and quality of labor force supply needs to include adjustment based on the needs of economy.

5. CONCLUSIONS

In the new context of the financial and economic crisis it is imperious to implement a policy mix that responds to Romanian economy's vulnerabilities related to financial turbulences from the international market. For that matter, in order to ensure the equilibrium in the economy the monetary policy needs to be accompanied by a similar behavior of the fiscal policy, by a prudent revenues policy, as well as by continuous structural reforms for creating the conditions to decrease budgetary deficit, current account deficit, external disequilibrium, and to ensure stability of prices and, implicitly, for the process of economic development.

In order to sustain the growth trend of macroeconomic stability, the measures to strengthen the restrictive character of the monetary policy need to be supplemented by prudent fiscal and wages policies, as well as by further reducing quasi-fiscal deficit. The conditions needed to revitalize the economy can only be ensured through an adequate policy mix so designed that the fiscal and budgetary policy, wages and monetary policy complement each other and that their interaction reflects upon the economy. A highly restrictive monetary policy can compensate only on short term the lack of support from structural reforms, fiscal-budgetary policy and revenues policy. For that matter, in order to achieve the equilibrium that provides an adequate environment, the inter-correlations between economic policies need to be considered so that their effects lead to achieve specific objectives, such as: prices stability and economic growth or stabilization of economic cycle, respectively.

A solid fundament of the fiscal policy that comprises the actual conditions of social and economic activity, and the prerequisites of present time and the imperatives of future time, can prove to be beneficial to progress. In case these factors are not taken into consideration, the fiscal policy can slow down economic development, lead to involution or even to social tensions

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2. *SOCIO AND HUMANITIES*

PANEL 1. *The psychology of defense, public order and national security*

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NANOPSYCHOLOGY IN THE EXTREME FUTURE

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Argument :*The end of the 19th century and the whole of the 20th can be characterized as a time of affirmation, self-definition, the time when psychology manifested and asserted itself as a science.Even if in its evolution psychology went through a drama, as one of the architects of the Iasi psychology school, Vasile Pavelcu, characterized it in his work "The Drama of Psychology" (1965), its destiny rose to the triumph of psychology, as we might call its evolution in the 21st century. There is no field of practical activity (economics, education, culture etc.) that does not resort to the latest knowledge and information of theoretical and applicative psychology. It is known that if the first use of the term psychology by Philipp Schwarzerd (also known as Melanchton) and then by Rudolf Godenius is dated 1590, the beginning of the assertion of psychology as a science is considered to be the year 1879, when the first laboratory of experimental psychology was founded by W. Wundt in Leipzig. From the beginning the studies and treaties of the history of psychology (c.f. M. Ralea, C. Botez 1958, P.T. Petroman 2001, M. Bejat 1972, I. Mânzat 2003 etc.) recognize the role of the discoveries in physics, psychology and medicine in stimulating research in the field of psychology and medicine, these disciplines being considered roots of psychology. This is what Ion Mânzat, author of "History of Universal Psychology" (2007, p. 477) asserts "Going beyond the two millenniums of philosophical existence of psychology and after the knowledge about nature acquired the prestige of a science, the experimental method used in physics began to be used in the research on man, too. The separation of psychology from philosophy and its becoming an autonomous science is due not to psychological analysis, per se, but to the research into the connected fields, especially the general physiology of the nervous system and the psychophysiology of the sense organs. Physics also had a crucial role, demonstrating the possibility of the experimentation and objective measurement, indirect of course, of what was considered «pure subjective experience»." In the society of knowledge dominated by IT and high technology, the impact of inventions and discoveries in physics, medicine and neurosciences open new horizons and new fields of research in psychology. The emergence of a new field of psychology – nanopsychology – is connected to this new dimension.*

Key words: nanotechnology, nanopsychology, extreme future

1. NANOPSYCHOLOGY – FORCE OF THE EXTREME FUTURE

WHAT IS THE EXTREME FUTURE

In the 1970s, Alvin Toffler, famous futurologist, drew the scientific world's attention by announcing the impact that the development of technologies was going to have upon mankind, using the term the shock of the future, while J. Naisbitt marked the main megatendencies that would determine the evolution of mankind in the future.

The mapping of the future became a preoccupation of futurologists, but also of economists, businessmen and politicians more and more frequently convinced by the syntagm "The future of the past is in the future, the future of the present is in the past, the future of the future is in the present" (J. Naisbitt, 1989, p.2).

To fill in the puzzle of the future, in 2006 James Canton, Alvin Toffler's disciple and collaborator, launches and defines the term "extreme future", dedicating it the work "Challenges of the future. Main trends that will reshape the world in the next 5, 10, 20 years."

"Welcome to the extreme future", James Canton said. "Everybody must change their attitude to the future, a future marked by changes, challenges and risks. It is a new type of future, different from moving from one stage to another on an evolution marked by the brief flashes of the innovations characterizing the greatest part of history. The future we live in depends on the way we understand the stunning changes in store for us." Major changes are in store for us, changes the quoted author calls *the extreme future,* describing it as extremely dynamic, turbulent and pluridimensional. In J. Cauton's opinion (2010, p. 18) the extreme future will be defined by five factors: speed, complexity, risk, change and the unpredictable and by ten main tendencies (2010, p. 15), of which mention should be made of the following:

One tendency refers to the energy of the future – the energy crisis, the post petrol future and the future of alternative energy, like hydrogen and nanoenergy (2010, p. 49)

The second dimension is the innovation-based economy – transforming global economy relying on the convergence of free trade, technology and democracy, thus leading to the appearance of new jobs, new markets, globalization, competition, peace and security. The four instruments of force of the innovation-based economy are nanotechnology, biotechnology, IT and neurotechnology.

A third dimension shows the reasons why the future work force must embrace innovations in order to become competitive at a global level.

The medicine ensuring longevity is considered among the key-forces that will radically change medicine, like nanotechnology, neurotechnology and genomics, so that people will enjoy a longer, healthier life.

Another tendency characterizing the future is the way in which the science of the future will change every aspect of our existence, culture and economy from nanobiology to multiple universes.

A tendency that is already manifest in the future present is ensuring security – the major threats at people's freedom and defining the risks specific to the 21st century.

The future of globalization: the clash of cultures – the new realities of global commerce and competition; the rise of China and India; the confrontation between cultures and values; the ideological fight for dominating the future - a challenge and a direction in the map of the future.

To the tendencies presented here, that are a reason for concern, to the changes of the clime and to what the future may bring in the context of their manifestation at the level of the individual are added questions regarding the necessary changes and the way people must act so that they can sail among the threats coming from technology, governments and ideologies in their fight for human rights, freedom and individual independence. These are the questions that theoriticians and practitioners are trying to find solutions to and all eyes are directed to the power of education to prepare, form and support the individual in the dynamics of an extreme future.

As emphasized above, among the instruments of force of the emerging innovation-based economy in the extreme future, J. Cauton includes nanotechnology and neurotechnology. These are extremely valuable technologies that will ensure the individual's adjustment to the extreme future.

The society of knowledge in which we live is the result of the manifestation of people's creativity at a performing level. The extreme future requires a high level of creativity in individuals endorsed with megaskills and inventive competence in order to discover, develop, understand and solve the challenges and problems of the future. Maybe one of the most necessary skills to develop in all members of society is the ability to change the hardships, obstacles and challenges of life into golden opportunities.

This capability based on the creative ability called sensitivity to problems and opportunities becomes an essential dimension in the process of personal development and the management of a successful career.

FROM NANOTECHNOLOGY TO NANOPSYCHOLOGY

Born in the society of knowledge, nanotechnology is a field of research of high technology, the first to create products whose value is to be found more than 8% from results in research and development. Nanotechnology is a fascinating science for many scientists who consider that it offers unexpected opportunities in fields with major implications in mankind's survival and progress: nanomedicine, nanofarmacology, nanoenergy and nanorobotics.

An eloquent example is the building and use of nanorobots in increasing the immune system, in detecting & treating cancer, in the diagnostics & treatment of diabetes, etc (Freites, Jr. R.A., 1999).

The concept of nanotechnology is defined as a collective term for technological developments on a nanometric scale. In a large sense, nanotechnology represents any technology that has nanometric results: fine particles, chemical synthesis, microlithograph, etc. In a restricted sense, nanotechnology represents any technology based on the ability of building complex structures , respecting specifications at an atomic level, using mechanical synthesis. Not only are nanometrical structures very small, relying even on an atomic scale, but they also possess totally different, unexpected properties compared to the same substance at a macroscopic level (ro.wikipedia.org).

Nanotechnology represents a radical solution requiring the exploitation of quantums, the manipulations of atoms (James Canton, 2010, p-49). It is a fantastic science, "an innovative theory of the possible. It can help discover new solutions to the energy crises, new techniques for treating illnesses considered incurable, it is considered a reservoir of opportunities and innovations steadily demanded by the extreme future that is beginning to manifest itself in the present." Intelligent medications for neuroregeneration and medication required for the medicine of longevity are some of these innovations.

For the question how nanotechnology will help man, scientists answer that "nanites will be used in medicine, being programmed to replace sick cells. Mankind's problem will be whose hands we will be in''.

Other questions refer to the effects and impact of nanotechnology at the individual's level. We consider that the answer will be given by psychology through the new fields – nanopsychology, nanocreatology and nanoinventics, etc.

NANOPSYCHOLOGY – A NEW FIELD OF PSYCHOLOGY

The beginning of this paper emphasizes the perceptiveness of psychology, the discoveries and progresses in physics and medicine.

In an informational society like the society of knowledge, the latest information in high technology has implications at the individual level, constituting its "rebirth". Psychology has the task of studying the impact that the phenomena and forces of the extreme future has on the human psyche. The use of the concept of nanotechnology has recently led to that of nanopsychology.

The concept of nanopsychology was first used in 2008 by Ramil Garifullina, who was on a doctoral program in psychology, at an international conference organized by the Academy of Science of Tatarstan in Kazan. He is considered a promoter of the concept of nanotechnology, starting from the era of nanotechnology that has just begun.

The future is nano, many specialists think Nanotechnology- "the microscopic angels of the future".

Nanopsychology can be defined as the science studying the correlations between nanostructures and mental transformations in the science of creating artificial neuronal networks that simulate the real ones, the quoted author affirms.

We define nanopsychology as the science dealing with the study of the effects of nanotechnologies at the level of psychic life and their impact upon the individual and communities.

Among the problems of interest for nanopsychology Ramil Garifullina mentions:

The problem of the influence of nanoparticles upon mental processes and the way relations between nanochips and various nanoenergetic structures and mental processes can be managed;

The problem of the manner of research into the structures of the brain and nerves by means of nanostructures in global networks, like the internet;

Another problem is the study of the global governing of persons with mental processes implanted in the brain through nanochips, by means of radio networks or the internet;

The study of the use of artificial nanostructures as instruments to create new techniques and methodologies of investigating mental processes;

The investigation of the subjective mental stimulation of reality through artificial nanostructures;

Another problem might be the prognosis and design of psychic reality by means of the conversion of information from nanostructures;

The study of the way in which the brain codes and creates value by introducing artificial nanoprotheses that will create imitators of coding the brain processes and observing the way in which mental processes change.

R. Garifullina asserts that nanopsychology may become a science of creating artificial neuronal networks.

To map the field of study of nanopsychology it is necessary, in our opinion, to enlarge the sphere of the psychic processes considered no to be limited solely to mental processes. The developments in nanotechnology in various fields that are already in practical use have effects at the level of affective, motivational, volitional processes, of creative, inventive processes etc.

Nanocreatology will be a subfield of nanopsychology, aiming at the way in which the nanocreation is produced and the way it influences the life of the individual. Training specialists in psychology in accordance with the tendencies and characteristics of the extreme future involves instructing and endowing them with the abilities necessary to study and develop nanopsychology in the 21st century.

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CULTURAL AND GENDER TOLERANCE PRINCIPLES IN SOCIAL SCIENCES AFFECTING THE SECURITY ENVIRONMENT

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ABSTRACT:*Postmodernism, globalization and new security threats in a multicultural context, but foremostly the need to accept the principle of culture and gender tolerance, introduce the new understanding of the role of men and women, and emphasise the need to accept innovation and flexibility of male and female behavior resulting in equal participation in all activities to support peace and security.*

INTRODUCTION

We live in a world characterized by *cultural diversity*. The distrust of everything that comes from abroad or that has origins outside of the own social group or society belongs to the natural human behaviour and experience. Anthropologists have already signalized the existence of the important socio-cultural regulator, the so-called „taboo for the contact with strangers" in some primitive communities. People tend to learn, explain and evaluate individual cultures from the perspective of the culture they belong to, they are the members of and the values, norms, religion of which are for them determining. They consider the elements of their own culture the only right and good ones, or the best and most mature ones. They consider other cultures aberrant or even abnormal, an anomalia, contradiction. Handling this process assumes understanding the theoretical principle of cultural plurality and tolerance which allows achieving the feeling cleared of emotional reactions against their own or strange culture. Tolerance can be considered an attitude that expresses the acceptance of otherness or „something strange" , universal means of future human communication getting rid of the radical ethnocentric moods in the increasingly internationalizing environment.

Theoretical principle of „*acceptation of otherness*" is specifically manifested in the need to deal with this issue as a result of the increasing trend of transformation of gender roles od men and women in the society and it also requires a broader analysis on the level of gender roles transformations when guaranteeing peace and security. All suggested problems result from *ethical theories* that all people are equal in their human dignity and in their rights.

Percieving our own security or danger based on the signals and sense perception, instinctive reactions of the organism, is a natural human characteristic.

From the psychological point of view[1] we can consider security a subjective psychical state, individual sensation and quality of life at the same time, which is connected to the signs of positive experience, feelings of safety, order, peace, harmony, stability. For every human, man or woman, in such situations is the need to maintain their own existence, surviving, securiy the ultimate need.

F. Škvrnda gives notice to *the anthropocentric approach* to the issue of security and points out especially the connection of security with the basic needs of life of a human as a social being while he tries to respect the microsociologic and macrosociologic dimension of this term. In his approach is the term security as a social phenomenon characterized by dynamics and processuality, subject-oriented character, arrangement, relativity, indivisibility and structured (differenciated) character. [2]

In the sociologic and social-psychological[3] understanding is the need for security and people´s fear often an important activating, motivating and incorporating factor of social integration. It manifests especially in extreme and crisis situations, when the safety of people is threatened and it helps create temporal or lasting social groupings, commonalties, more or less structured social systems.

The United Nations Organization has become an advocate of the so-called concept of *human security*: *„Human security... must focus on the human, not just the states and nations... The concept of security must change – from the exclusive concept of the security of the nation to the concept the goal of which is the security of human. It must change from the security achieved by means of armament to security that can achieve support of the development, from the territorial security to security in questions of providing food, employment and a healthy environment.“* [4]

The basic theoretical resources of the context of security in the multicultural environment are:

1, the new reconstruction of social sciences and multiculturalism in security questions

2, globalization effects and postmodernism as a part of security processes

3, the need for reconstruction of gender roles in guaranteeing security

We are going to describe these resources and trends on the following pages.

New reconstruction of social sciences results from the need for the complementarity of a human, nature and society. Learning about nature is different from the method of learning about society, but from the complementarity point of view today there is no point in talking about the boundaries between individual sciences. All sciences have many points of contact and many topics in common that they participate in and they methodologically converge. In the science of last century we can notice the rise of interdisciplinarity and transdisciplinarity which offers at present the formation and development of new scientific paradigms, methods of research and innovative systems approaches. Current trends in social sciences are influenced by the principles of pluralism and multiculturalism. Perceiving security or the ability of the complex perception of security thus becomes less and less transparent and less and less obvious and therefore also less safe in the system of multiple social interactions in the globalizing world of multicultural contacts. [5] In relation to these theoretic shifts in the everyday practice the need for systems, progressive and innovative

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[1] KMOŠENA, M.: *Dav a panika.* Liptovský Mikuláš: 4D s. r. o. 2004

[2] ŠKVRNDA, F.: *Sociologická charakteristika medzinárodnej bezpečnosti. In: Sociológia č.5, roč. 35. 2003. p. 391 - 410.* ISSN 0049-1225

[3] HAMAJ. P.: *Sociologické aspekty vojenskej práce a profesie*. Liptovský Mikuláš: AOS 2005. ISBN 80-8040-252-3

[4] WAISOVÁ Š.: Řešení konfliktú v mezinárodních vztazích: In: *Human Development report 1993.* Praha: Portál. 2005. p.68 ISBN 80-7178-390-0

[5] Pozri bližšie práce: ŠKVRNDA, F.: *Sociologická charakteristika medzinárodnej bezpečnosti. In: Sociológia č.5, roč. 35. 2003. p. 391 - 410.* ISSN 0049-1225

approaches of providing security in the current globalizing, multicultural society is increasing. [6]

The development of society requires innovations also in social sciences. An example of it is the increasing importance of the so-called helping professions and especially *social work* – a science which results from the everyday needs of professional, practical solutions of immediate and continually rising problem social situations.[7] At present, security studies and a new science *„securitology"* are being elaborated, which result from the need for reacting to the security challenges and the needs for solving crisis situations of the current society. [8] This trend introduces the need to define the question of social help and care in the context of rising sciences reacting to these situations. Š. Strieženec states that: „ *...dynamics of the changes, conditions of human life and its social dimension, changes in the environment are so intense that it is shown in the changes of humans themselves. A significant number of people have increasing problems to orientate in the modifying world. There are more and more needs for certain surety, values, constants which leads many authors to compile even a global science about humans."* [9]

***Globalization*[10]**, a worldwide complex process of contradictory (positive and negative) social phenomena creates increasingly more difficult conditions for securing social welfare, solidarity, subsidiarity, everyday security. Not only economy and knowledge are subordinate to globalization, but also experience of pain and suffering. We can also mention the anomic family, in which there is a significant decrease especially in the field of social supervision and thus also its traditional socializing function changes. [11] Marta Kolárová in this context states that "*... women´s paid jobs do not automatically lead to a social strenghtening or gender equality, but it is related rather to the weakened role of men in the family. Even if women work it can cause a crisis in the family and sometimes even violent reactions of men. In a broader dimension they can manifest in nationalistic or fundamentalistic reactions of men who are*

[6] KORZENIOWSKI, L.:. Od ryzyka do systemu./in:/Korzeniowski,L.:(red) Zarzadzanie bezpieczeństwem.Prace Edukacyjne.Kraków:Liport LFK 2001,s.21-26.

[7] Pozri práce: TOKÁROVÁ, A. a kol.: *Sociálna práca.* Prešov: Akcent Print. 2007. 573 p. ISBN 978-80-969419-8-8; MATOUŠEK, O. a kol.: *Základy sociální práce*. Praha: Portál. 2001. ISBN 80-7178-473-7 and MATULAYOVÁ, T.: *Sociálna pedagogika a sociálna práca*. B. Bystrica: UMB. 2000.

[8] Pozri bližšie práce: HOFREITER, L.: *Securitológia.* L. Mikuláš: AOS. 2006. 138 s. ISBN 978-80-8040-310-2; KORZENIOWSKI, L. F.: *Securitologia. Nauka o bezpieczeństwie człowieka i organizacji społecznych.* Kraków: EAS, 2008. ISBN 83-919932-7-2; ZAPLATINSKI, V. M. – MATIS, J.: Bezopasnosť v eru globalizaci. Kyjev: Centr učobovoj literatury. 2010. p.142. ISBN 978-611-01-0146-2 and also MACIEJEWSKI, J.: *Socjologiczne aspekty bezpieczeństwa narodowego.* Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego 2001. ISBN 83-229-2125-X.

[9] STRIEŽENEC, Š.: Poznámky k teórii a metodológii sociálnej práce. *In: Sociálna práca* č.: 3, z roku 2003. p. 49 - 61. ISNN: 1213-624

[10] Pozri bližšie práce: TOKÁROVÁ, A. a kol.: *Sociálna práca.* Prešov: Akcent Print. 2007. MATOUŠEK, O. a kol.: Základy sociální práce. Praha: Portál. 2001. MATULAYOVÁ, T.: Sociálna pedagogika a sociálna práca. B. Bystrica: UMB. 2000.

[11] Pozri bližšie prácu: ONDREJKOVIČ, P. a kolektív: *Sociálna patológia*. Bratislava: Veda, 2001. 297 s. ISBN 80-224-0685-6.

trying to win back their dominant position...“ [12]

Gender differences significantly affect the social roles represented by men and women in the conflict and postconflict reconstruction of the society and the basic infrastructure. Gender differences spring from the cultural, social, economic and political conditions, expectations and obligations within the family and community. The position of specific individuals is also influenced by the role they represented during the conflict – civilians, fighters, captives and tortured ones, medicians and observers, migrants, refugees, orphants or abused victims within the escalating terrorist attacks[13] as insignificant means of violence. Although women often cannot directly influence political decisions that result in armed conflicts, the traditional experience show, that it is them who consequently carry the burden of maintaining the basic functions of society during conflicts. One of the signs of the postwar society is the expansion of civil principles and human rights of the military staff. Thus we may consider the expanded military role of women a sign of a broader historical change from the society focused on a specified status to a society oriented on the output. It also intensifies the acknowledgement of the need to integrate gender optics into planning, suggestions and assigning adequate sources in this field. The contribution of women´s work in the times when most of the men are in the active military position is irretrievable and it contributes to the fact, that there is some education or upbringing towards peace, and that there are solutions to relieving the impacts of conflicts and violence. [14] Anyway they have to play a more active role when achieving peace. The principle of their *„equal participation and full engagement in all activities to maintain and support peace and security“* in line with the resolution of the United Nations Security Council No. 1325 from the year 2000 is not respected and the decisions about the precaution and solving conflicts are often met without the participation of women. The goal is not to replace men´s positions with women, but to extend the possibilities, to use a unique and powerful means by help of which women and men can inspire each other, complement and cooperate in providing security and peace.

CONCLUSION

The basis of a safe life in a multicultural environment in Europe of the 21st century is the education towards tolerance and reverence to otherness, to the empathic interest in solving problems, education towards a dialoge with an open end where there is no loser. Just in everyday communication, in a dialogue with otherness there is a new science rising and proeuropean identity of men and women overcoming the cultural, religious or other ethnocentric attitudes and stereotypes.

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TRENDS OF ACTION OF THE PRIVATE / CORPORATE TYPE OF SECURITY EXPERTISE IN ROMANIA

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Abstract
The private/ corporate security is a field that has inserted itself in Romania, in the last twenty years. The security field, once exclusive and only dedicated to state institutions, became, within the context of a democratic Romania, accessible to private area. This type of accessibility is limited by law and interferes with those components of the security that especially ensure personal security and public order.

Key words*: private security, corporate security, privatization of security, citizen safety.*

1. ARGUMENT

What manifests itself as a visible trend in the recent years, is the assumption of achieving a sequence of security by the private companies. Corporate / private security type has become ubiquitous in all social fields. Privatization of security, within the context of the public-private partnership, or just exclusively private is a process that tends to develop. Taking-over an area of security by the private companies is explainable in the complex security conjuncture that propagates both nationally and internationally.

The costs for the security achievement are very high, and the funds come from state budgets and from international organizations budgets. Therefore, security objectives, programs and projects are set, having a high relevance within the act of prevention and control of aggressions or major risk factors. If the institutional achieved and budgeted security is limited, this means that, in this field, a gap for the private intervention remains open.

Private security does not have the expression, the strength and the scale of the institutionalized security, but by the results and effects it produces, contributes to maintaining a socially optimal. Based on the principle of market economy, the private security has, as a target, the filling-up of the areas exempted by the institutionalized one.

Unlike the intervention area of the state institutions, the private security has a reduced action and spread area.

The area, which is assigned in the responsibility of intelligence services, is kept away from private security interference, because the field requires the organization of some special operations and actions and the use of some secret methods, means and stealths, that can not be used outside their internal legal and normative frame. Also, the activity of these services is a state secret all over the world, the services being themselves the warrant of protecting the secret

information handled or processed in other state institutions or companies of the belonging state.

However, there are situations in which sequences of intelligence services activity is based on the private sector. Currently, it is about those outsourced activities, regarding the logistics line of service and maintenance. From the tactical point of view, the intelligence accepts professional services from the private area only in the situation when there are collaborations for the making of technical means or instruments, which can not be produced by its own possibilities. In some states there are companies that produce technical means for the services, without including in this category those already known as suppliers, who are producing weapons and who are the providers for the specialized market.

The nearness of the private security to the area ensured by the intelligence services will not overcome the barriers mentioned above, another frame of affordability being excluded.

Private security makes its presence increasingly felt in the area of the enforcement of public order and safety of the citizen. Citizen safety is the first level for the achievement of the national security. The state, as an absolute entity in the relationship to its citizen can not provide all the support he needs in terms of a total protection, regarding his physical safety. The state institutions empowered to maintain order and public safety can not cover all the areas where human activities are carried out, and the spaces that require also a certain perimeter delimitation or where evolves activities that may raise the attention of some criminal acts can not be ensured at all times. This uncovered area is taken over by the private security through the companies specialized in maintaining guard, order and protection of urban objectives.

One of the slightly paradoxical situations is the one where the specialized agencies of some states have ensured the guard and the protection of the buildings by the private security companies. This situation was generated by the institutional restructuring and reform processes that led to the outsourcing of some services, because of the relationship cost / expenses – usefulness / benefit. Although it seems reckless to transfer a part of their own security towards operators who do not have similar situational intervention capabilities, the specialized institutions compensate the human guard with the electronic one, able to identify any gap imputable to the human factor. It is true that the electronic systems, although not infallible, are safer than people, who can commit errors or gestures of professional irresponsibility.

The private security intervene into maintaining order and security at the headquarters of the institution where values are handled (financial companies, banks) by providing them with ongoing human guard or electronic surveillance systems, permanent connection systems (those panic buttons).

The security of the big companies is achieved also through the guard and protection companies. Setting up some guard objectives within the premises of these companies is necessary to protect its staff, to maintain the security of the building, in case of the emergence of damage or destruction that can be caused by fires.

Besides, the big companies deal very carefully with the issues regarding their image, and the willingness shown to maintain the order and the safety of employees is related to the security policies, along with the data and the computer networks security.

The private security companies staff is usually trained by former staff who worked in the state institutions specialized in maintaining security and who is able to cope with the tasks entrusted to them: action into the guard order, detention of the offenders until the arrival of the law enforcement agents, description of the suspects distinguishing or of the identification elements of the vehicles they are using. Training lasts a short period of time and its quality is subject to the availability of employers to invest in human resource training.

Private security is also used by an exclusive group of individuals who require

for personal protection through the use of a human security device. In this context there is a point of overlap between institutional and corporate security caused by the migration of the specialists from the private to the public area. This process is increasingly evident in recent years, when the intelligence services face losses of specialists drawn to better paid jobs. The private sector will remain a serious competitor to institutional security, in terms of material and career opportunities, being known the fact that, in this field, criteria for advancement in the hierarchy are more lenient compared to the rigorous ones imposed by the type of military or intelligence organizations. Due to their initial status in structures from the institutional security area, bodyguards are aligned to the highest standards of training.

In the recent years, the military field has interfered at the best with the private security. There is actually an old tradition in the overlapping the war interests of the states armies with those of the groups of mercenaries. There were not few the situations when, driven by the same leader, mercenaries fought alongside with the regular army. The difference between the two categories of soldiers is that the first ones were fighting for big money in the interest of states without being their citizens, while the regular army was composed of citizens of the state, fighting for pay or on a voluntary basis.

The international society condemns[1] today mercenary actions carried out through armed conflict or acts of violence directed to remove governments or to undermine the territorial integrity of a state, by persons that do not have the quality of citizens of that state and are material motivated.

Taking over a section left uncovered in the theaters of operations was allocated to the private domain, these companies legitimately intervene without exceeding the mandate they are entrusted with, are designed to protect the life of important persons and act with the permission or under the aegis of international security organizations.

2. PRACTICE OF PRIVATE SECURITY EXPERTISE IN ROMANIA

Romanian application reproduces to a smaller-scale the Western models specific for this field. The private security companies in our country have been released with some force on a market with many opportunities. In the first years of market economy, the field has been practically invaded by guard and security companies. In time, due to demand and offer, some of them disappeared, managing to withstand only those who responded as expected, to the demands and needs of beneficiaries. Another cause of their disappearance was due to the liquidation of some state-owned companies, which represented an important category of clients.

Private security companies operate and act in accordance with Law no. 333 / 2003 on the protection of objectives, goods, values and protection of persons and on Methodological Standards adopted by GD nr. 1010 / 2004 and GD 935/2007. In order to operate, the favorable opinion of the Romanian Intelligence Service is needed, RIS being the national authority in this field, and the operating license is assigned by the Police. These structures must comply with the legislation, within the limits of the following activities: guard of the objectives, goods and values, and also consulting

[1] *The International Convention against Recruiting, Use Financing and Training Mercenaries, adopted by the resolution no 44/34 from 1989 of the UN plenary meeting*

services in the field; guard of transport of goods and valuable assets and consulting services in the field; specialized personal protection, called bodyguard and consulting services in the field.

Duties are limited and designing specific tasks for each job is mandatory, staff must have a moral profile correspondent for performing security guard duties, exceeds of competences are prohibited by law and conditioned by notifying the state agencies about any criminal events or facts connected to the guard service operation.

Guard and protection companies in our country have become a ubiquitous presence within the security field. The main beneficiaries of these companies are other types of private companies or state institutions. Romania (developed countries in the world are no exception) can not afford expanded citizen's protection expenses. The citizen is, in many situations, vulnerable in front of aggression carried out with violence, which puts his life, health, honor or dignity at risk. In the day-to-day space citizens are evolving, conjunctures are created, or they might reach areas with high danger potential, that can be life threatening.

State order forces that enforce public order and security, the Police and the Gendarmerie intervene in the public and domestic space in accordance with the powers conferred by law. One of the methods of ensuring a normal social life climate is the preventive type of intervention by the presence of specialized structures in places and areas where crime is more suitable to occur, or where favorable conditions for committing antisocial acts against persons or property are created. But because the number of personnel is limited and its area of competences is strictly limited, the necessary support for the intervention of private security companies is created.

The security companies in our country execute guard and protection missions into the state institutions whom prevalent activity involves the public, in which educational processes are organized and not least into military units. If, regarding the civil institutions of the state, the presence of the guard agents could be explained, in the second case, their working situation seems slightly unusual. What seemed to be impossible a few years ago, today already has an ordinary day-by-day character, this appearance being facilitated by the Romanian army reforming and restructuring process, which has facilitated the outsourcing of some services. The first of the outsourced services were those in the logistics field, the second category of activities being the guard ones. Army's trained staff is considered to be overqualified for the performance of the guarding missions, missions that would not need to be ensured by trained soldiers, fitted for other purposes.

This category of services is ensured according to the law, which provides private security a certain degree of freedom in the relationship with this institution of the state, subordination occurring only in specific cases. Guard and protection agents that guard the military units are not directly subordinate to the MND officers, but indirectly, and only in cases of major force. Thus, the guard agents report to a foreman, who, at his turn, will be subordinated to the officer on duty, but only in cases of fire or disaster; in case of imminent military action against the military objective for the destruction of hostile forces penetrated into the objective and for its freeing and for preventing a terrorist action. Guard companies should only take measures to limit the losses produced during special events. Military units have the obligation to provide to private companies the information that they have requested and are necessary to for fulfilling the contract.

Private security companies in Romania are as well exercising their powers in the benefit of companies belonging also to the private sector. These need protection to ensure the integrity of their premises, the security of staff and operating values. Companies that handle values are exposed to the serious risk of becoming targets of some criminal groups, which are organizing actions that have robbery as a final purpose. As a result of the economic degradation in Romania, during 2008-2011, numerous crimes of robbery or theft were consumed in

order to obtain the amount of money held by the financial companies. These antisocial demarches were completed, in most of the cases, money being stolen in national or foreign currency. Removal techniques have been aggressive, violent, and the perpetrators were armed. Until the arrival of the police forces at the crime scene, the perpetrators succeeded in disappearing, leaving behind material damage or casualties.

As a result of the rising poverty due to economic deterioration, such hold-up actions will be increasingly present in the cityscape. This type of crime is somehow unusual for Romania, where the robberies or rip-offs were done in darkness and in the absence of the employees. Case law reveals the acts take place more and more visible, towards the end of the working hours, when there's a peak of installments.

The manifestation of crime in this field of activity is also due, to a certain extent, to "victim" societies, which, by not taking any specific measures to protect the values, facilitate their consumption. Imposing a certain control over these problems can be done through the private security contribution, but also through the share of the concerned beneficiary. The level of professionalization of the private security companies in our country has to be continuously increased, since not all of them amount to the high standards of exactingness regarding the staff training. Although, in almost all cases, the assignees of the companies management are professionally overqualified in the field and have professional expertise gained while in the special services, not the same thing can be said about all the employees. In order to resist in the market, the companies promote themselves asseverating the professionalism criteria and the good references that they've received from the satisfied customers, related to the provided services[2].

Another way of providing the private security expertise is the one internationally driven. A segment of the private security in Romania participates to protecting officials, institutions and convoys in conflict areas missions.

3. CONCLUSIONS

In Romania, compared to other countries, the private security sector finds itself in the first phase of its evolution. Certainly a not too distant future will bring new opportunities to this field, and the enforcement and intervention ability and will be increasingly applied.

For sure, the privatization of security will become a priority for the democratic states, considering that along with the decrease of some high costs, a transfer of the involvement and also one of the civil companies' accountability towards this field is realized.

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[2] *The specialized companies that we present, without claiming the list to be complete, were selected according to the advertisement materials they realized and promoted: STARGUARD SECURITY; TEAM SRL CARPAT GUARD; RPG SECURITY ; SYKORA GUARD GRUP; SC PROROM; GUARD SECURITY; COMPANIA DE PAZĂ ŞI SERVICII EUROGRUP; ASTRA NOVA SECURITY; CLASIC GUARD SECURITY; BARTGUARD SERVICES SRL; REGENT SECURITY SRL; CALDO PRIVATE SECURITY.*

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WOMEN'S CONDITION IN MILITARY INSTITUTIONS

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This paper aims to explore the condition of women in military institutions. In spite of the numerous reforms this has not improved, women continuing to have only a formal role in the army that is limited to office tasks.

One can identify some theories regarding women's role in the army: the feminist anti-militarist theories which reject the women's entrance into the army, the militarism masculinised theories which also reject this option for women and also, the gender equality theories which supports the entrance of women in military.

This paper focuses on the last type of theory, which argues that in contemporary society gender equality is an objective which should be attained. Under these circumstances, there is no basis on which women should be denied entrance to the military. International organisations like NATO and the EU, have adopted some directives which encourage national states to include and offer equal opportunities for their female personnel.

***Key words**: military institutions, gender equality, feminist theories, militarism theories*

• The association of women with peace

Throughout human history women were associated with peace and men with war in most cultures. By deconstructing the war discourse, Elshtain is highlighting that it constructs stereotypes for both men and women. Men are seen as Just Warriors and women as Beautiful Souls. [6] Men are both subjects of war but also its narrators, while women should remain in the private realm and, through their statute, are the reason for men's wars [16]. Feminists have argued that by using a very technical discourse, these theories do not take into account human lives and thus, women's role should be to offer a moral perspective on war. [6]

Elshtain was the first author to point out that women's association with peace and men's association with war is not a good strategy for any of them. These stereotypes disadvantage both pacifist men and warrior women [6], by claiming that women's place is in the private realm as non-combatants and that men's role is to be warriors. "The pervasiveness and trans-cultural persistence of this imagery are well documented and reveal the extent to which male and female identities have been forged around the matter of collective violence". [4] Thus, these stereotypes express "a symbolic rupture with the dominant gender order based on the separation of male and female". [4] However, one can observe that the myth of the Amazons is one of the oldest examples of maintaining the gender order, and another example from contemporary society is that of kamikaze

women. If the Amazons are depicted like "heroines, but very unnatural, masculine and thus, marginal to the accepted condition of women" [4], kamikaze women are a transposition from our society of unnatural, crazy, outsiders from the viewpoint of the accepted gender order.

The violence of kamikaze women's action destroys the idealized image of women, imposed through the gender norm. Women had been labelled as being just Beautiful Souls, incapable of committing such atrocities. Thus, their lack of obedience to the rules of gender entails the disapproval of the entire society, not only for the severe consequences of such actions, but also for daring to challenge the society gender order. The idealized pattern imposed on women by the gender norm determines their socialization to become pacifist because of their female specific experiences. Women are educated to be pacifist, to take care of others, to conscientiously fulfill the roles of wife and mother, and certainly not to unleash their unexpected anger into organizing mortal attacks.

There are two assumptions concerning the kamikaze women's responsibility. If the discourse of Islamic groups holds that kamikaze women completely agree with their actions, demonstrating that they enjoy the same degree of equality as their men peers, the occidental discourse criticizes such actions precisely because it holds that such Islamic groups are using women's lack of decision ability and their naivety to develop such operations. [1] Either in academic studies or in media news, the decision of women to become kamikaze is seen as coming from a wish to be relieved from a traumatising life with sexual abuse, rapes, and all sorts of abuse towards women taking place in an extremely patriarchal society. [1, 18] Even if their declared objective, according to these women's discourse, focuses on political, national and religious issues, mass media keep depicting them under the sign of the private realm. [15] Thus, the emotional overcomes the ideology, their actions are explained by others as being caused by the corruption of the private realm. Because of such approaches, women are not blamed, but are deemed incapable of imposing their own opinions on the political agenda.

In conclusion, if their actions are not considered as being their own decisions, one cannot consider them as having any effect concerning the evolution of events at the international level system. [18]Denying their responsibility for terrorist acts represents in fact the denial of their agency and autonomy in making deliberate political decisions in a certain socio-cultural context. Thus, if one cannot accept the agency and the responsibility of these martyr women, the stereotype of women being innocent, powerless and in need of protection remains, and as we will see below, this affects the agency of other women, those in the military. [15]

- **Theoretical assumptions concerning the role of women in military**

- **The biological theoretical model**

The idealized image that women are peaceful was that who kept women outside military institutions for a long time. There are several approaches concerning women's role in such institutions. One of the approaches holds that biology plays still a very important role in defining the degree in which women should have a contribution. The biological theoretical model, agrees with a gender order which demands women to be peaceful and man warriors. Thus, because women are birth and care givers, they should be empathetic, care takers and in need of protection. Men, instead, are demanded to be very strong physically, to have a certain level of aggressiveness and to be very protective. Men's aggressiveness is justified by the lack of reproductive capacities and for that reason violence is considered to bridge the biological gap between women and men. [14]

This theory is embraced by certain theoreticians, either feminist or not. Thus, the argument is that the "warrior power to destroy

and kill" is proportional to women's power to procreate. [14]

If non-feminist theoreticians, the masculinised militarized theoretician, consider that biology is a very important factor, holding that women's lack of adequate capabilities should not allow them to enter into military institutions or to have a formal role, feminist theoreticians argue that women's capacity to reproduce determines them to have a less favorable attitude toward fighting in a war. Even though Elshtain has criticised the traditional roles, she does not support women's admission in the army, arguing that they will only represent a trophy and not achieve real power as they believe they will [6] Ruddick, even if she argues that women can be more peaceful than men because of their specifics experiences, considers that the association of women with peace is rather dangerous, explaining that men too can develop a "maternal thinking". [12] Constructing a maternal thinking is the road to reconstructing the military approaches and thus, to reconstructing the concept of peace. [11]

As we can see, the theoretical biological model assumptions, by being based on different biological characteristics, ignores the socio-cultural factors which determine the construction of female and male personalities and body structures. This model is not reliable because it assumes that women are inherently peaceful, an assumption which was demonstrated untrue through time. Women have always had a role in wars, examples including kamikaze women or women fighting along men in wars as in Vietnam or El Salvador. Another eloquent example which enforces the idea that women are not inherently peaceful is the well known situation when women's anger and aggressiveness manifests into violence of women against their children. [11, 16]

There are feminists which, agreeing that there are biological differences between men and women are different, argue that there are however several socio-cultural factors which contribute to the development of different types of roles for women and men. If the non-feminist theoreticians take into account only the biological characteristics, the feminist ones consider also the socio-cultural factor along with biological ones. Some feminists, even if they argue that women's different biological characteristics and different socialisation could determine important changes concerning the design of military approaches, do not approve of women's entrance to the army, holding that their role would be just minimal and that men will always feel the need to protect them by condemning them to office tasks.

- **Segal model regarding the role of women in armed forces**

Mady Segal had developed a systematic theory about the role of women in military institutions (1983), a model which was extended in 1995. Her model highlights a theory concerning the variables which determine a low or high level of participation in military affairs throughout history and across nations. She is interested in a set of three variables: Military, Social, and Culture. [14] "The Military dimension consists of those characteristics of the nation's security situation and aspects of military organization and activity that affect women's roles. The Social Structure category includes aspects of women's civilian roles and more general civilian social structural variables that affect women's roles. The Culture dimensions concern the social construction of gender and family roles." [14]

Segal points out that national emergency periods favour the entrance of women in

military institutions. However, after that period is finished, women's role is not adequately appreciated and the contribution of women is forgotten. There is therefore a process of cultural amnesia affecting the contribution women made during emergency situations. In the aftermath of war, women's military activities are reconstructed as minor (or even nonexistent), allowing the culture to maintain the myth "of men in arms and women **at** home". [14] Contrary to this situation is that of developed societies, that have a high standard of living and a low rate of threats to national security, but in which prevailing cultural values support gender equality and in whichwomen's participation increases. The author offers the examples of Canada and Sweden. However, if there are periods with high rates of unemployment, then women's access decreases because men usually tend to apply for such jobs. [14]
The author holds that if the level of gender equality is high then the distribution of family tasks enters military institutions. [14] The development of technology also allowed women to have better opportunities in the army, changing the face of war.

Segal's model highlights very well the variables which played an important role in modifying the condition of the military along the time and her model become a very reliable model for the analysis of many countries, even of those outside the EU and NATO. [9]

2.3 The gender equality model

Theorists like Tickner and Charlesworth reject the association between women and peace and oppose the anti-militarist perspectives holdingeither that women are more peaceful than men because of their womanly experiences [12, 6], or because of their different socialization in the spirit of cooperation and interdependence [2]. The two authors believe that such arguments serve to perpetuate the myth of „protector-protégé", implicitly excluding women from the decision-making sphere regarding the defence policy. Thus, focusing on the concept of 'citizen defender', Tickner argues that if both women and men are defenders, feminist values such as cooperation and interdependence should be found in the defence conception.

Tickner has added some important criticism to traditional theories, holding that it is neccesary to also value women's role in mantaing peace and in promoting security, not only that of soldiers and officials. [17] Thus, this author has argued in favor of some institutional changes, including women's access in the army and increasing their role in achieving sustainable global peace, arguing that women can offer a different image on war from their position as mothers, wives, and defender citizens. [17] She has also criticised the concept of citizenship, considering that it is imbued with a hegemonic view on masculinity and correlated with a devalued feminity. The social construct of devalued feminity determines the perpetuation of the"protector/protected myth", a myth that has allowed men to protect women because of their presumptive vulnerabilities. [17]

Tickner argues that a feminist perspective which values the relational universe could contribute to the reconstruction of the concept of security. Thus, she argues that a security approach which relies on the insecurity of other states cannot determine sustainability. A feminist approach to security will not consider an abstract state as main referential, focusing instead on the human beings. [17]

In pursue of gender equality, Charlesworth criticizes the gender perspective adopted by international documents regarding women's condition in conflict. The author deconstructs the UN approach, considering that the premises for a sustainable security cannot be based on the association of women with peace in light of their womanly experiences. [5] Thus, it is necessary to develop a defence approach based on values favouring gender equality and not just to provide for a specific number of women in the institutions empowered to ensure peace. Consequently, feminists consider that women's status must be improved in order for them to have an important role in shaping the defence concept according to their own values. Also, the author underlies the need for correctly transposing the "gender" term and not only

trying to associate it with feminity. She observes that United Nations documents contain an institutional orthodoxy concerning the association of women with peace.

According to the studies conducted by Caprioli (2001) and Carreiras (2007) there is an obvious correlation between the gender equality level of a society and the measure of gender equality in military institutions. [2, 4] One can find: the assumption that women have a higher role in developing and sustaining peace, the use of a language of "special needs" referring only to girls and women, the open suggestion to include women in the formal process of peace because of their skills towards pacifistic policies and not in the name of gender equality, the addition of references to the feminine when a gender perspective is presented. [5]

Concerning this type of assumption, that gender represents the feminine, it is also to be found inthe 1612 (2002) and 1820 Resolution (2008). „The last one focuses on sexual violence against women and girls", without considering the possibility that men and boys can also be harassed. [3] All these resolutions, UN1325, UN 1612 and UN 1820 highlight the connection between women and peace, and are trying to propose a gender perspective in all operations concerning the maintenance of peace. [7] The type of essentialism advanced in patriarchal societies is also present in international documents which aim to eliminate gender inequity, which in turn leads to the reduction of women's capacity and opportunities to gain power in decisional spheres.

The gender equality model focuses on equal rights for both women and men. Thus, without favouring one or another gender, this approach helps in attaining the principles of a just society.

- **NATO and UE role in promoting women's role in military institutions**

Women's entrance in military institutions was a result of either human logistical needs in a certain period, or due to the structure or the characteristics of armies caused by different cultural systems or by the economic or political characteristics of the society which accepted women in the armies. [4] Maria Gomez argues that, although now the military system is a plural one, we can identify some common characteristics which favoured the process of recruitment of women, like the professionalization of armies and changes in the traditional type of war. [8] These characteristics have removed some of the existing prejudices on low physical capacities, on psychological and biological issues, or the belief that women are morally superior and thus cannot fight. (Gomez, 2008: 32)

Carreiras identifies also as important factors the role of global pressure towards attaining gender equality in general, and the role of NATO, through the Committee on Women in the NATO Forces (CWINF), in advancing the military institutional system need for recruiting women. [4]

The European Union also had an important role in attaining gender equality. Being concerned with social cohesion, equal opportunities, gender equality, the European Union can be an important partner for those who are fighting against gender based violence. Its „feminine political culture", which is characterized by democracy, confidence and participation, could provide a good support for integrating gender in the mainstream of security approach and, consequently, for constructing a perspective more inclusive of women's interests in this field. [10] Thus, in the author's opinion, these two factors represented "a minimum (but operative) common denominator that

produced<comparable> effects in terms of cognitive models, policy orientation, and formalization of behaviours". [4]

Gomez proposes a taxonomy concerning the degree of inclusion of women in military institutions. [8] Thus, there are countries which did not impose any kind of restrictions, where women have total access to any position (Norway, Spain, Finland, Sweden, Switzerland), countries which do not allow women to perform on submarines (Germany, France, Italy, Portugal, Poland, Hungary, Romania, Bulgaria and Belgium), states which have imposed restrictions concerning access to certain positions, mainly the ones which refer to first line combat positions (Holland, UK, Turkey), and a last type, represented by Russia, where women hold functions correlated with the necessities of a period or another, for the moment having access only to certain positions. Gomez mentions Romania too in the category of states which do not need to improve the status of women in the military very much, and thus, do not need to adopt special policies for solving the problemof reconciliation between family and professional life.

Carreiras holds that thereare mechanisms which have an important effect of restricting or conditioning women's representation. Thus, rank restriction is a mechanism that in certain countries, which do not have a volunteer system but a compulsory one, lead to women not being recruited in certain positions. Thus, in these positions women were also not promoted. One can mention: Poland, Hungary, Check, Greece and Turkey.

A second type of mechanism which has a role in restricting the representation of women consists in the establishment of a maximum ceiling. The influence of "ceiling glass", in states which have internal conflicts, without a volunteer system of recruitment and without being under pressure for attaining a gender equality agenda, allowed women to enter the military only in a certain percentage and thus, limited their opportunity to promote in this kind of positions. The author provides the example of Greece and Turkey, where there is a 10 % quota, or 4 % quota of accession to military academies. Italy also imposed such a quota, although in its case it could be explained by the recent introduction of the volunteer recruitment system [4]. Analysing these types of mechanisms in relation to Romania's situation, one can observe that even if in Romania there is a volunteer recruitment system since 2007, the Romanian system is not similar with the Greek or Turkish ones. Also, although the introduction of the volunteer recruitment system was almost simultaneous in Romania and Italy (2001 for Romania and 1999 for Italy), the ceiling glass mechanism was applied. Its use contradicted all the expectations of above presented models, concerning the fact that the adoption of a volunteer system should have extended the inclusion of women. Imposing such a maximum glass ceiling limited the process of inclusion of women in these institutions, so one can speak about a limited representation. This limited representation also includes a lack of decision-making power of women on the defence design and the on the way their status should be improved.

• Conclusions

It is important that women are seen as real actors in achieving security, women's access to the military not being sufficient for achieving gender equality and sustainable peace. In order for women to be real "defender citizens" and to promote their values and interests in the defence policy, it is necessary to also promote policies which will change the perception on gender roles, will help promote women to decision-making positions and will create strong institutions to prevent and sanction prejudiced attitudes and discrimination.

I argue that women's access to the military should not be restricted, but that ensuring only that there is a specific number of women in these institutions is not enough. In order to improve their status and to propose their own perspective on security, women have to gain real power. Romanian women continue to have only a formal role in the army, limited to office tasks, which prevents the transposition of their own values and interests in the defence policy.

I have based my conclusion regarding the merely formal role of women in the army on the fact that the army is still a patriarchal institution governed by masculine values such as violence and aggressiveness, in which women's role is limited to administrative jobs. Given the fact that women are birth and care givers and that they have been socialized differently from the men, they are seen as vulnerable, peaceful and in need of protection. Thus, the patriarchal military institutions have chosen to protect them by condemning them to desk jobs. The patriarchal society and institutions, which have imposed gender differentiated roles, are responsible for preventing women's accession to top level jobs in the army, thus denying theirs right to contribute to the construction of a gender balanced defence policy.

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SECURITY RESEARCH AND NEW REQUIREMENTS ON EDUCATION AND TRAINING

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Abstract
The contribution speaks about results of research in the area of security research. Research was performed within soldiers of Slovak Armed Forces, participants in missions abroad with accent on missions in Afghanistan. The topic of research was focused on evaluation of environment – terrain and urban terrain, threats from potential enemy and applied attack means. Outside a lot of important information from different fields, the research shows requirements on new system in education and training. The article refers according these results about new possibilities in education on Armed Forces Academy and the same in training on Military training centre of Slovak Armed Forces.. In conclusion shows on new computer and software possibilities to increasing of safety participant of missions.

Key words: *operation, mission, research, security, threat, training, hazard, evaluation.*

Military - political situation in Afghanistan is still unstable. Oposite of increasing of political activity USA and European partners, military support from USA, NATO and other countries, in this region go badly to create stabil, peaceful environment, rather vice - versa. It confirm commanders missions massages from 2010, where especially in second half of the year comes to violent accumulation of activity and incidents from native militant parties. When we look at incidents schedule in the first and second part of the year we can see increasing of incidents nearly to 100% (tables 1 and 2).

Units of Slovak Armed Forces forced in two provinces - Uruzgan and Kandahar. Period with increased militia activity against the forces of ISAF was particularly marked during MUSHTARAK operations in Helmand province, which is directly adjacent to Kandahar province. The worsening security situation subsequently occurred in the months August - September 2010, what was reaction of the rebel troops to HAMKARI coalition operation in Kandahar province, when the frequency of attacks on ISAF unit was steped [1].

Tab. 1 Overview of incidents during the rotation of December 2009 – June 2010

Month	**Number of incidents**	**KAF**	**Tarin Kowt**	**Deh Rawood**
December	5	2	2	1
January	6	6		
February	10	10		
March	3	3		

April	6	4	2	
May	12	8	4	
June	6	6		
Together	**48**	**39**	**8**	**1**

The most serious threat to members of the SLOVCON ISAF unit was ground attack on the base KAF-executed suicide rebels of 03.08.2010, which was preceded by a series of rocket attacks. The biggest threat to ISAF units represented an IED (improvized explosive device) fired at a distance, so VBIED (vehicle born explosive device improvized), rocket attacks , IDF (indirect fire) on the bases of coalition troops, and occasional SAF (small arms fire), but these were the exception[2] .

Tab. 2 Overview of incidents during the rotation of May 2010 – December 2010

Month	**Number of incidents**	**KAF**	**Tarin Kowt**	**Deh Rawood**
May	1		1	
June	18	15	3	
July	17	17		
August	10	7*	3	
September	29	27	2	
October	4	4		
November	4	2	2	
December (to 9.12.2010)	1	1		
Together	**84**	**73**	**11**	**0**

* KAF Rockets attack útok + ground attack on KAF base

Against this background, at the participants of mission 2010 ISAF was performed a search, which was a continuation of research in the SIMS project and should supplement the information obtained from search of participants ISAF 2009, partly presented at the conference AFASES 2010[3]. From listed reasons was processed list of questions, whose contents was consults with some participants of missions the first of all with some commanders.

Just safety margin of participants regarding antiactivity of enemy was expressed by four grades ,VP - threat with high probability,NP - threat with lower probability,OZ - rarely threat , BO - without threat.

Look like threat means were appreciated: Piloted means , Unmaned means, SHEL - - rockets G -G, artilery grenats, mortar firing, grenats, firing by light weapons sniper rifle, supported load, ridden load.

The way of respondents threats by the effect of enemy

To the 11 way of threats respondents expressed in whole 308 times. From the whole count 308 threats not at single time were threats by manned aerial vehicles and unmanned aerial vehicles(Figure 1).

In 3 cases expressed about threat with high probability by rocket ground - air, it was 1% from all threats.

In 76 cases, more frequently from all threats were expressed about threat by rocket ground - ground, it is 24,7% from all threats, from that 61 cases ranked like threat with high probability 19,8 %, 12 cases like threat with lower probability 3,9 %, in 3 cases ranked threat like rare threat 1 %.

In 23 cases respondents expressed about threats by artillery grenades and it is 7,5 % from all threats. From that 18 ranked threat with high probability 5,8 %, 3 like threat with lower probability 1 % and 2 cases (0,6 %) like rare threat.

In 30 cases respondents expressed to the threats about mortar fire, it is 9,7 % from all threats. From these 24 cases were raked like high threat 7,8 % and 5 cases like lower threat 1,6 % and 1 case (0,3 %) like rare threat.

In 12 cases respondents ranked threats by grenades, and it is 3,9 % from all threats. From that 11 cases were ranked like high threat 3,6 % and 1 case like lower threat 0,3%.

In 62 cases were ranked threat by fire with light weapons, it is 20,1 % from all threats. From that 50 cases, 16,2% were ranked like high threat, 11 cases, 3,6 % like lower threat and 1 case (0,3 %) like rare threat.

In 30 cases respondents ranked threat by sniper rifles, it is 9,7 % from all threats. In 20 cases, 6,5 % were ranked this threat like high and 10 cases, 3,2 % like lower threat.

In 42 cases were threats by carried explosive, it is 13,6 % from all threats. 39 cases were ranked like high treat, it is 12,7 % , 2 cases like lower threat 0,6% and 1 case (0,3 %) like rare threat.

In 30 cases were threats by ridden explosives, it is 9,7 % from all threats. 29 cases were ranked like threat with high probabilities, it is 9,4 % and 1 case (0,3 %) was raked like rare threat.

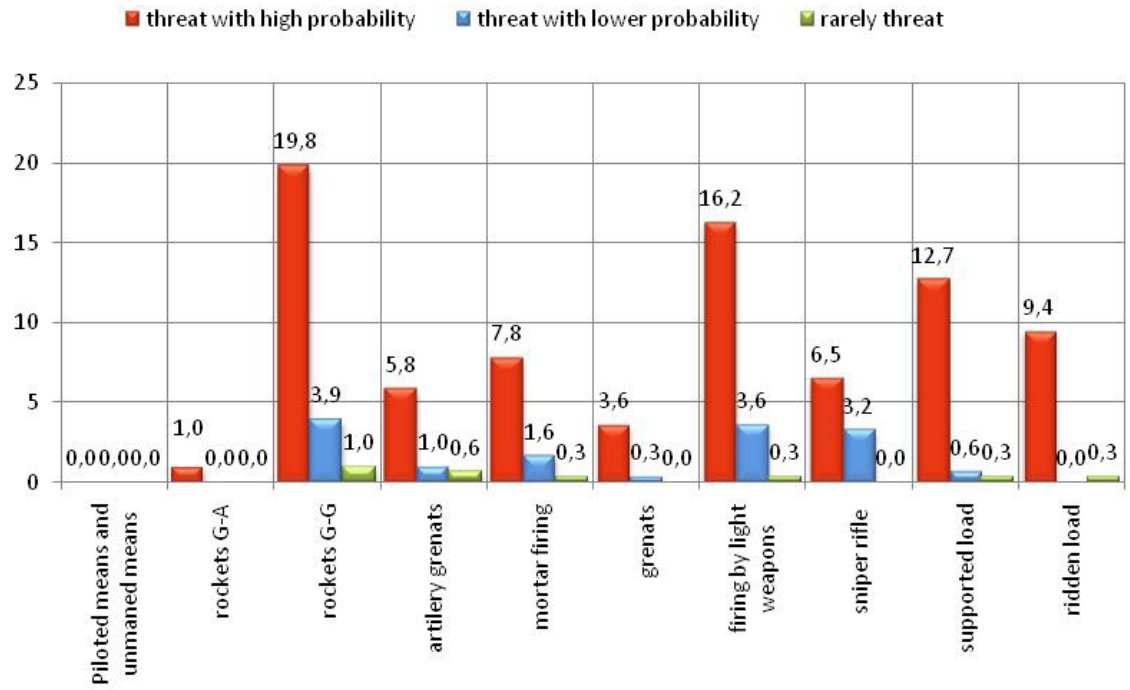

Fig. 1 The way of respondents threats by the means of enemy.

Very interesting is ranking of enemy effect, where were ranked 6 way of enemy activity on respondents (Figure 2).

From whole count 308 ranking were value effect numerous groups over 10 persons in 14 cases 4,5% from whole count, from that 11

cases, 3,6 % like high threat and 3 cases, 1,0 % like lower theat.

To the treat by groups up to 10 people expressed respondents in 78 cases, it is 25,3 % from whole count, in 60 cases, 19,5 % this threat were ranked like high, in 15 cases, 4,9 % were threat ranked like lower, and in 3 cases, 1,0 % this threat were ranked like rare.

To the threat by the individuals expressed respondents in 104 cases, it is 33,8 % from whole count of threats in 87 cases, 28,2 % were this threat ranked like high, in 13 cases, 4,2 % like low threat, and in 4 cases, 1,3 % like rare threat.

Threat by snipers were ranked in 20 cases, it is 6,5 % from whole count. In 13 cases, 4,2% were this treat ranked like high, in 7 cases, 2,3% were this treat ranked like low.

Treat by suicide bombers were ranked by 72 cases, it is 23,4 % from whole count of treats, from that 68 cases, 22,1 % were ranked like high treat 2 cases, 0,6% like low treat and 2 cases (0,6 %) were treat ranked like rare.

Treat by random attacker were expressed by respondent in 20 cases, it is 6,5 % from whole count of threats, from this 16 cases, 5,2% were ranked like high treat and 4 cases, 1,3% like low threat.

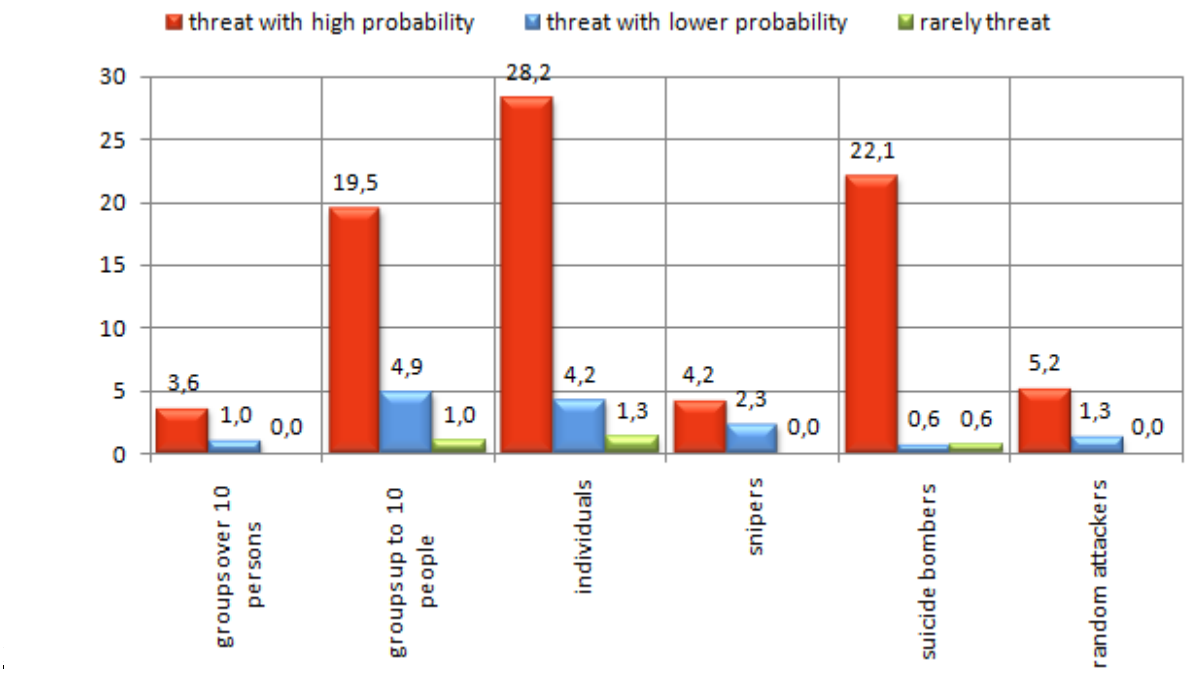

Fig.2 The way of respondents threats by the effect of enemy.

From the whole threat respondents like the main threat possible use rocket ground - ground (more than 24,7%) even though they met only twice, from the way of possible consequence at them evokes feelings higher dangerous. Till the big distance follow threat use light weapons (20,1%) and use explosive with continuity with activity of suicide bombers (23,4%). It is possible to predict, that the way of the treat we can accept with 100% certainty. It is possibility interchange of threat; let us say right inestimable using tools of attack (interchange rocket ground-ground by artillery grenades). In some cases can be valuation or revaluation using of attack tools, for example propagation of messages (mass psychology). For rocket were marked not only regular weapons system, but local produced instruments, which in the way of traffic on the target fulfill vision about flying rocket.

From the ranking follow that, the enemy effect were first of all by individuals and by the small groups (till 10 persons). To the

individuals (104 expressions) add effect by the random attacker (20) is this gap higher. Small groups arise in ranking in 78 cases, on the third place with 72 cases is threat by suicide bombers.
All these information we can use in knowledge database and threats database in SIMS tool. Concrete in identification of hazard and in assessment of hazard.

Identify Hazard

To identify a hazard, the amount of time available for the task must be determined. This process can either occur as the first step in the process or later. It appears that this task is performed continuously at different steps within the process [4]. The first main step can thus be considered as analyzing the mission. This typically involves gathering and synthesizing information from a variety of sources, such as the commanders' guidance, the commanders' intent, and other data to obtain a better view of the overall mission, that is, to obtain better situational awareness of the mission. When the goals of the mission have been analyzed, respondents in general followed an METT-TC approach to identify the hazards, that is, Mission, Enemy, Terrain and Weather, Troops and support available, Time available, and Civil considerations(Figure 3)

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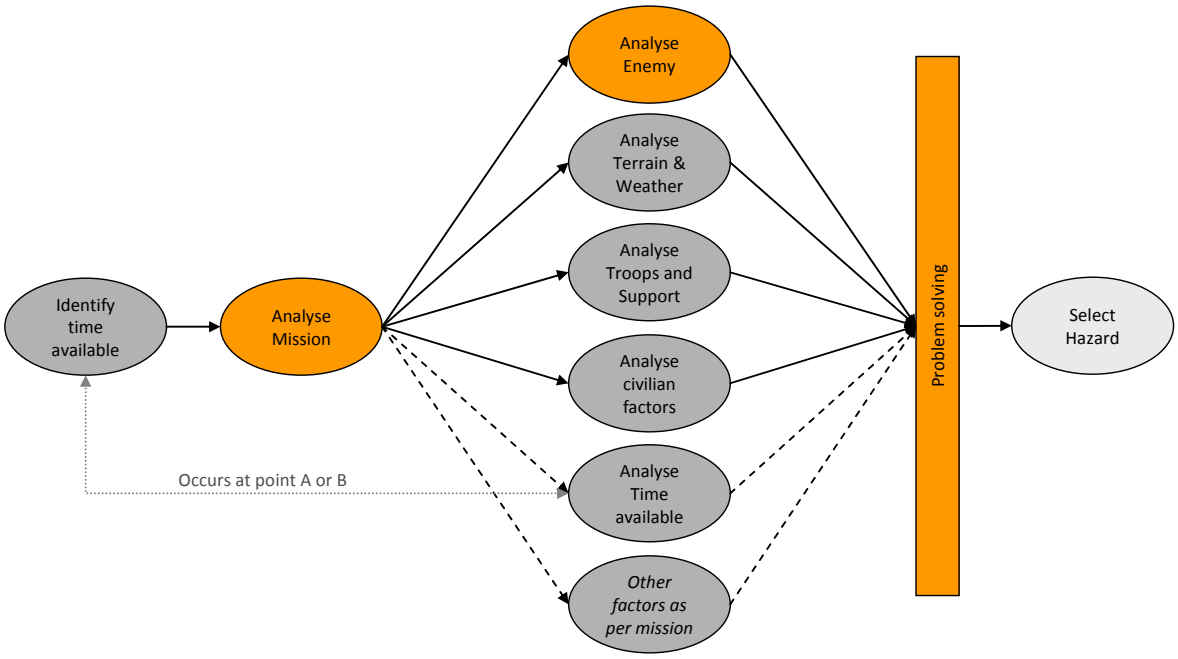

Fig. 3 Task Diagram for Identify Hazard

Assess Hazard

After a hazard has been identified, the 'importance' of this hazard must be assessed. From the responses, a four step process for assessing hazards emerged as presented in the figure below (Figure 4). The first, the probability of the threat occurring is predicted together with an estimate of the severity of the threat. These two steps can occur in either

order and are equally important. Once the probability and severity of a threat has been predicted, the various threats are prioritized. The process of prioritizing threats occurs iteratively with a gains-versus-loss analysis that is performed for each potential hazard. The gains vs. loss analysis involves determining for each hazard, how much effort/resources must be directed towards mitigating a potential threat, versus the cost involved in doing nothing. On the basis of this iterative prioritization and gains-loss analysis, specific risks are selected for which a control must be developed.

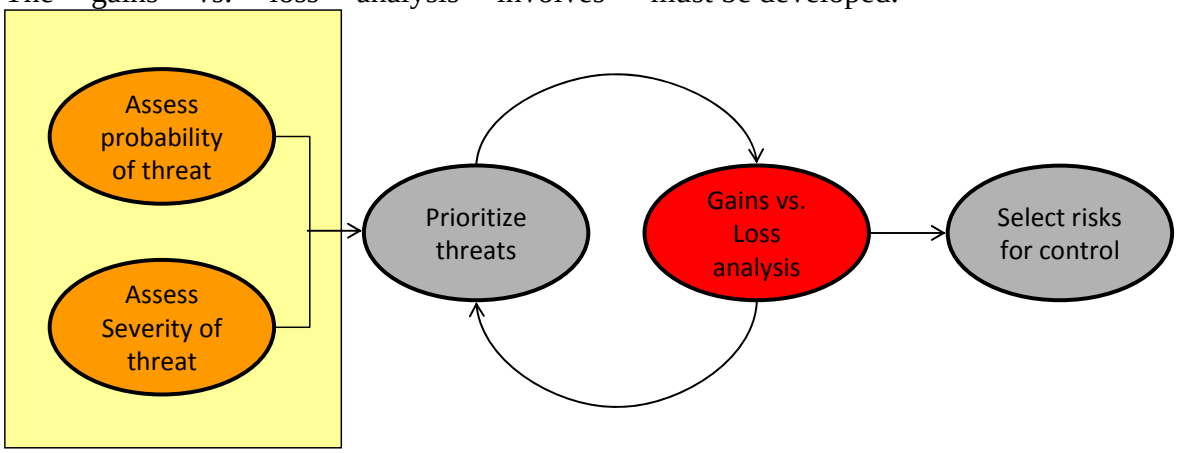

Fig. 4 Task Diagram for Assess Hazard

All these information have to find the place in improvement of preparation and training participation of missions [5].

Training

- The system has to provide two kinds of training: training for the use of SIMS and training and mission planning (Figure 5).
- The system must support training the user for planning at operational and tactical level.
- The system must support training the user for execution mission at operational and tactical level.
- The system must provide guidelines and methods for training associated to the mission planning for asymmetric threat defense.
- The system has to provide training for creating plans, depending on the user role in the planning process for each level (e. g. logistic, force protection).

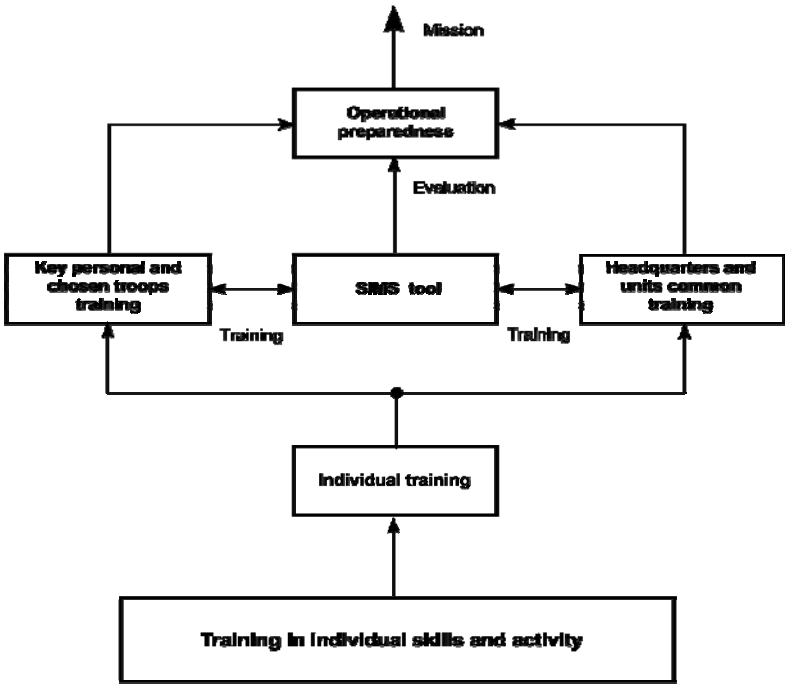

Fig. 5 SIMS in training.

- The system must provide different modes of training.
  - The system has to provide the exercise mode (possibility to correct and without time limit).
  - The system has to provide the test mode (limited time without correction).
  - The system has to allow conducting individual training courses.
  - The system has to allow conducting training courses in groups.
- The system must provide integration between training methods, tools, etc in order to provide a common training environment.
- The system has to provide hints on every stage of training.
- The system has to provide simulation environment for training.
  - The system should support dynamic changes in the tasks included in the plan.
  - The system should support dynamic changes in the tasks included in the plan in real-time mode.
  - The system should support dynamic changes in the tasks included in the plan in accelerated mode.
  - The system should support interactive simulation.
- The system should provide methods for evaluating the training.

Conclusion

The SIMS project with all parts - research activity, threat and knowledge database, computer tool for planning, execution and training for mission have to have only one basic idea - improvement of mission participant's safety. For recency using information we have to up-to-date change information in knowledge database. From that reason is research in army - participation of mission very important and it has still place in history, present time and to future too.

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APPLYING THE HUMANITARIAN INTERNATIONAL LAW IN DESTRUCTURED INTERNAL CONFLICTS

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ABSTRACT: *Destructured conflict represents situations in which state structures are disintegrated because of a local armed conflict in such a measure that they are unable to apply power and supply minimal public service, that is, to make sure international humanitarian law is applied. Such a situation is not stipulated by the UNO charter, so the Security Council needs to intervene for peace enforcement and has to assume functions and political, judicial, military, policing, and humanitarian authority. In such situation, humanitarian operations imply, beside humanitarian assistance, compensations for the deficiencies of the state or for the consequences of its collapse and UNO multinational armed forces have to rely on a clear mandate in order to enforce their intervention.*

Key words *Destructured internal conflict, international humanitarian law, UNO charter, Security Council, mandate, human rights.*

The UNO, its main concern being that of "*relieving future generations of the scourge of war*", has created its own mechanisms and methods of action to confront an aggressor that was usually a state. The international events of the latest decades, marked by the disintegration of certain states or the exacerbation of conflicts of an ethnic or religious nature, have determined the emergence of destructured internal conflicts that have generated humanitarian catastrophes and have spread on large geographical areas from Europe, Asia and Africa, becoming trademarks of our contemporary society.

Local conflicts have accumulated a diversity of shapes in the last period of time, from internal civil wars that have expanded over the borders to internal conflicts, secession, destructured conflicts, and some over questions of identity. Though their quantity and their destructive nature, local armed conflicts dominate the international sphere expanding on all continents. Situations of internal tension like those implying activities of public disorder, isolated acts of violence and other analogous acts are not considered as taking part of the category of local armed conflict. Internal armed conflicts become international when a third party intervenes on the side of either the government or the dissident group, like in the case of the Democratic Republic of the Congo, or when the conflict is transferred for solution to an authorized international organization, for one reason or another, usually the UNO Security Council, an agreement, or a regional organization, etc.

The conflict of Bosnia-Herzegovina, in its initial phase, was an internal conflict of the state, since each of the belligerents was supported by a state; the Christian- Orthodox Bosnian Serbs were advocated by the Yugoslav Republic, the Catholic Croatians by Croatia, and the Moslems by Turkey and Iran. Subsequently, when all state and military structures collapsed, the conflict, originally

ethnic and religious in nature, changed into a destructured internal one, similarly with the one in Rwanda.

The expression 'destructured conflict' doesn't have a precise judicial significance and does not correspond to a universally accepted definition. It reflects the mandate commissioned to the International Committee of the Red Cross (ICRC) by the XVIth International Conference of the Red Cross and Red Crescent to examine "situations in which state structures have disintegrated because of a local armed conflict", meaning that state structures are endangered to such extent that there is no authority to impose power and provide minimal public service.

Thus, 'destructured' conflicts cannot be characterized by a particular war objective, as much as through their shape, through the absence and dissolution of the whole structure (civilian, social, religious, and even military ones) within the state or belligerent factions. In reality, the goals pursued in such conflicts are not clear most of the times, just because of the absence of this structure. Sometimes we deal with pure banditry, in a fight in which the main objective becomes individual survival.

In such conflicts there can be noticed both the loss of control by the central government, which is not able to exert authority in territory and on population anymore, and the disintegration of the „chain of command" within the whole or within some factions which confront with one another. Since, generally, the internal conflict essentially implies a certain loss of control by the government on the territory and on the population, makes the weakening and the disappearance of the „chain of command" to constitute the essential characteristic of the „de-structured" conflict.

The internal de-structured conflict radically distinguishes from the non-international conflict in which there are two distinct belligerent parts – on the one hand the state authorities and the central military headquarters, and on the other hand the hostile organized insurgent forces, which are in control of a part of a territory and have at their disposal their own armed forces. In the event of a de-structured internal conflict, the state authorities are not able to manage the situation anymore, there is chaos in the country, there are mass assassinations, genocide acts, ethnic purges, massive exodus of populations etc. This situation is not stipulated in the UN Charter, to authorize the Security Council to apply constraint measures only against a state which infringes the rules and principles of the international law by performing threats to peace, violation of peace and aggression acts. If such a state does not exist anymore, there will not be anybody to incriminate. The situation is the same in the international humanitarian law, both with regard to the norms of managing the hostilities and means and methods of war used, and to incriminating the people responsible of committing serious crimes at the Geneva Conventions and Protocols. In case of the de-structured internal conflicts, the sate authorities disappear and there is no one „*to respect and make be respected"* the rules of the international humanitarian law, and practically there is not an issue of a humanitarian protection of the combatants and of the population, the civilians. To face these real humanitarian catastrophes, the Security Council, the principal authority of the United Nations had to intervene to *impose peace,* assuming political, military, police, judicial, humanitarian positions and powers. Consequently, the multinational military forces it has created were assigned the mission to solve all the problems encountered on the battlefield: to use armed force against certain belligerent factions, to defuse the antipersonnel mine fields, to arrest suspects of committing genocide and war crimes, to participate in humanitarian assistance missions, to restore democracy, to appoint public officials, etc.

The issue raised by these „de-structured" conflicts is related both the specific of the foreign intervention and the enforcement of the international humanitarian law by the intervening forces. The whole system stipulated by the Charter, regarding the UN actions in cases when peace is undermined, is based upon the idea of a dialogue with the government. The Council of Security can request provisional measure, and

then issue sanctions which do not include use of force and, finally, to use coercive measures. The tutelage regime that we might consider for use in extreme situations is excluded by the Charter (art.78) in the case of the member states. It can be used only if, in advance, the state is excluded from the UN on account that it can no longer meet the admission requirements, especially the one stating „*to be capable to meet the provisions of the Charter and to be willing to do so*" (art.4). Exclusion seems to be linked , however, to the willingness not to respect, even though article 6 is not very clear in this regard, According to this article, a member state can be excluded only if „ *constantly violates the principles laid down in the present Charter*". The historical background of this article, whose introduction spurred strong resistance, indeed proves that the purpose was to punish the state whose government constantly refuses the injunctions made, and not to sanction the loss of control.

The combatants enforcing the measures taken by the Council of Security are military personnel belonging to the regular armed forces of the UN member states, which are bound by the Charter to submit them to the Council of Security at their request and in accordance with any special agreements (art.43 of the UN Charter). As part of these multinational forces, both NATO and UEO military components have been included and their actions are not subject to the judicial order stipulated by the Charter. In accordance with Chapter VII of the UN Charter, the Council of Security is authorized to resort to serious infringement of the human rights, which poses a threat to international security and peace. However, the situation with the other regional organizations - NATO, UEO and UE - is not the same.

In the absence of a legal framework, and relying on ambiguous mandates and unstable authority, the multinational armed forces that participate in de-structured conflicts, cannot control the tense situations that emerge in practice, based on the humanitarian law and by respecting the humanitarian standards of protection. They do not have any authority to ensure the returning to a normal life, as is the case of the military occupation regime, they can neither detain nor trial persons who have committed war crimes or genocide, they cannot take prisoners of war, etc. Since the Council of Security has decided to abandon the consensual judicial order, a new order has been improvised based on some of its resolutions, either by interpreting some of the provisions of the UN Charter or some of the fundamental principles of international law, such as the right to self-determination and sovereign equality, or simply by replacing the main norms of humanitarian law with ad-hoc ones.

The conventional international law as reflected in the UN Charter and the subsequent interpretations (after 1945), have given priority to the sovereignty and integrity of states over the protection of the human rights. In time, the international practice has reexamined the human rights issue and so the judicial instruments in this field have become more numerous, ranging from the Declaration in 1948 both at the United Nations (for example, the International Pact on the civilian and political rights from 1966 and the UN Convention against torture from 1984), and regional level (The European Convention of the Human Rights from 1950, The American Convention on Human Rights from 1969, The African Charter on Human and People's Rights from 1981, etc.). Principles such as the forbidding of torture or attacks to the moral and physical integrity of people, who represent the pillar at the basis of all these texts, are considered by the jurists as leading

to *erga omnes* obligations, that is obligations which states must respect under any circumstances and with no exception. This is also the case with the forbidding of the genocide, which is more serious than „the massive infringement of the human rights" – a concept that is not defined from a judicial point of view and which represents the topic of a special treaty, the Convention from 1948 on the prevention and punishment of the genocide.

The *erga omnes* character of obligations under this Convention applies, particularly in this case, also for the humanitarian international law as defined by the Geneva Conventions (1949) and their additional Protocols (1977). Article 1, common to those Conventions, not only requires states to respect the rules of humanitarian international law, but also to make them be respected. Thus, members of the OSCE by the Helsinki Declaration of 1992, agree that "the obligations assumed within the OSCE human dimension constitute the subject of direct and legitimate interest of all participating States and do not belong exclusively to the internal matters of the respective State", being therefore obvious the deviation from the sacrosanct .principle of inviolability of the states sovereignty.

The second area, in which individual rights are considered to be above the sovereignty of the States, is the development of international criminal jurisdiction. Located at the intersection of international human rights law with humanitarian international law, as it refers both to the prohibition of torture and genocide, and to the concept of war crimes and crimes against humanity, international criminal jurisdiction was greatly expanded. The creation of international law courts to prosecute war crimes and crimes against humanity in former Yugoslavia (1993) and Rwanda (1994), the adoption in 1998 of the International Criminal Court statute, the imposition of criminal proceedings against the former Chilean leader Augusto Pinochet by a Spanish prosecutor and then by others, the investigation of a captain in the armed forces of Mauritania by a French court for "crimes torture" under the International Convention against Torture of 1984, are evolutions in legal practice, sometimes based on texts (and their ratification by a growing number of states) and some other times on a new legal interpretation likely to prefer the principle of protection sovereignty of human rights.

All these texts and practices have a common characteristic that is they made possible punishment but they do not have a preventive effect. Even in the 1948 Convention on Genocide, despite its ambitious title, it is difficult to identify measures to be truly preventive, not to mention the fact that there is almost no way to implement decisions[1]. However, it is obvious that preventing massive violations of human rights or humanitarian disasters has provided the basis of practice of extending humanitarian intervention in recent years. At the origin of intervention is the recognition of the fact that the population in starving danger, massacred, exterminated, deported on a large scale or subject to wide variety of serious and irreversible forms of oppression, have the right to receive assistance.

This principle, established by resolution 43/131 of 8 December 1988 of ONU General Assembly, reaffirmed and enlarged by Resolution 45/1000 of 14 November 1990, particularly in terms of *humanitarian corridors,* has been confirmed by numerous subsequent resolutions of the Security Council[2]. Therefore, the right of populations

[1] Malcolm Shaw, *International Law*, 4th Edition, Cambridge, Cambridge University Press, 1997, p.210.

[2] Resolution 688 of 04.05.1991, taken immediately after the Gulf War, which authorized the operation of humanitarian assistance by invoking the threat of international peace and security under Chapter VII of the Charter; Resolution 770 of 08/13/1992 on Bosnia where it was suggested that the use of force to ease the humanitarian assistance given to the Bosnians who were at war; Resolution 794 of 12/01/1992 on Somalia, which authorized the UN Member States to use all necessary means to achieve a secure environment for humanitarian assistance operations (in practice, the military intervention materialized in Operation Restore Hope led by the U.S.) Resolution 929 of 6/22/1994, which led to Operation Turquoise for the rescue of Rwandan refugees, led by France; Resolution 940 of 7/31/1994, which allowed the U.S. to organize a multinational force to reinstate the legitimate government of Haiti, Resolution 1101 of 3/28/1997, which allowed Italy to lead an operation (called *Alba*) for the humanitarian relief to the Albanian people under military protection.

at risk to get assistance can be considered today as an integral part of public international law.

Some of the humanitarian operations conducted after 1990, in addition to humanitarian aid, supposed also compensation for the sate deficiencies or its collapse consequences, as it was the case in Haiti in 1994 or 1997 in Albania. The same concern was also marked by Resolution 1031 of 15 December 1995 which supported the deployment of IFOR forces in Bosnia and Resolution 1244 of 10 June 1999 which supported the deployment of KFOR forces in Kosovo. Although the UN actions to compensate the disintegration of some states seem to have been politically necessary, there was a consensus in this regard. Thus, China abstained from voting on Resolution 940 of 07/31/1994 regarding Haiti, on the grounds that it went too far with the support of the interference in the internal affairs of Haiti in the name restoration of the democracy[3].

In conclusion, the first clarifications related to deconstructed internal conflicts refer to the *mutatis mutandis* extension of humanitarian law rules applicable in international armed conflicts as well as in the non-international ones, given that the boundaries between them tend to fade. In this context, clarifications also include determining the legal status of the deconstructed state. The deconstructed armed conflict is closer, as a form of anarchic development and not as violence intensity, to internal tensions and disturbances than to the non-international internal defined by Article 3 common to the four Geneva Conventions of 1949 and by Protocol II of 1977. Thus, the definition of the status of the deconstructed state must include the legal basis of the presence of the UN multinational forces and their competences, as well as the role of the multinational military missions in ensuring the compliance with the international humanitarian law and, on the other hand, the humanitarian action, intended to protect and save human lives and civil goods. This should be done taking into account the fact that, although maintaining international peace and security and humanitarian action are a whole, the protagonists are different - the first UN military forces on one side, and on the other side, the neutral and impartial humanitarian organizations, such as the International Committee of the Red Cross. Each of them must have clear mandates and coordinate actions on its own criteria.

As far as the international humanitarian law is concerned, it should be adapted to include clear rules regarding the new type of de-constructed conflict, namely rules to protect children and women, the Red Cross emblem, as well as rules referring to the monitoring of humanitarian aid, hunger during armed conflict and the issues of embargoes, of safeguarding the health of the civilian population. The concept of war crimes must also be broadened, so as to also apply it in non-international armed conflicts, including the deconstructed ones.

[3] Mario Betatti, *Le droit d'ingérece*, Paris, Odile Jacob, 1996, p. 257-259.

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EVOLUTION OF PATHOLOGICAL COMMUNICATION'S MILITARY DOMAINS, FROM PROPAGANDA TO INFORMATION OPERATIONS

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This paperwork aims to analyse some milestones of the conceptual history of pathologic communication in the military area, a type of communication successively manifested under different, more or less institutionalized forms, from the oldest and most generalized ones, like propaganda, to more elaborate and specialized forms of unconventional aggression, such as psychological warfare, that became psychological operations (PSYOPS), aggression which has developed later under the broader framework of information operations. The paperwork aims to demonstrate that pathological communication in the military field has been a constant concern of many state and non-state political actors over the years, and that this concern is vigorously manifesting itself in nowadays military operations, which are based on the massive usage of information, on the "soft" means of engagement in conflict.

Keywords: *Pathological Communication, Propaganda, Psychological Warfare/Operations, Information Warfare/Operations, Unconventional Aggressions*

The military environment nowadays possesses a wide range of means, besides the classical, conventional ones, making use more frequently of "soft" means, which are non-lethal, non-kinetical and unconventional. In this research, I will attempt to determine if the domains pertaining to the military field, being based on information manipulation, on forms of pathological communication, appeared in a spontaneous way, if they influenced each other, what the nature of their relationship is, and how their developing process unfolds.

Pathological communication is that form of communication having as objective the deliberate influence upon the will, understanding, perception and capacity of acting for a receptive entity (target), with the purpose to induce its reaction or inaction, in order to support the intention of the source of communication act. The types of pathological communication used for this type of persuasive operations are: manipulation, propaganda, misinformation, intoxication and rumor, all based on lies[1].[7] Within the military system, these techniques of influencing the free will of the opponent, the quality of the decisional act, by exploiting the fundamental needs (survival, information, integration or self-assertion), the social reflexes, by inducing emotions and motivating the individual or collective sub-conscience, even if they appeared during the Antiquity in empirical forms, they gained consistence and became refined, mostly during the last half of the century. The following is an analysis of the main military domains in which the pathological communication has been produced.

[1] Vasile Tran and Alfred Vasilescu, *Tratat despre minciună. Repoziționarea etică a conceptului de minciună*, ed. Comunicare.ro, Bucureşti, 2003, pp.133-141.

1. PROPAGANDA

The propagandistic aggression is a very old concept. A milestone relatively accepted by the specialists is represented by the institutionalization by the Catholic Church of the counteraction measures to stop the expansion of the Protestant Reform, by creating the Fide Propaganda College, in 1622. Propaganda was refined and applied massively at the social level, first by Great Britain, in the First World War, then by the Nazi regime (Joseph Gobbels[2] is known to have been an authority in this field), in the first part of 20th century, and by the communist regimes, until nowadays. The undemocratic regimes were not the only ones to have developed such instruments to maximize their social control and to keep the power. Democratic states, like Great Britain, excelled in making use of these techniques. Sefton Delmer is considered to be one of the greatest propaganda men of all times, at least of black radio propaganda led by him in the Second World War.

Afterwards, the propaganda was specialized on different fields (political, military, civic, and economical) being closely connected to the development of the means of mass communication. From it, different branches have emerged: the psychological warfare, the misinformation techniques, the image campaigns, or the mass media confrontations which, in time, gained distinct identities and doctrinaire autonomy, all based on persuasion techniques. Persuasion, seen as the psychological nucleus of propaganda, either manipulating or not, was based on rumor, misinformation, intoxication or other linguistic superstructures of lies and it was used more and more by state political actors as a coercion alternative.

Today, *propaganda* may be defined as an assembly of "persuasive communication actions planned, supported by a sponsor, having as end state the influence and even the alteration of atitudes and behaviours of a selected target audience, to satisfy the needs of some political interests of the sponsor, using false, partially true, distorted information and arguments together with the true ones and accompanied by various forms of constraint and censorship."[3][1] Ostracized from the vocabulary of the Western states to define their own actions by reasons of "political correctness", generated by the compromising of the term during the totalitarian regimes, *propaganda* still exists under different semantic avatars. The raw term is today preferably utilized to name the activities of the undemocratic regimes or to suggest a certain category of communication acts from a historical point of view. The place of propaganda was gradually taken by other concepts, like the following one.

2. PSYCHOLOGICAL OPERATIONS

Napoleon was the first military leader who used mass media as an effective weapon during his military campaigns, by a rigorous control (censorship) of the entire French mass media of that time. Therefore, he succeeded to intimidate enemies, and, at the same time, to stimulate the combat motivation of his soldiers. He said: "Three hostile newspapers are more fearless than a thousand bayonets."[4][2] During the Paris Commune, in 1871, more exactly, during the siege of the Prussian troops against the French capital, the first flyer dissemination from the balloon took place. And in 1915 France founded the Air Propaganda Service, with the mission to act the same way in the territories occupied by the Germans. Even if the French seem to have been the promoters of this type of unconventional activities, the circumstances of the First World War stimulated other states also, to develop this type of capabilities. As a counteraction measure, the USA approved in 1917, "*The Espionage Act*", by which the government could repress the points of view which may have influenced, in a negative way, the military actions. Russia followed its own way, after the

[2] Minister of Public Propaganda during the Nazi regime, between 1933 and 1945.

[3] Călin Hentea, *Noile haine ale propagandei*, Ed. Paralela 45, 2008, p.135.

[4] Călin Hentea, *Arme care nu ucid*, Ed. Nemira, Bucureşti, 2004., pp. 35-36.

triumph of the Bolshevik Revolution, by creating the Department of Agitation and Propaganda.

Born from another concept, that of psychological warfare, abandoned at the beginning of the 60s, in the last century, because it was excessively aggressive for the mentality of the public oppinion, psychological operations (PSYOPS) are the continuation of propaganda activities in the military field.

Being consolidated by the Nazi propaganda during the Second World War, this discipline was reconsidered both by the British and the Americans, who reestablished special structures like: the British, Political Executive Warfare in 1941, and the Americans, Office of War Information and Office of Strategic Services, in 1942. The term of *psychological warfare* had appeared for the first time in the title of a structure (*Psychological Warfare Branch*) in the headquarters led by General Eisenhower, in 1942. And the first PSYOPS doctrine may be considered *the Operative Memorandum no. 8*, issued by SHAEF – Supreme Headquarters Allied Expeditionary Forces, in Europe, on March, 11, 1944. The document defined and set three types of actions (strategic, combat and consolidation) as well as their type of development. Even if psychological operations were derived from propaganda, the Anglo-Saxons tried to avoid this term with negative connotation, choosing to replace it with *information warfare* (the Americans) and *political warfare* (the British). The French use another terminology to name psychological operations: *local communication*, *actions in the psychological field* or *influence military operations*. In the special Soviet literature, PSYOPS represented a part of the ideological battle, seen as a complex system of actions, used for diversion, rumors, defamation, misinformation and force demonstrations having as a purpose the weakening of the material and spiritual power of the enemy.[5][1] After the blow back of PSYOPS after the Vietnam War (1964-1973), the revival took place in the 80s as soon as the American DoD issued a new policy, called *DoD PSYOPS Master Plan*, establishing that psychological operations could be carried on both during peace or crisis time not only in war situations. The positive results could be seen during the operations *Just Cause* (Panama 1989), *Desert Shield, Desert Storm* and *Provide Comfort* (The Persian Gulf, 1991).

The American doctrine which appeared in 2003, considered PSYOP (the specific acronym used overseas) a vital part of a wider area of diplomatic, informational, military and economical activities of the USA.[6][5]

This vision was taken over by the NATO PSYOPS doctrine, but with some restrictions concerning politics.[7][11] NATO's definition for psychological operations, according to MC 402 policy, is related to those 'planned psychological activities in peace, crisis and war directed to enemy, friendly and neutral

[5] Călin Hentea, *Noile haine ale propagandei*, Ed. Paralela 45, 2008, pp.190-193.

[6] On June 21st 2010, Admiral Eric T Olson, Commander of US Special Operations Headquarters, announced the decision to completely replace the sintagm *psychological operations* with *military information support operations* (MISO). The decision was supported by General George Casey, US Army Chief of Staff, and approved by the Secretary of Defense. About this transformation Admiral Olson said: *This will be a complete organizational, training and doctrine change*. It is interesting that a similar attempt took place in The United Kingdom, where *15 (UK) Psychological Operations Group* changed its name, under political pressure, into *15 (UK) Information Support Group*. Because the change was a failure result in extremely high costs the initial title was reused. *Cf.* Alfred Paddock, Jr., „*PsyOp*" *Renamed* „*Military Information Support*", Small Wars Journal, 26 iunie 2010, in http://afpakwar.com/blog/archives/5874 retrieved on 19.11.2010.

[7] ****AJP 3.10.1*, art.0104.

audiences in order to influence attitudes and behavior affecting the achievement of political and military objectives."[8].[8]

PSYOPS which was also called "*the algorithm process of the military propaganda*"[9][2], is, without any doubt, one of the strongest, longest and most spread unconventional means of action today. But its independent, isolated action can not produce the cumulative effect of more non-kinetic action instruments. This vision found its expression in a way, which is complex and conceptually daring, specific to the American army, after the application of the *informational warfare* theory.

3. INFORMATION WARFARE

The concept that represented the basis of the smashing American victory during the First Gulf War and which meant the beginning of a new era in the military art was, finally, the *joint* concept, and it consisted in the assembly of the energies belonging to all branches, in adding the informational instrument and in enabling the efficient use of the new informational technologies and high precision weapons by this entire military conglomerate. The *integration* model was good for the four American military services, but for the newly born concept of informational warfare it was the vital catalyst. The informational warfare was based on integration, on the coordination of separate elements, on the syncronization and synergy of their effort. The practical success opened the way for the informational warfare (IW) theorization almost at the same time with the unfolding of the Gulf military operations.

Information Warfare included those "information operations conducted during times of crisis or conflict to achieve or promote specific objectives over a specific adversary or adversaries."[10][13]. It had been intuited by the political and military analyst Thomas P. Rona since 1976, which had been experienced by Americans during the Gulf War, in 1991, being officially launched in 1992 and named by the Department of Defence in September 1995.[11][1]

Thomas P. Rona defined the *information warfare* as „the strategic, operation, and tactical level competitions across the spectrum of peace, crisis, crisis escalation, conflict, war, war termination, and reconstitution/restoration, waged between competitors, adversaries or enemies using information means to achieve their objectives."[12][3]

Characteristics of the *informational warfare* emphasized its ideal configuration for unconventional aggressions initiators: of no geographical borders; the multitude of targets; the absence of clear warning indicators; the difficulty in quick counter-attack; using high-performance technology, but also those simple and cheap, largely spread and available; difficult to establish clear, accurate and exhaustive responsibilities by the specialists; relatively low cost compared with the potential results (effects); improved manipulation capabilities; erasing certain distinctions between levels of command; the possibility of denying the government involvement in operations; the existence of multiple gaps in national and international laws and the lack of effective international cooperation in the field .[13][4]

In addition to those five classical military areas from the command and control warfare (C2W, the parent concept of information warfare)[14], namely psychological operations,

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[8] ***MC 402 NATO Psychological Operations Policy

[9] Călin Hentea, *Arme care nu ucid*, Ed. Nemira, Bucureşti, 2004, p. 66.

[10] ***Joint Pub 3-13, Joint Doctrine for Information Operations*, 21 January 1997. It is interesting that the first draft of the doctrine, from April 1996, it was named *Joint Doctrine for Information Warfare,* which shows that at this point it happened the so called „doctrinaire leap" between the two concepts.

[11] Călin Hentea, *Noile haine ale propagandei*, Ed. Paralela 45, 2008, p.229. Another related concept is the *soft warfare*, which was launched with great resonance in 1991 by the American strategist Charles John „Chuck" de Caro, in *Providence Journal Bulletin*.

[12] Martin Libicki, *What is Information Warfare?*, National Defence University Press, ACIS, Washington D.C., 1995.

[13] Gheorghe Nicolaescu and Vasile Simileanu's abridgment, *Războiul informațional*, Ed. Top Form, Bucureşti, 2004, p.16.

[14] *Command and control warfare* was defined by Americans in 1995 as "a form of applying of the

military deception, security operations, electronic warfare and physical destruction (all supported by information), *Information Warfare* included the unconventional cyber media, economic or financial actions.

U.S. military forces have not only been interested in developing a so complex mechanism. Concerning Russian specialists point of view, *informational warfare* included: the destruction of the enemy's C2; radio-electronic combat, radio-electronic reconnaissance, cyber warfare, psychological warfare and use of information obtained from open sources. In addition to the first component, all others would have been used in peace time, the concept which encompasses them being *informational combat*. *Information Warfare* was one of the powerful and resonant concepts that marked the military area in the last decade of the previous century.

4. INFORMATION OPERATIONS

At one point, however, the concept of information warfare has become too "tight", too restrictive for military theorists who wanted to impose another term, more "soft" to define actions in peacetime, crisis or military operations other than war. They have realized more and more that to achieve maximum desired effects, defensive and offensive information operations had to be set up since the period of peace and that is long before the crisis or conflict had started. This type of military action could not be applied but the terminology of information warfare. Consequently, it was proposed a new phrase, that of *information operations*. *Information operations* had clear advantages, because they could take place continuously and also on a temporal and geographical coverage larger than the *information warfare*. But both could be applied from the tactical to strategic level.

This division of roles, however, raised a semantic difficulty, which may cause confusion. In this report, *information operations* appear to be broader, gathering a greater range of possibilities than the *information warfare*, which contradicts the classical military theory sense, where the operation is a subsidiary of the war. Therefore we assume that the chosen term *operations* from the syntagma *information operations* does not express the level of waging military action but, above all, the fact that most non-kinetic (the used means) and non-lethal (the produced effects) character of information confrontation. Moreover, U.S. psychological operations doctrine from 2006 (JP 3-13) renounced to the phrase *information warfare*, which shows a tendency to permanently and completely replace this expression with the *information operations* (as in "lifting language" of replacing the phrase *psychological warfare* with the *psychological operations*).

On the other hand, as noted above, there is a distinction between *information warfare* and *command and control warfare*, the latter being only devoted exclusively to operational or tactical levels (never strategically), the enemy's military centres of gravity (command centres, communications nodes, etc..).

After a famous phrase, we say that information operations (INFOOPS) were designed as a mechanism of coordination and synchronization of "non-lethal weapons"[15],

information warfare in battlefield or in military operations, a basic component of this."

[15] This„*non-lethal weapons* "are widely analysed in Călin Hentea's homonym research paper, quoted in its reference.

some of the most appropriate offensive and defensive means in the unconventional aggressions era. This type of non-kinetic weapons were defined by the U.S. military as "special weapons designed and primarily employed to neutralize personnel and equipment, while minimizing the number of dead, seriously injured and unwanted damage to the property and the environment "[16][12]. Their ammunition is the information, having as aim not destroying the alive force of the enemy but winning the mind and soul of the opponent.

Coordinated areas by *information operations* are diverse, some older, such as military deception or the attack and physical destruction, and some newer, that is the electronic warfare, computer network operations (CNO) or perception warfare. *Civil-Military Co-operation* (CIMIC), or in American version, *civil affairs* (CA) and also *public affairs* (PA - former public relations/public information) are also coordinating with INFOOPS, but from autonomy positions.

Invented by American pragmatic sense, the expression offset the extreme specialization on different areas of expertise, bringing back to the forefront of non-kinetic military actions the synergy of coordinated actions, the overview, that of "the big picture" so necessary to tackle a multitude of unconventional aggresions, with an equally large variety of different tools, but often redundant or, alternatively, unexploited optimally. In fact, information operations are the application of the Effects Based Operations (EBO) in the field of information.

Between 1990 and 2010 various U.S. military institutions (TRADOC - Training and Doctrinal Command Center, ARSTAF - Army Staff or LIWA - Land Information Warfare) worked to redefine the information warfare policies. They have redesigned both *the framework* (integrated policy - joint, military policy, command and control design), *the interim capabilities* (necessary military structures, appropriate technology) and *necessary institutional changes* (concepts, doctrines, training, organization, material resources, human resources).

We have considered that the counter-balance of the unconventional aggressions have to include not only policies of creating information and public relation structures, psychological operations structures, secret services, mass media and research but also the establishment of a legal, management and organizational framework, appropriate for their both offensive and defensive action.

NATO Doctrine (inspired by JP3-13/1998, the first specific American doctrine) defines information operations (INFOOPS) as "co-ordinated actions to influence decision-making of adversaries in support of the Alliance overall objectives by affecting their information, information-based processes and systems while exploiting and protecting one's own"[17][9]

In other words, all the things related to information have been considered as part of the *information operations*. Using this pattern, it has been difficult to determine those military capabilities which were *not* part of the information operations spectrum.

Around 90's, the concept of "INFOOPS means everything" was firmly promoted. The demystification of this idea started in the American Army after 2002. INFOOPS is now focused on integration, not only on synchronization. By comparison, *integration* is "The arrangement of military forces and their actions to create a force that operates by engaging as a whole."[18][12]. For instance, in 2006, the core capabilities of the INFOOPS, according to American doctrine were: electronic warfare, network warfare operations and influence operations, those which had supplied many engagement opportunities, able to "control, interrupt, corrupt or usurp". This doctrine developed influence operations in six other sub-capabilities: PSYOPS, military deception, operation security (OPSEC), counter-intelligence, counter-propaganda and

[16] ***JP 1-02 Department of Defence Dictionary of Military and Associated Terms*, November 2010, amended in January 2011, p. 261.

[17] ***NATO MC 422/1, *Information Operations Policy*, April 2002.

[18] ***JP 1-02 Department of Defense Dictionary of Military and Associated Terms*, November, 2010, amended in January 2011, p. 179.

public affairs operations. Furthermore, the joint-level planners had to feasibly integrate all the above mentioned capabilities in the campaign of the Joint Force Headquarters. The doctrine agrees that INFOOPS firstly provides non-kinetic capabilities for the combatants, as well[19][14]. Outstanding progress has been made in the last decade (quite sinusoidal) due to transition from quantity based operations to effect based operations.

A different approach of the *informational operations* content focuses on the "less is more" concept, trying not only to limit but also to cut down the domains from the coordination of INFOOPS. The obstacles generated by the inner institutional vanities from INFOOPS carried on to a relative definition and, paradoxically to the loss of synchronism in the working process of this mechanism, whose only purpose is synchronism! Consequently, there have been particular perspectives[20][6] (of the services) about information operations, many of them being entirely desynchronized. Different American military specialities have aspired to concentrate on their specific role and also to favour this role within INFOOPS: the communicators from the Air Force focused both on computer network and on providing intelligence to information operations. The intelligence community concentrated on gathering and exploitation information by engaging ISTAR capabilities[21]. In the United States, at least, after 30 years of improper financing, electronic warfare forces agree with the fact that one cannot decide if the integration mechanism of INFOOPS will be helpful for themselves or will prejudice the future of their status, as a legal pattern of their missions. Space forces have suggested INFOOPS to focus on relevance of the counter-space missions. Aerial transport has kept its own concepts which are nowadays almost forgotten, such as military operations other than war (MOOTW). The public affairs would like to attend to INFOOPS missions, setting up at the same time a limit between them and the influence operations, as PSYOPS, and military deception. It has been difficult also for PSYOPS, being a subsidiary of the INFOOPS, within the doctrine. Consequently, in all the states with strong or emerging INFOOPS, the spasm of this adapting process has been observed, due to the old concepts of the decision-making committee and, equally due to the clannishness military services spirit, to the difficulty, complexity and novelty of the unconventionality or, in other words, due to the battle for resources at military institution level. I therefore consider this symptom as being specific to an "growth disease" similar to the one generated by the implementation of the "joint" concept, at the beginning of 90's, in different services and armed forces. INFOOPS has now a more difficult issue to solve not only due to the bigger number of the involved actors but also to the difficulty to assess the result of their specific effort.

Defining the precise limits of the information operations has always been fluctuating as it has barriers coming from inside and because it has been permanently open to new non-conventional domains. New theories and domains come to light that INFOOPS can't ignore. Firstly, they have to prove their helpfulness in order to be included in the official panoply of INFOOPS, such as

[19] ***Air Force Doctrine Document (AFDD) 2-5. *Information Operations, J*anuary 2005: 1.

[20] Kelly G. Robinson prejoratory named this manner as „ tribal perspective ". Kelly G. Robinson, *The Death of Information Operations: Making The Case for Non-Kinetic Operations*, research raport for Air Command And Staff College, Air University, Maxwell Air Force Base, Alabama, April 2005, p.3.

[21] Intelligence Surveillance Targeting Acquisition and Reconnaissance.

other sub-domains of pathological communication previously does.

This project has given me the opportunity to notice that the security solutions based on the usage of pathological communication had a certain pattern of genealogical development by dividing/specialization of some activity domains (for instance *propaganda – military propaganda – psychological warfare – psychological operations*) as it has happened to different sciences, derived from the philosophy common trunk.

Furthermore, I have also noticed that *propaganda,* a favourite term of both policies and security strategies until 1990, is almost absent in nowadays practice; this concept has been replaced by others which haven't been morally used and compromised by their main promoters, communist and Nazi regimes.

I would like to mention that in the chronology of security solutions integration referring the counter-balance of the unconventional aggressions provided by pathological communication, there are two important moments: the first one is represented by the First Golf War (1991) when the USA became the first global superpower after the communism breakdown and felt the need to reaffirm its global supremacy using a new set of informational instruments and, the second, represented by 11 September, 2001 terrorist attack, the peak of counter-reaction against American foreign policy. The beginning of the second moment concurs with another important one: Vladimir Putin became president and started his geopolitical counter-offensive, by information vectors, in a favourable security environment.

Finally, I have also noticed that chronologically, there are some directions when talking about pathological communication: from simple to complex; from independent to joint actions; from military to non-military; from conventional to unconventional; from primordiality of structures to that of the effects; from kinetic to non-kinetic means; and from lethal to non-lethal effects.

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INTEGRATIVE CONTEMPORARY THEORIES ABOUT UNCONVENTIONAL AGGRESSIONS OF INFORMATIONAL TYPE, BASED ON PATHOLOGICAL COMMUNICATION

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The reasoning of this paperwork begins with the idea of the existence of continuity between certain key concepts and theories, which have appeared in the last decades and are based on the instrument of communication, which is founded on the manipulation of information, especially in the military field. Whether they are dilemmatic under a semantic aspect, as they are manifesting in the non-kinetic vs. non-lethal operations binomial, or they have conceptually reinvented themselves, as it is the case of public diplomacy and strategic communication (STRATCOM), or they are identitarily fluctuating, as perception management does, they all present however, a common trait: they are part of the informational arsenal of unconventional aggressions, which political actors use more and more intensively in the international security environment.

KEYWORDS: *Pathological Communication, Non-kinetic & Non-lethal Operations, Public Diplomacy, Strategic Communication, Perceptions Management, Unconventional Aggressions*

The occurrence of unconventional aggressions, especially of the information related ones, lead to the adjustment of military thinking, theoretical background of policies, strategies and doctrines as required by the new realities determining international confrontations. The advanced states in this area of expertise, usually the great world powers, have developed new concepts in order to cover the complexity of the new types of confrontation between statal, non-statal and supra-statal actors, as confrontations may be psychological, informational, media related, symbolic, imago logical etc. This paper tries to explore the evolutions of military action related domains in which pathological communication manifested itself, emphasizing their tendency to unify in a shape of some integrative theories, subsequent to those represented by *information warfare* and *information operations.*

Recent studies (published after 2005) have put forward a new approach which replaces the old concept of *information operations* with *non-kinetic operations*. Being more than just a change in terms, this new label has represented the bond between electronic warfare, influence operations and network warfare operations. According to Robinson, by adopting the term *non-kinetic operations* as the succeeding of *information operations,* the logical premises of *integrated operations* have been created, the only type of future operations which matter while performing operations based on joint effects.[1][6]

[1] Kelly G. Robinson, *The Death of Information Operations: Making The Case for Non-Kinetic Operations*, Research report for Air Command And Staff College, Air University, Maxwell Air Force Base, Alabama, April 2005, p. iv.

In an article from *Newsweek*, Evan Thomas and John Barry stated that this conflict in terms generates „a generational gap in the Army" in a period of time when the structure, size, and budget of the American Armed Forces will constitute a pressing issue for the Obama administration. *The Economist* named this phenomenon „the Army broken" referring to the competition between the old officers, stubbornly bond to a structure that was victorious in the two wars against Saddam Hussein and the new generation of military more focused on wining the „war of hearts and minds".[2][2] Kenneth J. Burgess, major in the US Army, states in his master dissertation his vision regarding the forms of unconventional military actions.[3].[1] His suggestions included structural changes related to the decentralization of resources, the narrowing down of command systems and the enhancement of intelligence personnel ability to integrate, mobility and population cantered capabilities (civil affairs, information operations, military police, civil infrastructure) down to the lowest levels (battalion or company).[4][1] Senator John McCain offered solutions himself to this problem. In the November – December 2007 issue of *Foreign Affairs*, he advanced the idea of setting up an Armed Forces Advisors Corps which would include experts in unconventional warfare, civil affairs and psychological warfare, special/covert operations and anthropology, advertisement and other relevant areas, governmental or not, and these experts will train and work together with military personnel, especially in post conflict reconstruction situations.

FM 3-0 US *Army Operations*, 2008 version, uses the terms *lethal* and *non-lethal* and not *kinetic* and *non-kinetic* actions. There are some differences between these terms. Therefore, the term *kinetic* refers to, or is characterized by movement. For example, an action of the Special Forces meant to find and neutralize a terrorist group, action performed using satellite surveillance, fits in this category, even if those forces acted or not at ground level, in a lethal or non-lethal manner. Similarly, if the target surrendered without fighting, without one shot, we are still dealing with a dynamic operation, a kinetic one. On the contrary, a CIMIC patrol assessing a certain locality should be considered a *non-kinetic* operation, and it turns into a *kinetic* one only if shots are fired on the patrol or the patrol reacts with open fire. The distinction between the two possibilities is that *lethal* and *non-lethal* actions are subsets of *kinetic* operations; they cannot replace this concept, regardless of their chronological occurrence. On the other hand, a *non-kinetic operation* is by definition exclusively *non-lethal*. The option of using the concepts of *lethal* and *non-lethal* instead of *kinetic* and *non-kinetic* when it comes to operations implies absurd situations as for example when the enemy shots a soldier who doesn't fight back, but it is wounded or killed because his own side doesn't hit back, this in its own views could be a non-lethal mission! For this reason, a careful use of the terms characterized by the lack of synonymy, case by case, is something to be desired.[5][7] Another clarification that I summit to your attention would consist of the statement that the terms *non-kinetic* and *kinetic* refer to the types of target engagement *means* while the terms *lethal* and *non-lethal* can and be used to describe the desired *effect* upon the target.

Information operations are intuitively *non-kinetic*. Psychological operations (PSYOPS), military deception, public affairs operations, they all point towards the cognitive domain, in order to persuade or inform a specific or global audience. Yet, one must not mistake kinetic platforms (helicopters for PSYOPS flyers

[2] Alan D. Campen, *Can a Regular Army Fight an Irregular War?*, in CyberInfoWar.com, September 2008, retrieved on 04.05.2010.

[3] Kenneth J. Burgess, US Maj, *Organizing for Irregular Warfare: Implications For The Brigade Combat Team*, Master Dissertation, Naval Postgraduate School, Monterey, CA, US, December 2007, in http://edocs.nps.edu/npspubs/scholarly/theses/2007/Dec/07Dec_Burgess.pdf retrieved on 08.11.2010.

[4] Kenneth J. Burgess, *op.cit.*

[5] Argument from Herschel Smith, *Kinetic and Nonkinetic Versus Lethal and Nonlethal Operations*, în http://www.captainsjournal.com/2008/06/30/kinetic-and-nonkinetic-versus-lethal-and-nonlethal-operations/, retrieved on 04.06.2010

launching, passive jamming measures, the destruction of a computer network hardware etc.) for the non-kinetic type of operations to which they may contribute.

Robinson, as a contribution of the American Armed Forces to the concept of joint operations, advances the idea of replacing the syntagma *information operations* with non-*kinetic operations*, because: it is easier to understand and integrate in the architecture of operations by military leaders; it 'demystifies' information operations with effects on budgeting a decrease in classification level of documents, it clarifies and creates integrated carrier opportunities for the personnel.[6][6]

The three components identified by Robinson (electronic warfare, influence operations and network warfare) have the capacity to produce both lethal and non-lethal effects on the battlefield although due to their nature they provide non-kinetic capabilities. This particular type of approach has already started to be taken into consideration by the American policy makers and also by their NATO partners, but somehow in a prudent and skeptic manner by the European armed forces

Another concept related to pathological communication which has been vitalized in the last decades is *Public diplomacy*.

Public diplomacy manifested as a integrating force of the unconventional means of information related actions, the last few years being such a comeback of this area of expertise. For this reason it is useful to place this concept in the context of the theories that have agglutinated unconventional actions forms through the years.

Public diplomacy is not a newly born concept, it appeared as a collocation in 1856 in Great Britain, and only 100 years later, in 1965, it was introduced in international relations by Edmund Gullion (an associate of the United States Information Agency – USIA) in order to describe the lead of foreign affairs by engaging foreign public, which often was an euphemism for propaganda, truth projection or lobby relations. In contrast with the classic diplomacy which was meant for foreign leaders, *public diplomacy* is centered on the means used by a country or an international organization to communicate with citizens of other societies, starting from the premises that dialogue is essential in achieving foreign policy goals. A great importance is given to the promotion of values and own image by specific products (films, music, television, sports competitions, and video games, cultural and artistic activities) and adequate messages which effect on target was assessed in a specific cultural context in order to develop more efficient instruments of persuasion. For the American foreign policy, *public diplomacy* has represented for decades an essential element not only during the Cold War but also after the vanishing of the communist block, or, after the events from 11th September 2001. The American foreign policy considered that not only states have a great importance in a technologized, globalised world characterized by massive migrations phenomena, but also nations, and as a result the promotion of a foreign affair policy centered on people.

Starting from the end of the 1940's there was in the United States a Advisory Commission for Public Diplomacy which was in charge of the evaluation process related to own efforts. After the war, USIA took over, the disappearance of the commission taking place only in 1999, long after the fall of the communism. Forgot but not forgotten, the term was still used by the State Department especially as a broad equivalent for *public relations* with foreign countries. As instruments of concept promotion were created

[6] Kelly G. Robinson, *op.cit.*, pp.24-25.

global radio stations like The Voice of America, student exchange programs, seminars, academic and economic meetings, but also indirect activities in the areas related to culture, tourism or computers. Although *public diplomacy* was coordinated by the government, it was also the appanage of non-state actors, independent media or private contributors.

On the 14th of January 1983 the president Ronald Reagan signed the Secret Directive no. 77, in which *public diplomacy* was defined as being „formed by actions of the US government meant to support national security objectives." The directive appointed a Special Planning Group as part of the National Security Council, group which coordinated a Public Affairs committee (its role being to explain and support American foreign affairs initiatives); a International Information committee (promoting „truth projection" policies); a International Politics committee (to coordinate the efforts to counterattack the Soviet Union's diplomatic, military, economic, and information aggressions) and an International Broadcasting committee (which coordinated the mass media sponsored by the government, like The Voice of America or Free Europe).

Once the cold war over, the '90's brought a less direct approach to the *public diplomacy* collocation and to its adjacent policies. The American doctrine defined them at the time as being "those overt international public information activities of the United States Government designed to promote United States foreign policy objectives by seeking to understand, inform, and influence foreign audiences and opinion makers, and by broadening the dialogue between American citizens and institutions and their counterparts abroad."[7][9]

On October 30, 2001, the US government founded the Department of Strategic Influence within the Department of Defense, an organization which was tumultuously criticized not only by the media but also by the officials and the civil society. As a consequence, this initiative was rapidly abandoned within only 4 months, at least at the public level. On January 21, 2003, on the initiative of the White House, the Global Communications Department was established, seen as a continuator of the Coordination Committee of Strategic Communication Politics which had been set up in September 2002. Unfortunately, due to the lack of a good coordination, resources and especially because of poor cultural assessments, none of these departments was successful.

The modern *public diplomacy* is latterly used not only by the USA but also by some other nations, such as France (with an accent on the cultural diplomacy), Great Britain (successful in radio transmitting), Japan (directed to academic exchanges) or Russia (based on psychological operations).[8][4] Although the public diplomacy can nowadays have different aspects, such as the action in cyberspace or the usage of Diasporas and expats, its classic components are still actual.

Another concept based on the use of the pathological communication techniques is the *strategic communication* (STRATCOM). This concept was issued in 2004 in the United States, being defined as ''a variety of instruments used by governments for generations to *understand* global attitudes and cultures, *engage* in a dialogue of ideas between people and institutions, *advise* policymakers, diplomats, and military leaders on the public opinion implications of policy choices, and *influence* attitudes and behavior through communications strategies.".[9][12] The following areas are aimed by *the strategic communication*: transcultural agreement, the proactive dialogue between citizens and institutions, the guidance of politicians and the control of attitudes and behaviors of the

[7] ***Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms*, November 2010, amended in January 2011, p. 297.

[8] Nicholas J. Cull, *Public Diplomacy: Lessons from the Past*, USC Center for Public Diplomacy, Annenberg School, Figueroa Press, Los Angeles, 2009, p. 24.

[9] ****Report of the Defence Science Board Task Force on Strategic Communication*, Office of the Under Secretary of Defense For Acquisition, Technology, and Logistics, Washington, D.C., September 2004, p. 11, in http://www.fas.org/irp/agency/dod/dsb/commun.pdf. retrived on 23.09.2010.

foreign audiences using various methods such as: public diplomacy, public affairs or information operations.[10][11]

The strategic communication of nations involves a sum of institutional vectors which are run based on a plan and coordinated procedures. In the military field, this strategic communication has provided a cultural shock, a serious transformation, changing not only the whole attitude of the system towards communication, but also its position as a central element of thought and daily actions, as a self-value of the military confrontation. However, the effects of this strategic communication in the military field have not reached yet the standards as the practice and theory in politics, economics or social life.[11][8]

Nowadays, *the strategic communication* is a concept in rising which, at the level of NATO headquarter, is viewed as a native integrator of public business and of INFOOPS, in spite of the reticence upon the full collaboration between the above mentioned elements.[12][3] As a matter of fact, the concept is also functional in the theatre of operations in Afghanistan, where it is already represented in different institutions.

As well as the public diplomacy and strategic communication, *perception management* is mainly represented in politics, these three concepts maintaining a certain distance towards the military elements coordinated by *information operations*, in order to assure a better service of the nation's interests at the strategic level, using the agreed terms in political communication or international relations fields. However, this does not mean that perception management is not silently performed or unmentioned in the high military levels of the national security institutions.

Perception management is defined in the American doctrine as it follows: "actions to convey and/or deny selected information and indicators to foreign audiences to influence their emotions, motives, and objective reasoning as well as to intelligence systems and leaders at all levels to influence official estimates, ultimately resulting in foreign behaviors and official actions favorable to the originator's objectives."[13][10]

Some researchers[14][5] use a stronger collocation, that of *perception warfare* in order to identify this type of actions which are not similar to the *informational warfare* (or even an euphemism of it) and *public diplomacy*. Although it is considered that there are numerous similarities between these concepts, sometimes they are not identical, the difference being perceived in the occurrence and the way of using the new technology. This concept of *perception warfare* has been first issued during the Iraq War 2, admitted as a new weapon used by the USA in this ''battle of ideas'', in

[10] ***NATO Strategic Communication Policy, 29 September 2009, pp. 1-2.

[11] Jan Techau, *What Makes Communication Strategic? – Preparing Military Organizations for the Battle of Ideas*, Research Paper, Research Division – NATO Defense College, Rome, No. 65, Feb. 2011, p. 2.

[12] An argumentative opinion of INFOOPS transformation in STRATCOM can be also found in Tony Corn's *From Info Ops to Edu Ops: Strategic Communication in the Age of the Long War*, thesis presented in the inter-session conference Strategic Communication: Managing Knowledge to Win Wars, U.S. Naval War College, Newport, 6-7 March 2006, in http://www.au.af.mil/au/awc/awcgate/navy/nwc_stratcom_conf06/corn.pdf. retrieved on 22.09.2010.

[13] ***Joint Pub 3-53, *Doctrine for Joint Psychological Operations*, September 2003, p. GL-7.

[14] Henrik Friman, *Perception Warfare: a perspective for the future*, Discussion paper, The Swedish National Defense College, Department of Operational Studies, 1999, in www.militaryscience.org/public/media/publications/Friman(1999)PW.PDF. retrieved on 23.09.2010.

order to gain the upper hand over the insurgents appealing to the worldwide mass-media.

The final aim of this *perceptions warfare* is to change the way of thinking and the volition not only of the opposing leaders but also of the population, this being achieved through the lesion of the right perception upon a certain situation and manipulating the truth using both rational and emotional methods of the pathological communication such as: security operations (OPSEC), undercover missions, deception, the projection of the truth or psychological operations. No need to mention that this *perceptions warfare* is not the exclusive prerogative of the state political actors, this being also started by non-political aggressors: international holdings being in a trade competition, financial trusts, in order to improve their image all over the world, terrorist organizations looking for legitimacy, or even individuals, celebrities interested in their ‘’rebranding“.

The integration process of all these action and coordinating informational non-conventional methods does not only refer to the theories previously analyzed. It also includes concepts such as: *Entropy-Based Warfare* (issued in 1998), *Unrestricted Warfare* (the strong Chinese theory issued in 1999), the modern *counter-insurgency* concept (rebranded in its actual configuration in 2006) or the *Comprehensive Approach* (as considered to be the conceptual phase of the Entropy-Based Warfare – EBAO – since 2006, at a higher level though).

During my research, I have noticed that most integrated politics and doctrines regarding the non-conventional aggressions based on the pathological communication have been launched recently, more exactly after 1991, even if some of these concepts have been rebranded, prefaced by their “archaic” start point (*public diplomacy* or *strategic communication*).

In the present study, I have also noticed that the security solutions based on the use of the pathological communication have had a certain pattern so far, one of a genealogical development, by adding new qualities to the previous nuclei (as in INFOOPS – non-kinetic operations – STRATCOM succesion), the evolutional process remaining not only intensive, but also outgoing and creative.

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PANEL 2. *Educational psychology, counseling and vocational school*

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ANXIETY ASPECTS IN PUPILS' BEHAVIOUR

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Abstract: Anxiety Aspects in Pupils' Behaviour

We live in an active, tensionate environment where stress is the main factor responsable for our health or psychic problems. This may lead to both communication or interpersonal issues, introversion and emotional unbalance. School, apparently a bond within society, is, sometimes, a means of determining certain negative reactions among pupils.

Our main abjective, when choosing this topic, was to monitor the emotional of students, especially those related to anxiety and katzenjammer, to analyse the way they mingle and to observe the teachers' reaction to all these.

The degree of involvement, interest and information coming from teachers when they have to deal with students' emotional problems has a direct impact on pupils' behaviour both in school and in society.

Keywords: *ANXIETY, EMOTIONAL UNBALANCE, BEHAVIOUR, COMMUNICATION*

We live in an active, tensionate environment where stress is the main factor responsable for our health or psychic problems. This may lead to both communication or interpersonal issues, introversion and emotional unbalance. School, apparently a bond within society, is, sometimes, a means of determining certain negative reactions among pupils. Family problems that students face are outgrowing and varied. Pupils can be part of domestic violence or they may live in a vicious environment or be involved in their parents' divorce; they may suffer because of their parents' leaving abroad to work or there may be a lack of understanding or communication when it comes to pupils' problems. All these have a great impact on teenagers' personality development.

Interpersonal relationships are not as tight and settled as they were years ago. Nowadays, everybody wants to solve his own problems, to achieve his objectives thus individualization and self-centered persons seem to be the core of society while family life is left behind since time is no longer our ally. For many parents school is nothing but a cheap baby-sitter due to the oportunity it gives to parents not to have their pupils educated, but to leave them spend a part of the day there

For an introvert child, relationships seem hard to achieve within a group, most of the time anxiety and low esteem being the main problem. Social anxiety can stop a pupils' development because those six hours spent at school among his classmates could be such a nightmare because the others are skeptical when talking about the way he reacts in certain situations. Students make fun of such kind of persons and never include them in the group.

School should offer environment and support to those in difficulty, but the lack of interest coming from certain teachers, classmates, parents and headmasters offers them just a couple of hours away from their families or homes and, sometimes a tensionate atmosphere.

Our main abjective, when choosing this topic, was to monitor the emotional problems of students, especially those related to anxiety and katzenjammer, to analyse the way they mingle and to observe the teachers' reaction to all these.

After deciding upon the purpose of this paper, we have erected the following hypothesize:

- if anxiety and emotiona instability are high in pupils, then the risk of behavoiur disorder and depressive tendencies is heightened
- if the degree of irritability is high in students, then they have a sharp probability for developing behaviour disorders.
- the degree of involvement, interest and information coming from teachers when they have to deal with students' emotional problems has a direct impact on pupils' behaviour both in school and in society.

Describing the Research Group

When choosing the research group we have thought about teenagers aged 14-19. They belong to different social environment: 70 girls come from normal families, while 41 have one or to parents working abroad or they belong to broken families; 39 boys come from normal families, while 24 are part of broken families. The 174 subjects involved in the research were divided into the 4 categories so that we cand observe any differences when analysing and interpreting the results.

There were 40 teachers aged 25-58 that were involved in the research because our intention was to test different points of view coming from their experience.

The first thing we could say about teachers was their reluctance when being asked to fill in the questioneer. Some refused to take it saying that they did not want to hear about writing extra papers, the other asked me to give it at home so that they can complete it because they knew few things about this topic, while a small part of them filled it responsabily, on the spot. My general impresion, after talking to the teachers, was that the topic was unknown to them, but there was a major lack of interest when it comes to finding information about it. It was easier for them to say that the topic was difficult and they only did this because I had asked them to. Although I informed them about the devastating effects anxiety can have on human psychic, most of the teachers did not show any interest in the topic.

When it comes to pupils, the situation was different. They were all very anxious to solve the questioners. After explaining them what they had to do, I have decided to read them the questions so that they can answer individually, thus, they could have been honest and I could better interact with them. The idea was successful since students started to discuss them while filling in thus offering me extra information related to their personal life. My purpose was to explain them that there were individual answers and none was good or wrong, but an honest opinion on this topic. It was clear to me that the conclusions were going to validate the hypothesis.

Methods and Techniques:

- Eysenck Personality Questionnaire
- Burns' list for checking the level of anxiety and katzenjammer
- A test for the teachers
- Some other investigation methods: the interview, the discussion, the observation.

The Analysis, Data Processing and Interpretation

After analysing teh teachers' questioner, some conclusions could be drawn:
92% were female teachers
8% were male teachers

When it comes to studying:
87% only have an university graduation diploma
13% have post- graduate studies

We have considered this an important question because there are a lot of teachers who are not interested in knowing more.

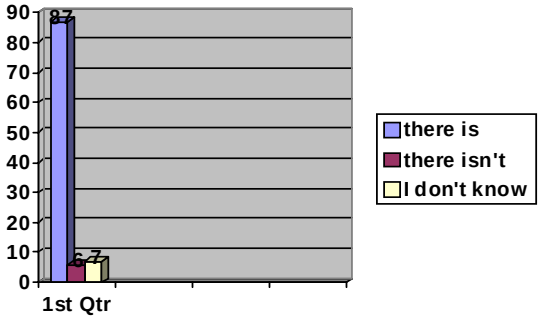
As for their age:
67% of the subjects are between 25-35 years old
23% of the subjects are between 35-45 years old
10% of the subjects are between 45-58 years old

In order to have relevant results, we have tried to include all age-groups in our questionnaire. As we can see, there is a change of generations in the educational system. More and more young teachers become part of it. The main problem that may appear is related to the generation gap. The young ones have less chances to show what they can or to apply active-participatory strategies, being always involved in old and rigid teaching-learning-assessment methods that the most experimented teachers use not to lose control over the pupils in the classroom.

To our next question, what anxiety is, our subjects answered:
42% gave corect answers
28% gave relative answers
30% gave wrong answers

As I have earlier mentioned in the paper, most of the subject we have interviewed could not explain what anxiety was when discussing about this, before they filled in the questionnaire.

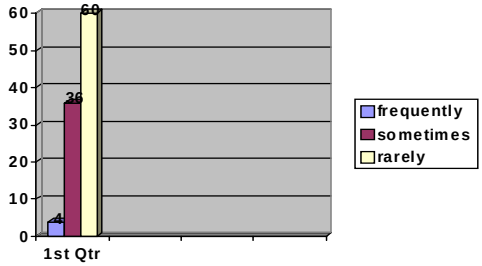
When it comes to anxiety among students, the results are as they follow:
87% of the subjects consider that we may talk about anxiety among students



6% of the subjects said that we can not talk about this topic when it comes to our students
7% of the subjects did not know what to answer to this question

As results show, we can certainly say that there is anxiety among students and most of the teachers have the power to detect the problem and they are interested in doing their best to solve it. At the same time they proved to be empathic when their students asked for their guidance.

The level of anxiety among students



The frequency of anxiety cases as they were observed by the teachers among students.

60% of the subjects considered anxiety a rare problem
36% of teh subjects answered that sometimes we cand find it among pupils
4% of teh subjects frequently found it

If we analyse the teachers' answer, we could say that anxiety is not a problem we should be worried about because its frequency among students is low. It seems that it can not induce behaviour problems to students. -
40% consider That school can provide psycho-pedagogical information to a small extent.
35% of them do not know
20% of them say that school provides infoemation to a great extend
5% of the subjects sat that school does not offer any support when it comes to this field of activity.

Although the school I am working in is quite big, the interest for developing an important information base in all fields of activity is unimaginative. This kind of materials are rare at the school's library and teachers are not very interested in them. Since 35% of them have no idea about their existance, we may say that this should worry us because the fact shows us the lack of interest coming from teachers when this has to do with their training activity.

When being asked who is responsable for producing anxiety, the subjects answered as it follows:

- 58% of them consider parents as the main factor in developing anxiety
- 34% of them consider that the group of friends has the major influence when it comes to producing anxiety
- 8% of them consider that teachers are responsable for this problem

When analysing and interpreting the results coming from the questionnaires given to students, by using SPSS programme, there were found the following correlations:

- there was a huge correlation between the level of nervousness among girls and the frequency of disorder behaviour.
- there was a huge correlation between the girls' predisposition to psihotism and the frequency of behaviour disorder.
- there was a huge correlation between the level of nervousness among boys and the frequency of disorder behaviour.
- there was a huge correlation between the boys' predisposition to psihotism and the frequency of behaviour disorder among those who do not have their parents at home when compared to those that are luckier and have al least one parent staying home with them.
- there was a huge correlation between the depresiive tendencies and the level of anxiety in girls who do not have their parents at home when compared to those that have al least one parent staying home with them.

If we take into consideration the fact that at least half of the students learning in our school have parents working abroad or come from broken families, we may conclude that family is the main factor for producing anxiety disorder. Another important factor that can sustain the results of our quest, could be related to the fact that high school pupils have an informational and emotional background and teachers cand only adjust what is already there.

If family is a source of pressure, students tend to interrelate. Choosing the group is a difficult task and it may burden an unstable psychic. What cocerns me is the fact that our educational system is not based on an active-participatory learning and the relationship between students and teachers can lead to anxiety.

Conclusions

I hope that our paper is going to be useful to those teachers that have students with anxiety problems and who have difficulties when it

comes to integrating in a group. The hypothesize that we erected proved to be true when analysing the data from the questionnaires filled in by the pupils and thus we can conclude that:

- there is a strong boud between the students' anxiety and their tendency to develop katzenjammer or behaviour desorders
- there is a strong correlation between the degree of nervousness in pupils and the frequency of behaviour disorders
- the level of active involvement, interest and information of teachers related to their students' emotional problems has a direct impact on the pupils' behaviour in school and in society.

As trainers, we are responsable for our students' affective-emotional development. We should try to reduce, if not eliminate, the level of stress in schools by using active-participatory methods, by encouraging all students to take part in the lessons and by finding the best solutions to solve pupils' problems while being open-minded and interested. It is our duty to take care of pupils' state of mind because they are our future and we count on it. Beauty is in the eye of the beholder and but to achieve this we all have to deal with our inner struggles and win.

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PARALLEL VOICES IN TWO AMERICAN NOVELS

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Abstract: *If we think of man as being the sum of his memories, than, the image of a place can be regarded as a resolution of flashbacks seen from different perspectives. Until modernism, reality could be clearly defined and literary works were mostly an imaginary trip through love, time and consciousness. Modernism reevaluated these themes and the importance of characters. Reality is now like a drop of water that splits when reaching the ground. As Bleikasten observed, the American South seemed to be, for many writers, both "transparent and opaque".(Philip Weinstein, 1995:6) The two books that I intend to analyze in terms of character development and inner life, are Faulkner's "The Sound and the Fury" and William Styron's "Lie Down in Darkness". They are relevant when talking about family life, racism, individual characters, mixed feelings and complex lives.*

Keywords: *modernism, parallel voices, consciousness, individual characters, feelings*

"The language in which I might be able not only to write, but to think is neither Latin, nor English, neither Italian, nor Spanish, but a language none of whose words is known to me, a language in which inanimate things speak to me and wherein I may one day have to justify myself before an unknown judge." (Hugo von Hofmannsthal, The letter of Lord Chandos).

Modernism gives authors the chance to reveal every hidden part of the human mind in such a way that we can actively involve in its understanding while associating and revealing the best perspective as a whole.

Caddy and Peyton's life can be considered a search for freedom and self-identity. They both live their lives "like nigger women too".(William Faulkner, 1954:113) These sexual independence, this woman awakening gives them chance to escape from the destructive struggle of their family to survive. Caddy's experiences as a "nurturant mother" for Quentin and Benjy, as a lover, mother, a wife and then exiled with no baby and husband, traumatised her being and transformed her life into o continuous attempt to redefine her self as a woman. (Cheryl Lester, 1995:139) Peyton is desperately looking for a proper moment to escape from her parents' clashing voices and find equilibrium. She thought of alcohol, the sexual experiences, marriage and, finally, suicide as opportunities to harmonise her tormented being. But none of these helped her find unity and self-identity.

Caddy, the only powerful character whose strength is given by rebellion, is never given an interior monologue of her own as Payton has the chance to express herself. She is there do to her brother's interest in her, but she's more like a ghost: running, vanishing, retreating, standing in doorways, forever elusive, forever untouchable. She is the center of the novel, an "absent presence" (http://www.bookrags.com), a woman who can control the minds of each male character: for

Benjy “smelled like trees” or “like leaves”, she is the symbol of life, of regeneration, of vitality and change (William Faulkner, 1954:5), the image of a mother and of a sister; for Quentin she represents the loss of “some concept of Compson honor and of a myth of Southern woman hood”(Albert J. Guerard, 1976:109), she is obsessively desired by him and blamed by her brother Jason because “once a bitch, always a bitch”.(William Faulkner, 1954:223)

Payton is trapped between her father’s need for love and incestuous feelings, and her mother’s struggle to prove that she, “a suffering woman”, “had brought together the broken family”.(William Styron,1951:261) She can not find the peace in their family anymore. She wishes to be different, to have her own life, dreams and thoughts, but the burden of a dark heresy brings her close to madness. Her dying naked has no other meaning but the return to innocence, to a state of purity from which she can begin a new life, having a new identity. Not able to love, to have children, to be a good wife or an active lover, she wasted her life in vane with no hope of harmony or stability.

Symbols of decay, the two women, as the key characters in both novels, gather all the other protagonists around them. As the story is built on their development, they destroy each attempt to bring order because they cannot hold together those multiple voices that undermine their authority. As the world created by them collapsed, they are caught under the conflicting selves of the others. They shout, cry, decay and struggle, but their inner life seems to be so deeply hidden that nothing can be seen on their faces. They live to endure, just like a stone is polished by winds and rivers but it never complains until the end of time.

Having no clear-cut in the lives of those around them, they cannot define themselves but in relation to each person that comes in contact with Caddy and Payton. For every step in their development, there is a price to be paid. Unfortunately their search brings neither satisfaction, nor fulfillment. Although Caddy has the power to fight for her life and to assume responsibility for her decisions, she cannot be considered a winner since she was the center of family discussions and of mental breakdown. Failing in every attempt to define themselves, both Payton and Caddy can be labeled as lost identities.

Both Faulkner and Styron’s works “reflect or represent certain realities” but their method is inductive, an indirect way to see beyond past realities and, at the same time, they criticize the same realities they represent “calling reader’s attention back from what they see to how they see it”; this meaning going back to “the nature of reality” and to “common sense” and, by doing so, participating to the realities they represent.(Richard C. Moreland, 1995:17)

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PARTNERSHIP AND PROJECTS AS EDUCATIONAL INTEGRATED ACTION

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Abstract: *Integrated education is interpreted in a double meaning. The common sense is revealed by the integration of children with special needs in kindergarten and schools, but the most provocative meaning is creating educational activities which engage information, abilities and competencies in a monodisciplinary, interdisciplinary, pluridisciplinary and transdisciplinary interpretation. Both can represent main point for designing, implementing and evaluating educational activities, either formal, non formal or the informal kind. The formal system of education is rather opaque in managing educational activities as an integrated methodology of implementing the curricula. The more educational philosophy connects with the integrative dimension, the more children (later teenager and grownups) can became more flexible and connectected with rapid changes.*
To argue these issues in this article, there are presented two case studies for project/partnership regarding integrated education. One of them refers to kindergarten as early intervention and education in the context of creating sustainable partnership and implementing project in a formal educational system. The second one looks at teenagers involved in projects as non formal educational interventions. Two different age group, two different types of activities, but aiming at the same results: development of competencies, raising tolerance and accepting different point of view determined by different types of life and educational experience.

Keywords: *Integrated education, curricula, integrative dimension, early intervention, development of competencies, educational experience, project, and partnership.*

1. INTRODUCTION

The introduction in 2008 of the educational policy document "New Curriculum for preschool education" determined a change of vision, not only in the field of instructive educational activity conducted by preschool teachers, but also in the area of introducing new ways of conceiving the overall educational activities.

The new curriculum is a new reference document characterized by new goals and objectives that are consistent with the evolution of information and society in general. This document entailed a reconsideration of all educational activities conducted with children (by introducing the daily schedule, thematic projects, annual themes, morning meeting, etc.) but also by introducing new concepts such as integrated activity, experiential domains (Language and Communication Domain, Science Domain, Aesthetic and Creative Domain, Psychomotor domain, Human and Society Domain), transitions, routines,

experiential areas activities, personal development activities, etc.

Within this document it is underlined the "bi-univocal relationship content-educational methods and there is a special emphasis on the teacher's role in the activation of constructive and creative mental functions of children" [6]. Besides this, the main element of integrated/integrating perspectives is the idea of a teacher who acts as resource person, who informs the pupil and gives them full access to information, diagnoses problems and supports and directs the child without contradicting or labeling him or her, by working individually or in small groups with preschool respecting their own rhythm etc."

The perspective presented in this paper is determined by conducting a long-term partnership between Kindergarten no. 9 Brasov and the Center for Inclusive Education and Recovery of Deaf Children (CSEIRH), both located in the city of Brasov. The collaboration that exists between the two educational institutions is one of the successful models of integration of deaf children at local and regional level. The collaboration dates back to 1993, when two classes of deaf preschool children were established followed by increasing the number of children in the center. Joint initiatives have been focused during the collaboration on: integration of deaf children in each of the groups of preschoolers (total or partial integration that was determined by each case), organizing joint educational activities, managing common events or festivities, trips, organizing and participating in joint pedagogical and methodical commissions.

The following sequences are specified elements of good practice and results of activities undertaken jointly by the two institutions both in the context of partnership and conducting the same project. Also in this paper is presented a proposal of a project for teenagers regarding intercultural education in order to emphasize the formative and informative role of partnerships and projects as learning instruments.

Implementing educational activities through different types of projects can become a desideratum equally important for achieving formal educational aims and objectives. Also it may be a proper frame to establish long term collaboration between educational institutions and local or regional partners (either public or private, NGO's)

2. PARTNERSHIP AND PROJECTS AS EDUCATIONAL INTEGRATED ACTION

In this paper there are presented two conceptual clarifications. One of them refers to this new "logic of projects" and the second refers to the "integrated/integrational perspective of activities specific to implementing a project.

2.1. The "logic of projects" in the view of the New Curriculum refers to the design, development, implementation, monitoring and evaluation of activities whose outcomes are determined by the aims of the specific educational objectives converged by educational preschool level. These activities are time bound and require a certain amount of resources (information, human, material and / or financial). Given this description, in preschool education there can be implement the following types of projects:

a) Thematic projects

It is determined by the introduction of the New Curriculum. It can have a maximum duration of five weeks, it is in conjunction with one of the six annual issues of curriculum proposed

b) Educational projects

These imply cooperation between minimum two partners (schools, institutions), they can have varying duration assumed by the partners, the needs identified are conjunction those identified by partners or those involved in their management plans

c) Project proposed for financing

It involves creating a solid team whose members belong to two or more institutions, the duration is determined by the maximum amount of funding, the complex of effects outreach institutional area.

Following collaboration between the two institutions, there have been successfully carried out the first two types of projects initiated by teachers from both institutions. Integrating children with special educational needs involves daily activities of partial or

total integration of deaf children in kindergarten groups (mass education).

2.2. Integrated/ integrational perspective

Integrated perspective of pre-school educational activities is described as "knowledge from several disciplines can be merged smoothly during an entire day and, on this occasion, the integrated activity includes games, activities chosen or interdisciplinary knowledge from experiential domains are focused on specific areas chosen by the teacher or by children)". It is important to remember that any phase or sequence of activities (phase I, phase II, phase III, etc.) can be established by teacher .

The integrational aspect concerns, in the spirit of collaboration between Kindergarten No.9 and Inclusive Education Centre for the Recovery of Deaf Children (CSEIRH), integrating children with special educational needs in preschool education.

The long-term objectives are aimed not only at integration and inclusion of children with SEN – special educational need (deafness) in classes of preschool children but also in the real, authentic exchange of experience and knowledge between teachers and managers of both institutions.

Given the logic of projects and the integrated/integrational vision, the role of such partnerships in this context should be focused around the following key areas: providing direct beneficiary (the child with SEN) with the best interventions in order to maximize the ameliorative interventions, information and training of teachers (both mainstream and from the specialist) on the integration and intervention for children with SEN, offering information for future specialists trained in higher education institutions (especially pedagogy and psychology fields) on the integration model, how to design educational goals and current tasks for such children.

3. PRESENTATION OF EXAMPLES OF GOOD PRACTICE OF PROJECTS/PARTNERSHIPS

3.1.Educational project "Friendship is a ray of hope" (Education for peace , cooperation and participation , Education and Democracy).

Developed by teachers from kindergarten no. 9 Brasov , CSEIRH Brasov) and Kindergarten Nr. 1 Teliu, Brasov

The purpose of this partnership aimed at:

Developing and strengthening of positive attitudes towards preschool children, and ethnic and cultural diversity for people with disabilities.

Involvement of both preschool children in mainstream education and special education in the development of joint activities proposed and developed according to age and individual peculiarities and features of the communities in which they come.

Development of an institutional communication platform as a basis for carrying out educational projects and partnerships.

3.2. Introducing the "COME TOGETHER" project.

The project aims to increase ethnic tolerance and acceptance among young people. The project's target group is represented by high school students from high schools in the county of Arges and teachers specializing in history and social science teaching in the operating schools level.

The main activities to be implemented under this project are to train teachers on issues of intercultural and development of intercultural exchanges between young people in the counties of Brasov and Arges

The overall objective is to increase tolerance and acceptance among young ethnic diverse individuals.

The specific objectives are: development of knowledge related to intercultural diversity and intercultural education for a total of 20 teachers of history and social sciences in secondary schools in the counties of Brasov and Arges, exchanging cultural experiences in ethnic Romanian high school students in the county of Arges and Hungarian high school students in Brasov county, encouraging activities involving inter-ethnic relationship between young people. The expected outcomes of the project are: high school teachers selected and trained in cultural diversity, students - both Hungarian and Romanian ethnics -, informed and involved in the project, organizing intercultural exchanges between Romanian and Hungarian participants, students awarded the creative contest Diversity, editing the COME TOGETHER magazine, institutions and organizations informed through the 500 information and promotional materials, an increased level of understanding and acceptance of ethnic diversity, a high degree of active involvement of young people, setting an example of good practice in inter-ethnic cooperation and communication.

3. CONCLUSIONS & ACKNOWLEDGMENT

Project-based activity (the performance of specific partnerships) is generally determined by the specific characteristics different from those familiar with whom people are involved in its operations (teachers, or educational trained specialists at preschool level). For implementing successful projects (educational, thematic or for financing projects) are required a set of elements regarding: establishing clear project objectives and expected results, sizing activities, required resources (human, material, financial, informational), the allotted time period, the deadline for achievement of the person/persons responsible, establishing the roles within the management team and implementation team, identifying external persons who may be involved in the project, permanent monitoring of project implementation, continuous assessment of the project.

An educational institution has initiated numerous projects in the Brasov county area and is now the task of pre-school institutions to generate ideas and viable projects. Each of these initiatives, including this symposium highlights the information and disseminates models of best practices and successful experiences.

The partnership model presented in this paper is a successful and long lasting. Ongoing work of teachers and managers of the two institutions concerning enrichment activities and resources in gaining experience as relevant to the success of integration of children with SEN.

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SELF – DISCLOSURE AND PARENTS – CHILDREN RELATIONSHIPS DEPENDING ON PARENTAL STYLES

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Argument

The present paper brings to attention an aspect of the relationship between parents and children, focusing on the dynamics of the relationship in accordance with the phenomenon of self-disclosure and the corresponding parental style.

It deals with the role of self-disclosure and parental styles in keeping open communication between children and parents, children and his guardian.

Considering that in this epoch of technologies, of virtual communications, expressiveness of the face and the body is no longer necessary, an epoch when everything is robotized, it is important to debate the phenomenon of communication, of disclosure and self-disclosure in the light of parental styles, because the styles adopted by parents in educating and guiding children towards developing their personality and character influence the child's capacity, to develop, and here we have in mind introversion versus extraversion, the spirit of socialization, the ability of assertive, non-violent communication, but also the fear of being judged and criticized, therefore of expressing one's opinion.

Key Words: *relationship, education, communication, self-disclosure, parental styles*

1. SELF-DISCLOSURE IN THE RELATIONSHIP PARENTS – CHILDREN

As psychosocial phenomenon belonging to the sphere of the behavioral comportment of the social self-disclosure plays an important role in the manifestation of the adolescent's real self.

The concept of self-disclosure was introduced in to the specialty literature by Sidney M. Jourard in 1958, in "A study of self-disclosure".

□tefan Boncu, in his book "Interpersonal Processes", defines self-disclosure as a process by which the individual communicates information about him self (□t. Boncu, 1999, p. 10). A. Gavriliuc (2002, p. 67) underlines that "The social actor, generally after initiating a relationship transmits conscious information about his own identity self-disclosure being a more advanced stage of communication with "The other", situated at the level of confluence between the intrapersonal and the interpersonal levels, naturally following after self-perception and self-presentation".

The spheres of the concepts of self-disclosure and impression management intersect, but do not overlap, the intersection areas being practically coincidences with those where, the self-disclosure sphere intersects that of self-presentation.

Self-presentation represents the control over information about one's own person through the communication of certain aspects that pertain to "public strata" of personality.

Self-disclosure symbolized communication of private, sensitive confidential information, with a view to social integration by opening up to others, without particularly aiming at influencing the others.

The social Self (the interpersonal Self) is the dimension of personality we are willing to show the world; it is the persons "window". Some of us have a social Self of the "cactus" type (I feel safe only when I am warlike and on the offensive), others of the "mimosa" type (the defensive attitude gives me protection) or a plant that blooms or wither according to the environment in which it lives (I react in accordance with the surrounding world). The greater the gap between the social and the emotional Self, the lower the person's degree of maturity. An immature person will generally behave one way at home and among friends and another way (that will make him/her safe) in social interactions.

There are four levels communication usually passes through: the level of clichés, of actions, of opinions and of feelings.

In other words, when to persons meet they use clichés such as "Good morning, How are you?" etc., as a sign of greeting, but without symbolizing a desire of initiating conversation, information exchange, and for this to happen the two persons start talking about actions, daily events, things that can make the conversation go on, and when the two have got closer they talk about their opinions on various things, politics, social events, money, love, jobs, etc., subjects that give information about our interlocutor's personality.

Finely after the stage of opinions their came the feelings, which offer further information about the interlocutor, his/her personality and manner of reacting.

Mariana Caluschi (2001) considers that self-disclosure is essential in the process of the social communication of emotions and suggests to educators (teachers, parents) they teach children instructive ways of self – presentation and self-disclosure. According to the child's temper, his/her extrovert or introvert orientation or the openness given by the parental style, the social communication of emotions through self-disclosure can be beneficial for the children's development of personality and social and school integration.

Developing students self – knowledge in one of the fundamental objectives of education. Knowledge and self – acceptance are fundamental variable in then optimum functioning and adjustment to the social environment, in maintaining mental and emotional sanity. Family and school are the key institutions that create the background in which children and adolescent can develop harmoniously according to their own interests and abilities. In these institutions the student starts discovering himself/herself, creating an image of his/her own person, developing self-confidence. Developing students self-knowledge is one of the fundamental objectives of education.

2. PARENTAL STYLES

Parental styles are closely connected to self-disclosure, because children who have developed a spirit of conversation and communication, children who have been listened to and guided by their parents have confidence in themselves, in what they want to communicate, therefore it will be easier for them to disclose themselves.

On the other hand, parents who do not listen to their children and do not understand them who do not spend time with them or do not trust them, rise in them the fear of being examined, criticized, exposed, of putting themselves forward, of expressing themselves, of communicating and disclosing themselves.

In this problem, in the social communication of ideas as well as in the dynamics of interpersonal relationships, the family, through the family educational climate

and the parental styles, has a first class role and places.

Diana Baumrind (ap. Nicoleta Turliuc, 2004) delimits and discusses, on the one hand, parental styles and, on the other hand, their consequences upon children's development. According to the author quoted above, there are four parental styles: the permissive parental style, in which the relationship between children and parents is very good, with seldom any conflicts; the authoritative style, in which there are often conflicts between the parents do not show their affection for their children and are often aggressive; the authorized style, in which warm, affectionate parents teach their children to respect their authority and the negligent style, in which the parents – children communication is almost absent. This style is to be found in families in which the children are of no interest to their parents, in families where the parents do anything else but, or where the parents, thinking they act in the children's best interest, only cause them traumas, confusion, feelings of abandon etc.

The parental styles are presented below, according to the Diana Baumrind.

The permissive style, in which the family, though greatly expressing their affection for the children is not traditionalist, they allow the children to decide for themselves, with full knowledge of responsibilities and duties. The permissive family will give their children a higher degree of freedom.

Generally the impact of the permissive styles leads to positive consequences in the development of the parents – children relationship, like a high level of self esteem, of social abilities, creativity or autonomy, a low level of depression, but these children tend to troublesome behavior.

The authoritative style is the style in which the parents are very authoritative to their children, do not allow the children to disobey, are always ready to use verbal or physical punishments when the children do not respect their orders or the instructions for performing a task, through they feel affection for their children. These parents are hardly open to information or influences from the children, believing they alone are right. The consequences of this style are a growing hostility, low self esteem, high level of depression and the child social anxiety.

The authorized style is practiced by warm, affectionate parents, who communicate their children. Such parents have authority in front of the children, can control their conduct and expect from them a mature attitude, according to their age, at the same time respecting their independence.

The authorized parental style comprises two other versions: the overprotective style and the authorized style proper or authoritative objective style.

The overprotected style is characteristic of parents who manipulate their children in order to obtain their subordination. The parents using this style practice excessive control and tend to smother their children with their love. Consequently, the children suffer from depression, make suicide attempts, have alimentary disorders and difficulties of attaining autonomy when adults, etc.

The parents practicing authorized style proper or the authoritative objective style try to channel their children's activities, resorting to restrictions, explaining to the children, even at an early stage, the reasons underlying the parents' conceptions recording firm control. The consequences of this style are to a large extent positive, the children being eager to assert themselves being sociality responsibly, cooperative, capable of adjusting to new rules and situations.

The negligent parental style is the style in which the parents focus on their own problems interests; it is the case of parents who avoid any parental responsibilities. It is characteristic of parents who do not get involved in a relation with their children, in

their education, who do not offer affection and have very little control over their children. The children of these parents will have poor results in all spheres, a low level of self esteem and socialization, and will not have a clear idea of family rules.

We can resort to the theory of groups in order substantiate a vision of family in terms of organization – crises – disorganization – reorganization. A "well organized" group is characterized by a high degree of unity and a mutual functioning of its members and by welt defined function as against the larger community it belongs to. The family functioning may be described, especially, in terms of its members' roles. In the well organized families the members have accepted, well defined roles that are complementary and through which contribute to family life, to achieving the objectives and goals of the family. A well organized family conceives of itself as having a certain status in front of their relatives, friends, and community. The concepts are useful only in order to define a result of the factors interacting in the process of family life, none of this concepts can explain why a family is organized or integrated, while another is disorganized and unintegrated.

The crisis produces disorganization both at the individual and the social level: criminality, psychic disorders, suicide, family dissolution, unemployment, reduction of consumption. The external effects of the crisis are well – known. The reduction of real income determines families to change their life plans – current or long term; to cut down expenses, to move into cheaper places, to give up the phone, to ask help from their acquaintances or institutional networks. But the most destructive effects are not only diminished incomes, but rather diminished social status; not only giving up "luxury" expenses, but rather limiting their ambitions and aspirations.

The deficiencies intervening in the structure and functionality of the family couple have a negative influence on the affective relationships between parents and young people, characterized – in most cases investigated – by lack of affection and indifference or even occasional conflicts, with effects leading to imperfect or even negative socialization of young adolescents.

The education process is the main means of formatting, especially for the young generations, under all aspects. The quality of the teaching process is measured by the student's results in and outside school, these results depending on every teacher's capacity, every school's capacity of combining the whole range of necessary activities in order to achieve their objectives and improve them. From the perspective of the thins mentioned above, the unitary efficient unfolding of the instruction – education process, the creation of a real, lasting self-regulating partnership between teacher – family – student are decisive. The family is an equal partner, alongside the teacher, in forming the child's personality. It can offer the child many resources or, on the contrary, can deprive him/her of them. No matter how perfect a system of education, it remains insufficient of it friends, opposition or indifference from the parents. As the child spends most of his/her time in the family, the educational effect will be diverted or even annihilated when it meets the parents' opposition.

Possessing the characteristics of a real community integrated into the larger society, the family directly contributes to shaping and developing the personality.

The parents' care, love and cultural behavioral models ensure the child's healthy psychic development attitude particularly in disorganized families – results in various psychic anomalies.

The families' adjustment is psychic and social at the same time. Obviously, anxiety, excessive worrying, nervous disorders,

suicidal thoughts will increase, as well as changes in level of living, in the structure of the roles in families, in personal and family objectives.

3. RESEARCH INTO THE PARENTAL STYLES THAT INFLUENCE SELF-DISCLOSURE

The aim of the research: The present study proposes an investigation of the way in which parental styles facilitate the phenomenon of self-disclosure and conditions an efficient communication in the relation parent – child.

Objective: Working out a study of the way in which different parental styles influence self-disclosure and the challenge to the children's self-disclosure.

General hypothesis: There are significant differences in the frequency of self-disclosure, depending on the parental style by which the parents are guided in education.

Methodology: The first questionnaire used is **the self-disclosure questionnaire** used by Prof. dr. Marian Caluschi, measuring the degree of self-disclosure to various persons, questionnaire made up of 14 items, in two parts, as follows:

The first part comprises 10 items referring to various themes of self-disclosure, with six versions of answers (mother, father, friend of same sex, friend of the opposite sex, another person, nobody).

The second part comprises four questions, generally connected to confessions, with five versions of answers (very frequently, frequently, sometimes, seldom, never).

The second questionnaire used in this investigation is **Parental Authority Questionnaire**, created by John R. Buri from the Psychology Department at the St. Thomas University; it is made up of 30 items with answer versions from 1 to 5 and is conceived in order to measure parental authority or disciplinary methods from the child's viewpoint (any age). PAQ has three subscales: permissive, authoritative and authority.

The investigated population and groups:

In conducting this research we administered the two questionnaires presented above to a class of 25 pupils at the "Gheorghe Asachi" Technical College, Ia□i, their ages being between 15 and 18.

The subjects participating in the research expressed their free consent and were informed on the confidentiality of the data offered, as well as on the fact that the results will be used solely for research purposes.

The analyses of the data and psychological interpretation. **Checking the hypothesis**.

Correlating and interpreting the results to the administrated questionnaires, we found out that, through the parents practicing an authoritative style are hardly open to information or influences to their children, those who are oriented to a status and value the children's obedience, who expect their orders to be carried out and do not hesitate using force when the child's actions or ideas contradict their own, who favour the growth of hostility, reduce self esteem and prevent the child's developing social competence, the children belonging to parents who are adepts of this style disclose themselves more frequently then those whose parents are guided by other styles in education.

Conclusions

The lack of self-disclosure has a negative impact, mainly on the adolescent because of its possible repercussions. During adolescents, this factor can induce isolation, errors caused by a lack of knowledge, blocking of communication, etc.

The concepts of organized – disorganized, integrated, adjustable – unadjustable families are, more or less, intuitive, taking into account a number of family life characteristics. None of these concepts can explain why a family is

organized and integrated, while another is disorganized and unintegrated. The deficiencies intervening in structure and functionality of the family couple have a negative impact on the affective relation between parents and characterized, in most cases investigated, by lack of affectivity and indifference, or even by occasional conflicts, with effects leading to an imperfect and even negative socialization of adolescents.

The educational process is the main means of human's formation, especially for the young generations, under all aspects. The quality of this process is measured by the students' results in an outside school, results depending on the capacity of each teacher and each school of combining the whole scale of necessary activities in order to achieve and improve their objectives. From the viewpoint of the ideas above, the unitary efficient unfolding of the instruction – education process, the ensurance of a real, lasting partnership, with a self regulating role, between teacher – family – student, are decisive. The family is an equal partner in forming the child's personality, through with the teacher. The family can offer the child numerous resources or, on the contrary, can deprive him/her of them. No matter how perfect a system of education it remains insufficient if it finds opposition or indifference from the parents. Since the child spends most of him/her time in the family, the educational effect will be diverted, deformed or even annihilated when it meats parents opposition. Having the characteristics of a real community integrated into the larger society the family directly contributes to shaping and developing personality.

Parental care, love and cultural behavioral models ensure the child's healthy physic development. On the contrary the parents negligent attitude – especially in broken-up families – results an various physic anomalies.

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DEVELOPMENT OF EMOTIONAL INTELLIGENCE – AN EXPERIENTIALIST APPROACH

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Abstract: *The present paper started from the following general hypothesis: the experiential methods and techniques which are being used within the personal optimization group lead to the development of emotional abilities in Psychology students.*
An experiential group for personal optimization of 30 Psychology students was involved (with a frequency of 15 h/weekend every 2 months for 3 semesters), control group being composed also from 30 Psychology student.
The preliminary results show that students from experimental group improve their self awareness, empathy, motivation, social abilities, and self-regulation, as components of emotional intelligence, during the experiential group for personal optimization. Their development of emotional abilities has an influence on the improvement of their own didactic behaviour and professional success.

Keywords: *emotional intelligence, emphaty, motivation, self-regulation, self-awareness, social abilities.*

1. INTRODUCTION

We cross a period of continuos changes that require those personal competences that are found in one of the newest concept from psychology – *emotional intelligence (EQ).* Defined as awarness, understanding and expression of emotions, EQ togher with cognitive intelligence help a person to adapt easier to situations and experiences from personal and professional life.

Emotional intelligence represents a bridge between emotions and cognition with emotions representing an important source of information that assist the individual in understanding and exploring social environment. It became a „cultural trend" [1] as it promises to contribute to a better solving of human problems such as the conflict between what a person thinks and she/ he feels. Researches involving emotional intelligence are more numerous and for this subject specialists manifest more and more interest.

Emotional intelligence seems to be mostly nurtured and emotional knowledge can be develop. Studies showed that people increase their EQ along the years as they learn how to manage their impulses, how to motivate themselves and to show more empathy and social flexibility all of these meaning that they become more emotional intelligent. [2]. As a consequence people are more understanding toward themselves and others, happier with their life, more efficient and appropriate co-workers. They benefit of a plus no matter the domain they activate in, professional, personal and even intimate relationships, EQ contributing to success in any domain.

2. METHODOLOGY

2.1. Objective

The objective of the present study is the development of emotional intelligence of psychology students by enabling personal resources as a result of awareness and responsibility of their own life during the sessions of experiential training for personal optimization.

2.2. Hypotheses

General hypothesis

Experiential methods and techniques used in the personal optimization training session lead to the development of emotional intelligence of psychology students.

Specific hypothesis

1. Experiential programme determines the development of self-consciousness in students of experimental group versus control group.

2. Students in the experimental group, following the experiential group intervention, have a greater capacity to regulate emotions than those in the control group.

3. The level of motivation development is higher in the experimental group compared to the control group following experiential group intervention.

4. Experiential group intervention facilitates the development of empathy in students of experimental group versus control group.

5. The level of social skill development for students in the experimental group is higher following experiential group intervention.

2.3. Assessment tools

Four tests were individually applied before and after experiential group intervention in order to assess the development of emotional intelligence and its components:

- Emotional intelligence test through behaviour measurement – TQE (Segal, 1997) [3];
- Emotional Intelligence Scale – EIS (Schutte, Malouff, Hall, Haggerty, Cooper, Golden, Dornheim, 1998) [4];
- Emotional intelligence test – TIE (Goleman, 1995, adapted by Roco, 2001) [5];
- Battery of emotional intelligence profile – BTPIE (Wood, Tolley, 2003) [6].

2.4. Participants

60 psychology students were involved, with a mean age of 23.74 and 7.62 standard deviation, divided into two groups.

a. *The experimental group* - comprising 30 psychology students who participated to an experiential training of personal optimization focused on the development of the emotional intelligence and of its components (self-awareness, empathy, motivation, social skills and self-regulation). The training consisted of 12 meetings that took place over 18 months, totalizing between 96 and 120 hours.

b. *The control group* - statistically comparable (age, sex, level of development of emotional intelligence) consisting of 30 psychology students.

To respect the rules of professional ethics the written consent of each student participant has been demanded. The results are confidential and used only in the present study.

2.5. Techniques

In order to test the above hypothesis, we prepared a module design for development of emotional intelligence and based on principle from humanistic and experiential approaches. This orientation was selected because the accent is placed on self evolvement, interpersonal relationships, and experience of *here and now*. The students are allowed to become aware of self perceptions, their thoughts and emotions and to understand, transform and control them. The module encompass twelve sessions in which we planned to obtain group cohesion, to familiarised participants with experiential techniques, to facilitate self-awareness and interpersonal interaction and also to develop self-consciousness, empathy, motivation, self-regulation and social abilities [2].

Most of the exercises were centred on provoking the students to experience the *here and now* feeling in relation with different life situations and to practice constructive interrelation skills followed by deep personal analysis.

Some examples of exercises used in the intervention group are: ***„Decoration of the doll", „The story of the three faces" „The***

picture of my emotions", „The flying balloon", „In the symbolic world", „What are the books saying about me", „The story of my family", „We draw together", „The story of the hands who become alive", „The mirror room", „The emotions puppet", „The duet or the history of my becoming".

3. RESULTS

In order to test the efficiency of the intervention module centred on the development of emotional intelligence we compared the mean values for the component of emotional intelligence for the two groups (experimental and control group). There were used four tests, two of them multidimensional (BTPIE, and TQE) composed of factors that are component of emotional intelligence and two test that measure a global score for emotional intelligence (TIE and EIS). The scored obtained by each of the component of emotional intelligence and the global score are bigger for the experimental group and smaller for the control group. The results are showed in table 3.1. Provoking exercises followed by a deep psychological analysis lead to the development of self consciousness ($t_{(58)} = 2,01$, $p = 0,05$), an increased capacity to regulate their own emotions ($t_{(58)} = 6,25$, $p = 0,001$), and an increased motivation ($t_{(58)} = 2,91$, $p = 0,01$). The level of empathy also improved after experiential sessions ($t_{(58)} = 7,88$, $p = 0,001$). Students showed an improvement in their social abilities ($t_{(58)} = 4,41$, $p = 0,001$) - as a component of emotional intelligence in Wood and Tolley model. Emotional intelligence quotient as a global capacity improved in all the other measurement used and the results are also summarised in table 3.1.

Tab. 3.1. Comparison between means in the post-test for experimental and control group

Psychological tests	Mean (σ)		t	p
	Experimental group	Control group		
Self-consciousness BTPIE (Wood, Tolley, 2003)	89,67 (10,56)	84,50 (9,20)	2,01	0,05
Self-regulation – BTPIE (Wood, Tolley, 2003)	66,93 (6,88)	57,53 (4,51)	6,25	0,001
Motivation – BTPIE (Wood, Tolley, 2003)	65,60 (5,88)	61,43 (5,15)	2,91	0,01
Empathy – BTPIE (Wood, Tolley, 2003)	72,47 (5,33)	62,33 (4,59)	7,88	0,001
Social abilities BTPIE (Wood, Tolley, 2003)	41,33 (4,91)	36,40 (3,64)	4,41	0,001
IE – BTPIE (Wood, Tolley, 2003)	66,93 (4,66)	60,06 (3,31)	6,56	0,001
IE – TIE (Goleman, 1995, adapted by Roco, 2001)	109,50 (22,33)	86,33 (23,45)	3,91	0,001
Emotional consciousness – TQE (Segal, 1997)	1,93 (0,58)	1,50 (0,86)	2,28	0,05

Acceptance of emotions – TQE (Segal, 1997)	2,07 (0,74)	1,43 (0,77)	3,24	0,01
Active awareness of emotions – TQE (Segal, 1997)	2,63 (0,92)	2,07 (0,98)	2,29	0,05
Empathy– TQE (Segal, 1997)	2,23 (0,62)	1,50 (0,82)	3,89	0,001
IE – TQE (Segal, 1997)	8,87 (1,92)	6,43 (1,96)	4,85	0,001
IE – EIS (Schutte et al. 1998)	129,60 (11,78)	122,47 (10,27)	2,49	0,05

The level of development for emotional intelligence measured by Wood and Tolley battery (BTPIE) for the experimental group has a value of 66,93 (presented in the right side of the imagine pre and post intervention) compared with 60,06 for the control group (presented in the left side of the image, first and second testing) ($t_{(58)}$ = 6,56, p = 0,001) – figure 3.1.

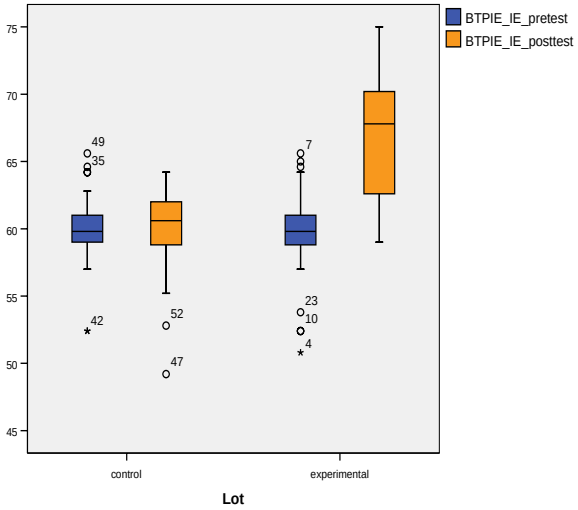

Fig. 3.1. The influence of the experiential intervention on the level of emotional intelligence tested by BTPIE battery

Emotional intelligence quotient obtained by the experimental group at the test for emotional intelligence proposed by Goleman and adapted by Roco – TIE has a value of 109,50 compared with 86,33 for the control group ($t_{(58)}$ = 3,91, p = 0,001). The values for the control group are depicted in the left side of the image and for the experimental group in the right side, for the two moments of the testing (pre and post intervention) – figure 3.2.

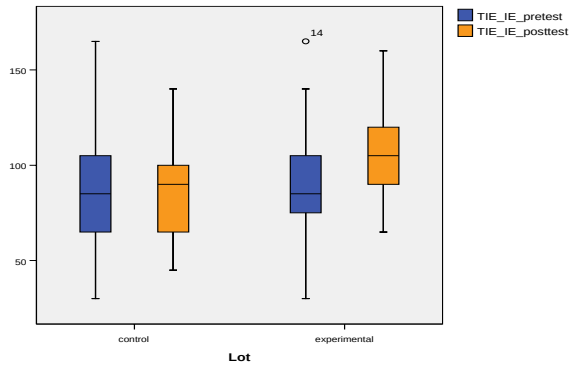

Fig. 3.2 The influence of the experiential intervention on the level of emotional intelligence tested by TIE

The next test measured EQ using behaviour description and was proposed by Segal in 1997 – TQE. Experimental group obtained bigger values of the total score after intervention (8,87 points) compared with control group (6,43 points) - $t_{(58)}$ = 4,85, p = 0,001. Figure 3.3. illustrates the difference between the two groups.

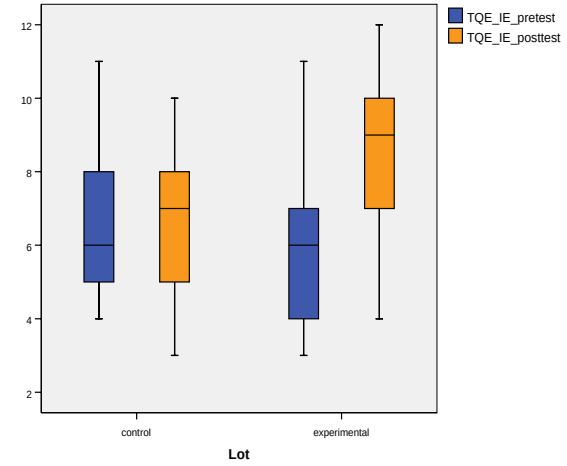

Fig. 3.3. The influence of the experiential intervention on the level of emotional intelligence tested by TQE

Another global measurement for the emotional intelligence is the one proposed by

Shutte and co-workers – EIS. At this test the students from the experimental group obtained a score of 129,60 compared with 122,47 received by the students from the control group ($t_{(58)}$ = 2,49, p = 0,05). The values are presented in figure 3.4.

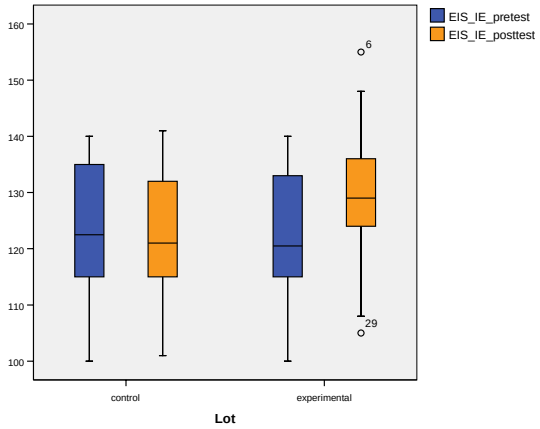

Fig. 3.4. The influence of the experiential intervention on the level of emotional intelligence tested by EIS

4. DISCUSSION

In experiential training of personal optimization it was aimed to optimize the psychology students' development of emotional intelligence by activating personal resources, by discovering new patterns of effective interaction, by becoming aware and responsible of their own life. The statistical results obtained support the assertion that experiential group intervention determines the development of emotional intelligence and its components - self-awareness, empathy, self regulation, motivation and social skills. Psychology students included in the experimental group improved the level of development of their emotional intelligence assessed with all four psychological tests: Battery of emotional intelligence profile – BTPIE, Emotional intelligence test – TIE, Emotional intelligence test through behaviour measurement – TQE and Emotional Intelligence Scale – EIS.

Using the control group in the experimental design emphasized the beneficial effects of experiential training sessions especially that in post test there were confirmed statistically significant differences between the results obtained by students in this group and those in the experimental group.

Also, experiential group members have achieved superior results for each component of emotional intelligence, which entitles us to characterize them as being able:

- to identify and express their emotions, to adopt a positive attitude, to be honest with themselves and to respect themselves avoiding to focus only on logic and reason;
- to manage their own emotions and impulses, to be more flexible, detached by problems and to express emotions in an assertive manner;
- to channel their desire and striving to evolve and to achieve set goals, to take initiative and to maintain positive attitude towards the challenges of life;
- to identify and accept others' feelings, to participate in their emotional issues, to relate to others' feelings and needs without sacrificing their own emotional experience;
- to initiate, to develop and maintain quality and constructive interpersonal relationships, to communicate and collaborate effectively in group activities.

Methods and techniques of art therapy, gestalt-therapy and drama therapy challenged the psychology students involved to experience "here and now" various life situations and thus to realize their own perceptions, thoughts, emotions, feelings, fears, blockages and vulnerabilities, and then,

to deliberately assume them, to transform them through re-significance and take control over them and over their own person. Provoking exercises led them to know themselves and the others better, to understand and accept that each person is unique precisely because he has both qualities and faults. They also became aware of the feeling that they belong to the group, that their difficulties may be common to others and that it is important to adopt an attitude of trust and mutual support. The experiential group stimulated the students to discover their own way to cope with life challenges as effectively as possible and get the chance to negotiate with themselves, to forgive and accept, to foster, assess, observe, and gratify themselves in a conscious and responsible way.

In and through meeting with themselves and with others, psychology students activated their resources and re-channelled locked energies on a course of creative and always flexible personal and professional development based on free choices and accountability. Acquisitions took place both during exercises and as a result of intensive personal analysis focused on the following themes: emotional immaturity and dependence, separation anxiety and abandonment, fear of rejection and failure, self rejection and low self esteem, lack of authenticity, conduct of over adaptation, aggressiveness and fear of authority, confusing relationships and lack of border in relations with parental figures, "family loyalty" and family myths, hostility and repressed anger towards others, intolerance to frustration and possessiveness, anxiety and mistrust of others.

The assessment, conducted by psychology students, on significant effects arising from their participation in experiential group is meant to highlight the considerations above.

In the next lines present the saying of one of the participants:

„Throughout the group meeting I started to discover the value of Socratic thinking. Analyses that I was part in and diverse techniques helped me to understand conflict and tensions that I buried inside of me and free energies that I believe I can have. Actually I discovered that even if I believed I can swim only now I learned the correct movements. But first I had to forget or to correct the old movements. I discover that the entire burden covered under projections, introjections, transfers were in fact slowing my development. Was it meaningful that I referred to myself in rather masculine form not feminine? What consequences had the fact that I clarified my sex-role in the family? What about the integration of my feminity? All of these are rhetoric questions. Now I know to listen to people without judging them. The empathy that I inherited and that always helped me to come closer to people is not stopping me to say NO when I realised the danger of becoming a permanent „helper". Now I finally discover the benefits of being a wife and a mother without forgetting that I am a woman too." (Daria)

The training of personal optimization focused on the development of students' emotional intelligence is valid and supports the vision of a new educational paradigm described in volume led by Laurențiu Mitrofan (2007) [7]. Moreover, it can be extended, adapted and tested in schools for parents, especially in teachers' of all specializations and school psychologists' initial and continuous training.

This research, beyond its contributions and limits***, is intended*** to be ***an invitation from soul, to teachers, present and future, to reflect on the importance of developing their own emotional intelligence*** and ***work with himself*** in order to ***obtain self achievement of the human potential, personal self perfection, to win creativity, authenticity and spontaneity so much needed when training sociable, creative, happy, free and intelligent children and young people*** [8].

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STRESS AND JOB SATISFACTION AMONG UNIVERSITY TEACHERS

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Abstract: *The aim of this study was to investigate the relationship between stress and job satisfaction among Romanian academics. Stress was indicated by the levels of depression and anxiety. 70 university teachers participated in the study. Burns Anxiety Inventory, Burns Depression Inventory and Warr Job Satisfaction Scale (adapted by Travers and Cooper) were used to collect data from respondents. The results indicated that: a) there is a negative correlation between stress and job satisfaction; b) women report a high level of anxiety and depression and a low level of job satisfaction and are found to be significantly different on these scales from their male counterparts; c) academics with tenure have substantially greater job satisfaction than their colleagues without tenure. Academic title or the types of the faculty do not produce significant differences among subgroups of teachers within the measured variables.*

Keywords: *occupational stress, job satisfaction, academic environment*

1. INTRODUCTION

Although, work activity has a strong and long formative potential upon human, it can also be an important source of stress with major consequences for both the individual and the organization he works in. Work environment affects employee's physical, emotional and social health, producing states of depression, irritability, substance ingestion, and somatisation. Deterioration of health drives to diminution of employee's job performance, translated in difficulties in concentration, decision making, assertive communication, difficulties in team work and human relations management. The tasks that university teachers are expected to undertake have changed significantly in recent years and increasingly their work is perceived as pressured. The topic of stress and its relation with job satisfaction is important because its job related implications for job related behaviours such as productivity, absenteeism or turnover. Research findings suggest that there is a linear and negative association between occupational stress and overall job satisfaction [10, 22, 5, 6, and 12].

2. RESEARCH METHODOLOGY

This research aims to investigate the relationship between stress (measured by the level of anxiety and depression) and job satisfaction among 70 Romanian academics, and to highlight the individual differences in experiencing stress and job satisfaction depending on demographic factors.

To emphasize the dynamic and complex nature of stress phenomenon, we used, as research instruments Anxiety Burns Inventory, Depression Burns Inventory, and Warr Job

Satisfaction Scale (adapted by Travers and Cooper) [21].

3. RESULTS AND DISCUSSION

3.1. Stress level. Emotional abilities are the individual's internal resources, with a great role in protection and maintenance of emotional health. The lack of these abilities (demonstrated by the tendency to overstate the events and to exacerbate the negative aspects of the experiences, self blame, failure generalization, permanent worry towards events that never took place, and irritability) leads to incapacity to adapt to demanding or stressful situations and a poor quality of life. A high level of anxiety and depression are indicators for emotional health degradation as an effect of occupational stress. Table 1 indicates the means and standard deviations obtained by our research group for these two variables. We registered a moderate level of anxiety and depression for the entire group:

Variables	Mean	Std. dev.
Anxiety	20.22	13.17
Anxiety - feelings	4.45	2.86
Anxiety - thoughts	5.31	4.73
Anxiety – physical symptoms	10.42	7.14
Depression	9.41	5.70

Table 1. Emotional health indicators

Gender produced significant differences among investigated subgroups. In comparison with their male counterparts, women obtained significant greater means for the two analysed variables. Thus, the general score for anxiety is significant higher for women as group (t= 4.21, p< .000). Decomposing this score in the main three components (anxious feelings, anxious thoughts, and physiological symptoms) we observed that, although anxious thoughts (t= 3.94, p< .000) and anxious feelings (t= 3.81, p< .000) are significant higher for feminine gender representatives, the third component, physiological symptoms (t= 3.46, p< .001) is the one that makes really the difference (figure 1). Women somatise more and their fight for attaining higher expectations than men has its greater physiological and emotional costs. Also, the general level of depression is significant higher for women (t= 4.16, p < .000). The results are similar to the ones presented in the literature

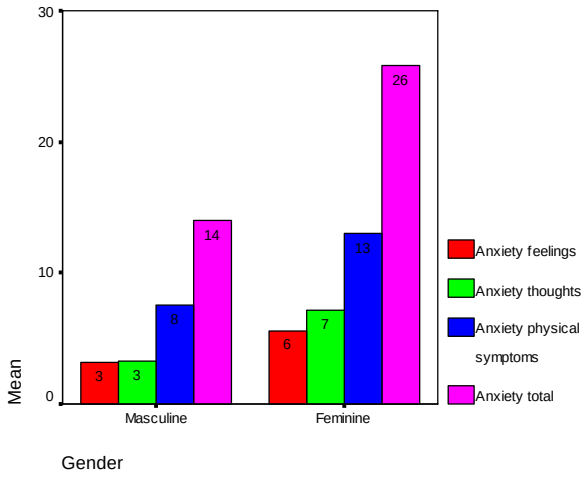

Fig. 1 Anxiety indicators by gender

Results regarding the role of gender in experiencing stress are contradictory. There are studies which sustain that women are more stressed than men. Dey [8] affirms that women report more stress compared to men especially regarding aspects like time pressure, lack of personal time, work overload, family role management. Smith et al. [19] discovered that women register a higher level of stress than men, and the main sources are role ambiguity and role conflict. Blix et al. [2] discovered that the score mean for stress is significant higher for women, almost a third of them taking into consideration a job change, towards only 9 percent of men. Thorsen [20], Boyd and Wylie [3], Gmelch et al. [12], Sharpley [17], Bradley and Eachus [4], and McInnis [14] discovered that the women' stress level of is significant higher in comparison to men.

Other studies sustain the contrary, that men are more stressed than women. Thus, Currie [7] argues that the higher level of stress for men is due to the fact that women hold inferior positions where there are fewer responsibilities, although their volume of work is bigger at didactic level. Dua [9] didn't identified significant gender differences regarding occupational stress, but, in his study, men report as stress factor the work volume

while women place as main source of stress work politics.

Finally, there are studies that sustain that there are not considerable differences between men and women in experiencing stress. Abouserie [1], Kinman [13], Gmelch and Burns [10], Winefield and Jarrett [23], Winefield, et al. [24] found no relationship between stress and gender, race, academic title or remuneration.

Age and tenure have minimal effects on discussed variables. Although the differences are not statistically significant, we detected a progression of the anxiety scores depending on age. Individuals from the young segment (24 – 35 years) of organizational adult age, manifest fewer anxiety symptoms. That is because, at this age, individuals mobilize themselves easier, their professional motivation is stronger, now being the time when first work motives appear, when individuals set professional goals to attain. On the other side, ageing brings a visible reduction of biological vigour for individuals from over 50 years category, although intellectually, their abilities achieve superior levels because of the accumulated experience.

3.2. Job satisfaction

In this study we considered job dissatisfaction as a direct response to stress. The inventory used comprised questions which are scored from 1 to 7, meaning that for any subject the job satisfaction score could range from 15 to 105. The mean score for the academicians in this sample was 73.87, with 11.95 standard deviation; this value is much closed to the mean score for normative population of 74.6 (Warr et al., 1979, after Travers and Cooper) [21]. When comparisons are made with other occupational groups like tax officers – 62.0 – (Cooper and Roden, 1985, after Travers and Cooper) [21] or nurses – 72.8 – (Cooper and Mitchell, 1990, after Travers and Cooper) [21], our findings show that university teachers have a relatively high job satisfaction. Teachers from Britain pre university system record a mean of 59.6 [21] which mean that teachers are very dissatisfied with their job. A number of advantages that university system offers could explain these differences in job satisfaction: much more freedom and flexibility concerning the programme and curriculum, freedom in following your own research interests, travelling abroad for scientifically purposes, a greater variety of work, students' bigger motivation towards the learning process.

For a detailed image upon academic job satisfaction we present the results for each of the 15 items in the scale that measured different aspects of the job (table 1).

As the table shows, academics are revealing the highest levels of dissatisfaction with extrinsic aspects of the job (i.e. rate of pay, relations between management and teachers in the faculty, their fellow teachers, and working hours). Aspects of the job that teachers are satisfied with are those that deal with freedom to choose their own working methods, job security, and opportunity to use their abilities.

In his study of job satisfaction in ten universities in Britain, Stevens [19] obtained similar results. The main aspects of the job that teachers are satisfied with are: work itself, (5.48), decisional freedom (5.54), relations with colleagues (5.59). Those aspects that teachers are less satisfied with are: chances of promotion (3.69), financial satisfaction (3.85), and total earnings (3.95).

Data analysis revealed that women tend to report lower levels of global job satisfaction ($t(68) = 2.99$; $p < .004$) and significantly lower levels of satisfaction with the majority of the aspects of the job, except the aspect that deals

with freedom to choose their own way of working. Some reasons for these results are related to the fact that women in this sample are younger, have a lower experience in the field and are occupying inferior academic positions compared to their male counterparts.

The relationship between job satisfaction and age or job tenure is linear, meaning that job satisfaction tends to increase with age and with experience. The overall job satisfaction score is lowest for university teachers who are under 35 years of age (overall job satisfaction score 71) and it increases progressively for each older age group, with a final satisfaction score of 77 for university teachers over 50 years of age. Also, the results showed that university teachers with tenure are generally more satisfied with their jobs, with an overall job satisfaction score of 78, than the inexperienced university teachers, whose overall job satisfaction score is only 71.

Some explanations stand for the linear and positive association between overall job satisfaction and age or job tenure. First, according to Oshagbemi [16], as they grow older, until the retirement age, people change in their cognitive structures, meaning that they possess greater stability and ego strength. In addition teachers who over 50 years of age hold superior scientifically titles and academic positions, but also managerial responsibilities, which makes their job more rewarding. Theory of accommodation could be another explanation. Thus, if at the beginning of their career young people have high expectations, after having stayed in their jobs for some time, they tend to adjust their work values to the workplace conditions, resulting in greater job satisfaction. Also, the longer people spend their time in a workplace or a professional context, the better they can predict and avoid the frustrations produced by that environment [15].

In his study among British universities, Stevens [19] identified a positive association between overall job satisfaction and work productivity; this could explain the lower level of job satisfaction of those people who are at the beginning of academic career. In universities work productivity is measured by the research output, the number of publications in peer-reviewed journals representing the measure instrument for productivity. Or, this is an issue that creates difficulties for teachers with low levels of academic and research experience, which means that, in order to obtain academic credentials, they have to perform jobs with lower levels of job satisfaction than more experienced academics with similar levels of productivity.

Some significant differences emerge when each individual aspect of job satisfaction is examined.

Financial satisfaction is by far the lowest for academics without tenure ($F = 9.67$; $p < .000$) and increases progressively for the other categories of seniority. It is known the fact that the pecuniary aspect is more attractive for readers and professors and that there is a large discrepancy between the inferior and superior academic positions. Personal chances of promotion represent another issue with high levels of dissatisfaction for debutants than for those with academic experience ($F = 7.67$; $p < .001$). The quality of human relations registers a contradictory dynamic when is related to seniority: a mean of 4.0 for those of 1- 6 years of seniority, 5.3 for the 7 – 15 years seniority segment, and 4.5 for 16 – 40 years category. These results are regular for the beginners since the entrance into a profession corresponds to professional adaptation and integration and implicitly to the creation of interpersonal networks. But this doesn't hold for the last segment of seniority where professional integration, as a psycho social phenomenon, should have got to maturity. We obtained similar results for the aspect dealing with the amount of given responsibilities, the most satisfied being the middle segment of seniority (with a mean of 5.0), followed by seniors (with a mean of 4.5) and beginners (with a mean of 3.5). One possible explanation is that, for the beginners, the specific tasks (didactic, research and administrative activities) lap over the effort of achieving the scientifically status (71% of the aspirants for the doctoral diploma pertain to this category).

3.3. Relations between variables

Analyses indicate that there is a linear and negative association between occupational

stress and overall job satisfaction, as found in the literature [10, 22, 5, 6, and 12]. Thus, overall job satisfaction correlates negatively with the anxiety level ($r = -.240$; $p<.01$) and with the depression level ($r = -.447$; $p<.01$).

4. CONCLUSIONS

This research revealed that: there is a negative correlation between stress and job satisfaction; women report a high level of anxiety and depression and a low level of job satisfaction and are found to be significantly different on these scales from their male counterparts; academics with tenure have substantially greater job satisfaction than their colleagues without tenure. Academic title or the types of the faculty do not produce significant differences among subgroups of teachers within the measured variables.

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Job satisfaction item	**Min.**	**Max.**	**Mean**	**St. dev.**
The freedom to choose your own method of working	3.00	7.00	6.15	.87
Job security	1.00	7.00	5.48	1.17
The opportunity to use your abilities	3.00	7.00	5.45	1.13
The physical working conditions	3.00	6.00	5.27	.89
Your immediate boss	1.00	7.00	5.22	1.42
The way your faculty is managed	2.00	7.00	5.15	1.17
The amount of variety in your job	1.00	7.00	5.10	1.40
The recognition you get for good work	1.00	7.00	4.88	1.11
Your chance of promotion	2.00	7.00	4.80	1.23
Working hours	1.00	7.00	4.72	1.42
The attention paid to your suggestions	1.00	7.00	4.67	1.34
Your fellow teachers	1.00	7.00	4.61	1.57
Relations between management and teachers in your faculty	1.00	7.00	4.48	1.34
The amount of responsibility you are given	1.00	7.00	4.34	1.45
Your rate of pay	1.00	6.00	3.80	1.79

Table 1 *Academic job satisfaction*

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OCCUPATIONAL STRESS IN UNIVERSITY: PERCEIVED CAUSES AND COPING STRATEGIES

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Abstract: *This study investigated perceived occupational stress and stress coping strategies in a sample of 70 university teachers. Data was collected using a Perceived Stress Sources Inventory and Occupational Stress Indicator (coping Scale). The results indicate that university teachers confront especially with the necessity of compromise between the amounts of professional tasks, the needed time for doing the work and the quality of activity. The main sources of pressure are great volume and variety of the tasks, reduced remuneration, difficult promotion, conflict between profession and family life, conflict between research and didactic activity, time pressure and unrealistic deadlines. In comparison to other occupational groups, university teachers employ greater use of all types of coping strategies. In addition, compared with their male counterparts, women academics generally experience higher overall levels of stress in their jobs and use social support as a way to cope better with the demands placed upon them.*

Keywords: *occupational stress, sources of pressure, coping strategies*

1. INTRODUCTION

The major changes that took place into our society have imposed pressure on university teachers and have therefore created reasons as to why the study of academic stress is growing increasingly important. In an attempt to minimize its negative effects, stress researchers have conducted numerous studies to identify potential risk factors for occupational stress. Different stressors have been recognized, some residing within employee cognitions, others relating to environmental sources of stress, such as organizational constraints and interpersonal conflict at work.

2. METHODOLOGY

In the present research, the perceived sources of academic stress and the coping strategies are studied in a sample of 70 university teachers. The perceived sources of stress were assessed using an inventory that contained some demographic questions too. Each of the 56 items was measured from a range representing (1) total disagreement to (6) total agreement. The instrument was based on an interview applied to the teachers and on a literature review concerning the academic stress. Coping strategies were measured using Occupational Stress Indicator - OSI (coping Scale) which contains 6 subscales as follows: *social support, home/ work relationships, task strategies, involvement, logic*, and *time*.

3. RESULTS

3.1. Sources of pressure. Table 1 includes the inventory's 56 items and their perception

as stressful factors. The results show that the most pressing source is *the great volume and variety of the tasks*, with an average of 5.11, while the source perceived as the least stressful is *the tendency that others take the credit for my work*, with an average of 2.71 (score 1 indicates a low pressure of the source and 6 shows that the item provides a great stress). The results are convincing if we are thinking that the university teachers have responsibilities in three areas: didactical, research and administrative. Analyzing the most pressing identified sources, we can see some connections between them. First, most of them refer to the work conditions and the status and promotion possibilities provided by this profession. Secondly, the great volume and variety of the university activities have at least two effects: the didactic and e research activities become secondary towards the administrative ones, when the main activities should be documentation, research, courses development, writing scientific papers, working with students; on the other hand, a great amount of work transfers at home (courses preparation, writing papers, documentation, research, etc.), and the interference of the two zones (work and family) generates tensions. In addition, career promotion and material and professional acknowledgment demand many years of sustained effort and are based upon European norms (international visibility of the research, ISI articles or articles in international data bases), while university as organization offers little support for acquiring the promotion conditions; in many cases teachers produce, communicate and finance themselves the scientific research.

With regard to gender, women obtain bigger scores for all the stress sources than men, which mean that the academic environment is perceived as more stressful for women.

Contradiction between research activity and the didactic one is a greater stress factor for women than for men – $t(68) = 3.09$; $p<0.003$. The explanation is that having lower academic titles, women have a more loaded didactic norm, so that the problem is finding the time for doing the research. In addition, research outputs are a fundamental condition for promotion, and a pressure factor for the women engaged in this process. Besides, *difficult promotion* is a more stressful source for women, $t(68) = 3.13$; $p < 0.003$.

Because women have more family responsibilities, factors as *work – family interference* and *conflict between professional activity and personal life* are experienced as more stressful by the women – $t(68) = 3.57$; $p < 0.001$, and $t(68) = 4.46$; $p < 0.000$.

Significant differences are registered for factors that imply interpersonal relationship: *human relations* , $t(68) = 2.31$; $p < 0.025$; *competence acknowledgment*, $t(68) = 3.32$; $p < 0.001$; *sharing relevant information*, $t(68) = 2.52$; $p < 0.014$; *the lack of regular feed-back*, $t(68) = 2.86$; $p < 0.006$; *reduced collaboration in problem solving*, $t(68) = 2.31$; $p < 0.024$; *taking personally students' critics* , $t(68) = 2.22$; $p < 0.030$; *poor management support*, $t(68) = 2.59$; $p < 0.012$. These results show the bigger concentration of women on relations and team work. When these are defective, they are experienced as more stressful factors. The fact that women invest a great deal in human relationships can be explained by the difference in identity development for men and women. For men, identity development is a process that involves getting autonomy, independence implying assertiveness growth, competition spirit, aiming your own interest, while for women identity develops through training responsibility and attachment, that are specific to human relations.

Difficult access to recent information, $t(68) = 2.94$; $p < 0.004$, *responsibilities uncertainties*, $t(68) = 3.87$; $p < 0.000$, poor *work procedures*, $t(68) = 3.64$; $p < 0.001$ represent another significant more stressful sources for women. Also, *rapid changes in the system* and *deficient preparation for managing the change* are stress factors in a greater manner for women than for men – $t(68) = 2.17$; $p < 0.033$, and $t(68) = 2.24$; $p < 0.028$.

Seniority which brings consolidation of personal position through academic and scientific titles operates differently in perceiving academic stress sources. We grouped the subjects into three seniority categories (i.e. 1 – 6 years, 7 – 15 years and 16

– 40 years). The feeling of personal and professional competence grows through the years, and that is the reason why, at the beginning of university career, teachers feel more acute the discrepancy between the demands and competences. Analyses revealed younger's bigger need for confirmation and feed-back ($F = 6.93$; $p = 0.002$), the need for sharing relevant information ($F = 3.25$; $p = 0.045$), and the greater pressure for factors that involve professional competence ($F = 4.13$; $p = 0.02$) and defining work procedures ($F = 4.63$; $p = 0.013$). Being on the professional accomplishment road, the young people perceive as more stressful the fact that professional activity hogs most of their time, influencing their personal life by delaying events like marriage, foundation of a family, etc. ($F = 3,62$; $p = 0,032$).

3.2. Coping strategies used by academics

The ability to cope with the demands arising in one's environment is a crucial factor in determining the levels of stress that an individual experiences (Travers)

Respondents were asked to rate on a scale of 1 to 6, 28 items describing coping strategies. The most frequently used strategies in order of preference, were: "having stable relationships", "using selective attention", "trying to recognize your own limitations", "prioritizing", "planning ahead" and the least frequent methods were: "force one's behaviour and lifestyle to slowdown", "seeking support from supervisors", "delegation" and "trying to avoid the situation". We made comparisons between academics' scores and those of normative data and other occupational groups. Table 2 shows that university teachers use greater amounts of all type of coping strategies than the norms provided by the authors of the OSI, except "time management". This result is confirmed by the fact that academics indicated "the time pressure and unrealistic deadlines" as one of the main source of stress.

Compared to their male counterparts, women employ greater use of coping strategies like "buy time and stall the issue", ($t(68)= 3,71$; $p< .000$), seek as much social support as possible" ($t(68)= 3,85$; $p< .000$), "having a home that is a refuge" ($t(68)= 2,51$; $p< .014$). As for men, they employ coping strategies like "try to deal with the situation objectively, in an unemotional way" ($t(68)= 2,13$; $p< .039$), "try to stand aside and think through the situation" ($t(68)= 2,07$; $p< .042$), "resort to rules and regulations" ($t(68)= 2,64$; $p< .010$), "accept the situation and learn to live with it" ($t(68)= 2,03$; $p< .046$).

Differences in the use of coping strategies were found with regard to the age of teachers. Along with the ageing process we noticed a progressive increase in the use of strategies like: "resort to rules and regulations" ($F= 8,88$; $p< .000$), "plan ahead" ($F= 2,98$; $p< .057$), "look for ways to make the work more interesting" ($F= 4,49$; $p< .015$), "have stable relationships" ($F= 3,95$; $p< .024$); "use selective attention" ($F= 4,00$; $p< .023$). The 24 – 35 years segment uses strategies like: resort to hobbies and pastimes" ($F= 3,45$; $p< .037$), "having a home that is a refuge" ($F= 3,04$; $p< .054$). "Delegation" is more specific to the 36 – 50 years category. A similar effect produces the seniority or the job tenure. Along with the refinement of professional competencies, we noticed a progression in the use of coping strategies like: "resort to rules and regulations" ($F= 9,85$; $p< .000$), "plan ahead" ($F= 3,65$; $p< .031$), "look for ways to make the work more interesting" ($F= 5,17$; $p< .008$), "having stable relationships" ($F= 3,88$; $p< .025$); "using selective attention" ($F= 4,04$; $p< .022$).

3.3. Relations between variables. The total of the 56 items of the *Perceived Sources of Stress*

Inventory gives a summary measure of the level of stress that an individual experiences. We correlated this score with the scores of the coping strategies scales in order to identify individual's ability to cope with the demands arising in his work environment. Analyses revealed a negative association between the *perceived stress* and the coping mechanisms from *logic* category ($r = -236$; $p < .05$), meaning that as the feeling of pressure increases, distractions, negative thoughts, and anxiety conquer individual's brain and don't let him to be creative, rational and make good decisions.

4. CONCLUSIONS

The assessment of stress potential of specific aspects in the university system revealed that teachers confront especially with the necessity of compromise between the amounts of professional tasks, the needed time for doing the work and the quality of activity. Another main problem is the system financing issue. The main sources of stress identified by the research group are, in order, *the great volume and variety of the tasks*, *reduced remuneration comparing with the effort and responsibilities involved, difficult promotion, the fact that teachers have to finance themselves their scientific research, interference of the profession with family life, the contradiction between research and didactic activity, time pressure and unrealistic deadlines.*

Work overload is the most cited stress source specific to the academic environment [2, 6, 3]. Blix et al. [1] have discovered that the great volume of work is the main cause for leaving the profession, and Stewart and Spence [8] identified a negative relationship between the great volume of work and the low moral of faculties' members. Thorsen [9] revealed the fact that rather the big quantity of work and not the nature of it is the main factor of stress.

Compared with their male counterparts, women academics generally experience higher overall levels of stress in their jobs and use social support as a way to cope better with the demands placed upon them, whereas men employ *logic* coping strategies. The research literature stresses the importance of support networks in enabling individuals to cope with the stress they experience [4, 7, 10, 11, 5].

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Table1. Perceived sources of academic stress

Sources of pressure	N	Minimum	Maximum	Mean	Std. dev.
Great volume and variety of the tasks	70	1.00	6.00	5.11	1.30
Low remuneration compared with the work involved	70	1.00	6.00	4.92	1.21
Difficult promotion	70	1.00	6.00	4.87	1.17
Financing your own research	70	1.00	6.00	4.81	1.19
Work – family interference	70	2.00	6.00	4.70	1.14
Scientific research vs. didactic activity	70	1.00	6.00	4.54	1.53
Time pressure and unrealistic deadlines	70	1.00	6.00	4.50	1.89
Economic profitability vs. work quality	70	1.00	6.00	4.45	1.58
The size of group students and didactic norms	70	1.00	6.00	4.41	1.46
Professional activity vs. personal life	70	1.00	6.00	4.32	1.59
Student centred teaching	70	1.00	6.00	4.21	1.50
Over sizing the work formations	70	1.00	6.00	4.20	1.80
Presence of the students in syncope	70	1.00	6.00	4.20	1.45
The lack of regular feed-back	70	1.00	6.00	4.18	1.40
The conflict between needs and superiors' vision	70	1.00	6.00	4.17	1.55
Competition between the colleagues/ departments	70	1.00	6.00	4.17	1.60
Rapid and constant changes in the system	70	1.00	6.00	4.15	1.36
Initial selection of the students	70	1.00	6.00	4.11	1.89
The lack of student effort in their own training	70	1.00	6.00	4.10	1.74
Social perception of the university	70	1.00	6.00	4.05	1.45
Students' lack of intellectual effort	70	1.00	6.00	4.05	1.76
The lack of involvement in decision making	70	1.00	6.00	4.01	1.63
Students interested of the diploma	70	1.00	6.00	4.00	1.76
Accreditation and reaccreditation of the specializations	70	1.00	6.00	4.00	1.54
Hierarchical nature of the educational system	70	1.00	6.00	3.98	1.71
Depreciation of teacher's status	70	1.00	6.00	3.97	1.86
Bologna system	70	1.00	6.00	3.97	1.25
Permanent documentation	70	1.00	6.00	3.92	1.85
Professional competition	70	1.00	6.00	3.88	1.76
Reduced collaboration in problem solving	70	1.00	6.00	3.87	1.67
Poor opportunities for career decisions	70	1.00	6.00	3.87	1.48
Disloyal competition of private universities	70	1.00	6.00	3.85	1.63
Poor work procedures	70	1.00	6.00	3.80	1.38
Society pressure	70	1.00	6.00	3.78	1.42
Responsibilities uncertainties	70	1.00	6.00	3.77	1.52
To be at student's disposal	70	1.00	6.00	3.72	1.85

Evaluation through students	70	1.00	6.00	3.60	1.84
Emotional involvement in relationships with the students	70	1.00	6.00	3.60	1.60
Poor management support	70	1.00	6.00	3.58	1.68
The way your colleagues do their job	70	1.00	6.00	3.58	1.74
Work climate discipline	70	1.00	6.00	3.51	1.75
Defective preparation for change implementation	70	1.00	6.00	3.47	1.49
Human relations	70	1.00	6.00	3.47	1.56
Testing the teacher's tolerance	70	1.00	6.00	3.45	1.59
Poor material endowment	70	1.00	6.00	3.45	1.57
Accent on quantity in research	70	1.00	6.00	3.44	2.06
Deficient competences	70	1.00	6.00	3.44	1.78
Sharing information	70	1.00	6.00	3.37	1.69
Difficult access to recent information	70	1.00	6.00	3.30	1.52
Profession as a deadfall	70	1.00	6.00	3.25	1.75
Incompatibility between the tasks and competences	70	1.00	6.00	3.15	1.72
Competence acknowledgment	70	1.00	6.00	3.14	1.52
Obsolescence of the speciality domain	70	1.00	6.00	3.02	1.71
Testing the teacher's professional limits	70	1.00	6.00	2.95	1.55
Taking personally students' critics	70	1.00	6.00	2.94	1.58
The tendency that others take the merit for my accomplishments	70	1.00	6.00	2.71	1.47

Table 2. *Comparisons of academics' stress-coping strategies with other occupational groups*

Strategy			**Occupational groups**							
	OSI normative data (N= 156) *		University teachers (N= 70)		Pre-university teachers (N= 1776)*		Management consultants (N= 105)*		Middle managers (N= 48)*	
	Media	*σ*	*Media*	*σ*	*Media*	*σ*	*Media*	*σ*	*Media*	*σ*
Social support	13.54	3.56	16.92	2.88	15.48	3.36	14.21	2.61	13.77	2.28
Task strategies	20.51	2.90	29.08	4.42	25.90	3.79	25.78	2.89	24.94	3.11
Logic	11.75	1.77	12.58	2.60	12.59	2.38	12.80	1.78	12.60	1.62
Home/ work relationship	14.98	3.57	16.62	3.23	16.43	4.04	13.46	3.84	14.48	2.81
Time	14.23	2.14	13.87	2.81	14.74	2.21	14.35	1.74	13.50	1.57
Involvement	18.32	3.02	27.37	3.95	24.30	3.60	22.38	2.85	22.33	2.36

** Adaptation after Travers and Cooper (1996)*

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VIOLATING WORK AND INTERPERSONAL RELATIONSHIPS IN ORGANIZATIONS AS A CURRENT PROBLEM OF PERSONAL MANAGEMENT.

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Abstract:*Favourable interpersonal relationships as well as work relationships which contribute to meeting the objectives in an organization are one of the important aspects of personal management. The stress which is activated in working environment by negative socio-pathological phenomena, e.g. bullying, mobbing or bossing, has besides hard physical and mental implications for victims also significant economic impacts. The efficiency and reliability of afflicted employees is slumped deeply and the organizations can lose their competitiveness by fluctuation of the employees. One third of Slovaks have experienced bullying at work. Its elimination is in the hands of managers, personal managers, psychologists, experts for psychology of work as well as the employees. If all possibilities of solving this unwanted phenomenon fail, to defend themselves the employees should turn to personal and legal options of solving it.*

Key words: *employment relations, socio-pathological phenomena, bullying, mobbing, bossing, psychoterror*

Introduction

Where people work long hours together there definitely is not often idyllic atmosphere, but often there are many disagreements which distract us from everyday work routine, creating stromy waves, which need to be sorted out. These conflicts starting from opposite needs and values of each person do not necessarily mean violating the interpersonal relationship in the workplace. The interpersonal relationships at the workplace become dangerous when someone systematically and often unlawfully intervenes the work and private life of someone else. Then we talk about so called psychoterror in the workplace, which can have various forms. It is a serious, all-society, work – legal, but also psychological aspect, which must be respected by managers of organizations in terms of personal management.

Inner integration and fellowship of employees with the organization in a dynamically difficult economic environment becomes a must. Organizations are more and more required to provide dynamic, flexible and cooperative behavior with the emphasis on inner adaptation of the permanently occuring changes. In such situation the importance of healthy and productive *relationships among employees* and the need of *loyalty* in organization rises.

Everyday situation convinces us about the need to understand the relationships among employees, to know them and to be able to predict and prevent the tension. A big number of conflicts, or misunderstandings in a better

case, which can occur between employees, between employee and employer, subordinate and superior, employee and a group of employees etc. is a proof of that. The area of relationships in the workplace is a dynamic process and therefore we cannot understand it as something definitely defined and closed.

Each organization is based on formal as well as informal relations. Formal structures of organization clearly codify labour relations. Informal relations rise accidentally, spontaneously. They start from personal sympathy and also unsympathy. They have big influence on the moral, motivation, job satisfaction and commitment, overall efficiency of employees in an organization. This is one of the reasons why it is important to watch the *social atmosphere* in the organization, because it represents a set of various external and internal factors affecting and influencing the behavior of individuals and also groups in the organization. People can sense from the first meeting if the atmosphere of trust and cooperation outweighs the frosty atmosphere of fear and doubt of the future.

When watching the social atmosphere in an organization we talk about aspects such as the level of written and common norms of an organization, values of organization, which are related to the organization culture as well as management of the organization. One of the important factors which to a large extent violate the social atmosphere in the collectives are *social – pathological phenomena*. *Social – pathological phenomena* include *bullying, mobbing, bossing*. We can also find the expression *psychoterror*, which includes the mentioned negative phenomena.

Handling and eliminating it is the most difficult area of the employment relations. Individual negative phenomena are difficult to be proved, there often is not the will to make decisive steps to eliminate it. Not even the organization should ignore it. What are the reasons and impulses of mobbing from the site of one of its participants?

The reasons of mobbing by the *management of organization* can have the following features:

- an uncompetene manager in the area of managing human resources,
- excessive pressure on the productivity of work,
- low organization culture,
- organization structures working wrongly.

Reasons of mobbing by the collective of coworkers are characterized by:
- lack of tolerance,
- envy, badmouth etc.

Impulses to mobbing on the side of the victim employee can be:
- problems when solving conflict situations,
- fear of losing the job, which can lead to the tolerance of the attacks,
- specific personality traits.

Just a combination of any of the above mentioned facts can cause stress in less immune and less adaptable indivituals. Similar effects can have the deliberate hurting by means of some of the following tools. In this case we also talk about psychoterror.

Since the issue of psychoterror at the workplace is in general well elaborated, we chose just some basic aspects. Firstly we focused on defining some expressions.

Basic expressions and theoretic outcomes of psychoterror in the workplace

The issue of bullying is very old. It was usually connected to schools and basic military service. At present we more and more talk about bullying at work. We consider it important to mention some facts that are well-known in the organizations as well as private lives. According to the surveys of some agencies one third of all Slovaks has experienced bullying. Signs of bullying can be found in every organization. If we look at these negative phenomena from different points of view, we realize that the stress caused by bullying has beside serious physical and also psychical effects also outstanding economic impacts. Production rate and reliability of employees affected by bullying is decreasing very fast and the organizations can

lose their very important employees due to fluctuation (caused by bullying).

When talking about theoretic outcomes which are related to the given issue, we need to clarify the expressions and definitions connected to it. Firstly it is the expression *social pathology* which describes ill, abnormal, in general unwanted social phenomena. The expression stared to be used by the English philosopher and sociologist H. Spencer. He was looking for the connection between human organism and its illness and the society with its illnesses. In our case it is an unwanted, therefore social-pathologic phenomenon in the human relationships at the workplaces of organizations. Social-pathologic phenomena always have social-cultural background and are changeable depending upon time, location and region. Dealing with social-pathological phenomena of organizations means dealing foremostly with *norms*. Norms are the basic element of social existence of a man – they define the anticipated behavior, they determine what should and should not be done, what is or is not correct, what is in line with social needs, goals, interests and values. The boundaries of norms are strictly restricted, behind the boundaries we evaluate the behavior as deviant – turning away from the social norm. Where norms exist, there is also the check-up of following them. The expression social check-up includes all social mechanisms with the task to secure order and stability in societies, organizations, social groups, work teams and other. Social check-up also includes punishment, which enforces following the norms. When evaluating social-pathologic phenomena at work we talk about violating formal and informal norms, which can have various forms, e.g. *mobbing, bossing* or *bullying*.

The term „*bullying*" means evil bothering, harassment, molesting, chasing. It is a bizarre form of long-term hurting and harming other person by means of threatening and power abusing. Bullying can occur in any type of relationship in any area of social life. Typical signs of bullying include:

- purposeful hurting resulting in physical and emotional stress,
- bullying is abusing the authority, power,
- bullying is long-term type of relation rising gradually,
- the essence of bullying is applying the authority, power in human relationships (using physical power, applying psychological dominion and using social authority) (Kmošena M. 2008 p.83).

The word „*mobbing*" comes from the English „to mob" . The free translation is „to attack, ambush, or to crowd into". Mobbing is psychical terror, chronic, systematic and intense attacks, intrigues and bullying by a larger number of people or the superios against an individual or a smaller group. It is a serious failure of communication or relationships in a group of people, a form of unwanted aggression among people, the most serious deformation of social relationships, roles and norms of life. The experts agree that the launching moment is a conflict and the failure of its solutions.

„*Mobbing or psychological terror includes the unfriendly and unethical communication in the workplace, which is systematically practiced by one or more persons against an individual, who as a result becomes powerless and vulnerable.*„ (Kmošena. M . 2008 p.77).

Bossing is also one of the forms of mobbing and represents *bullying of the subordinates by a superios manager*. To prove a manager guilty of bissing, a new form of humiliations, dictatorhip and cult of personality, is not easy. The damages cannot be proved, because the

most serious damage is the hazard with human trust, human abilities and confidence.

Rise, forms and methods of mobbing and bossing.

The first question to be answered when talking about mobbing in organizations is its rise, forms and methods. The matrix of mobbing in the workplace is the location where:

- dulness and boredom rule – the possible perpetrator has enough time for evil thoughts and planning intrigues as well as its realization, wrong style of management

– organization management, managers always determine the moral level of the organization, as well as the acceotance of a specific form of behavior of individual people,

- competition tension and the fear of unemployment rule – fear of losing the job, fear of cleverer colleagues, low self-confidence, various forms of complexes, anger, frustration, desire for power, effort to gain position, dominance or membership in a group often change into aggression,

- certain personal predispositions: pleasure in manipulating people, need to attract attention, pleasure in hurting others, cruelty, aggression, jealousy, rudeness etc.

There are no special conditions needed for the rise of mobbing such as the presence of a pathological saddist, or the lack of discipline in the workplace. It usually rises in a normal group, where the aggressors may seem to be absolutely normal people, very often favourite members. It is not possible to define when a harmless joke becomes mobbing. The relationships of the victims of mobbing have a different Dynamics and development than a joke. We talk about following levels:

1. *Rise of mobbing*. In every group there is someobe less favourite, more or less abandoned by the rest, mocked and being a laughing stock. If the victim does not resist and nobody helps them, the pressure gets bigger and aggression grows.

2 *Stiffening up*. It happens when the tension in the group rises due to more difficult tasks and the outsiders serve as a vent to release the pressure. Another reason of this phase is also the situation when two or more aggressors meet and use aggression as a means of satisfying their needs, sometimes even making the rest of the group happier.

3. *Creating a core*. The leading aggressor is joined by others, they create a group of bullies and systematically affect their victims.

4. *Acceptance.* The majority accept the bullies´norms.

5. *Totality*. Mobbing becomes a normal behavior in the workplace.

Classification and types of bullies should not be ignored. We can divide them into three groups:

Creators – they are determining factors in mobbing

- they create methods and forms of psychical terror,
- they chose their victims,
- they have a sick feeling of satisfaction when hurting their victims.

Accidental perpetrators

- it happens foremostly when a trivial conflicts develops into a permanent argument between two sides and is not sorted out reasonably

Participants

- they actively support the creator in his/her activities or they just passively watch and do not intervene and do not defend nor support the victim.

Concrete manifestations and methods of mobbing may be various and have various forms, for example:

Limiting the victims in their verbalization and expression

- the victim is not allowed to verbalize,
- is constantly shouted at,
- is the target of personal attacks,
- details and little mistakes are searched for,
- victim´s privacy is being invaded,
- is verbally attacked,
- is threatened on the phone, via e-mail,
- is deprived of any contact leading to a possible defence.

Limiting the employee in the social relationships

- nobody wants to talk to them,
- it is prohibited to talk to them,
- they are being ignored,

- they are verbally attacked,
- is the „black sheep",
- they are being embarrassed,
- their ideas and comments are bagatelised and nobody is interested in them,
- their psychical health is questioned,
- their work and private life are questioned etc.

We could continue in piling up the facts and the list would be very long. The creativity of some perpetrators has no limits.

Bossing has similar characteristics. The question that might be interesting for us is, why do managers mob and what does bossing look like? The manifestations of bossing by managers can have dofferent reasons:
- being angry at the organization, pressure, desire for power, personal reasons, fear of losing control, fear of the dominance of a subordinate, fear of unexpressed ideas, constant feeling of being badmouthed, - these managers suffer from a certain form of paranoia.

The effects of bossing can vary, e.g.:

- victims are assigned with difficult tasks, which are reasonable,
- little requirements – assigned tasks do not correspond with the victim´s abilities, qualification, experience,
- unreasonable requirements – victim is assigned with tasks that cannot be successfully achieved and fail,
- victim must deal with mostly the most unpleasant tasks,
- victim is constantly under exaggerated supervision– every step is watched and examined,
- decisions about the victim are done behind their back and the victim has to face the results at short notice,
- competence of the victim and the scope of work are limited,
- victim is excluded from meetings, has no access to important information,
- victim is exposed to isolation,
- victim is forced to perform harmful tasks,
- victim is said to suffer from psychical illnesses and psychiatric diseases.

In general we can say that psychoterror in a workplace can occur only with the help of other participants who offer active or passive support. It sounds as a paradox, but the victims of psychical terror are usually diligent and hard-working people. They are unlucky because they do not match the average and do not blend with the crowd. The impulse can be the above-average work results, exaggerated humbleness, or calmness as well as not getting accepted in the collective and its habits.

The most common victims of mobbing are women between 20 – 30 years old, that do not have a fixed position. Another threatened group are women in the middle level of management when trying to win recognition in the male collective. Mobbing more frequently affects people with a lower degree of education. Very frequent victims of mobbing are very active colleagues who are more productive than others. They are a provocation for others and they cause the fear of competition. Also being different can be a reason of mobbing (sexual orientation, physical disability, belief, religion etc.).

Protection from psychoterror in the workplace

What is the protection from psychoterror? We can answer that from different aspects. We chose two basic aspects, although we are aware that they may not bring the resulting effect. The first aspect is *personal protection* and the second one is *legal protection*, which will be dealt with more in detail.

Firstly every employee has to realise that they are the ones who determine what others can do to them. There is no universal formula

to lead us in such situations. If the employee has the right to speak up, they should. Injustice cannot be tolerated. It is necessary to prevent such situations where injustice can occur, if it is possible. But if somebody wants to have conflicts, there always are means. The question is: What can protection give us and what can protection take from us away? We can offer some advice. In case the victim decides to fight back, they must endure till the end. It is important to be self-confident, to be sure to find some support in the collective. Also family background is important that can offer support.

The employer must understand that the enemy has nothing to lose. If the employer wins, it is a personal defeat and humiliation for the perpetrator. The perpetrator lost what made him unbeatable – creating fear. The surrounding finds out about the perpetrator´s weakness. The superios, who supported him in his activities or secretly tolerated them, back off because of self-preservation. They do not want to bear the consequences. The victim has usually a strong enemy. Except these facts it is also possiblr that the terrorised employer analyzes the facts – thinks the situation over outside of the workplace, documents the facts and find witnesses of the problem etc.

If the employer finds out about any form of psychoterror at work, they should analyze the situation and the possible reasons of this negative phenomenon. Preventive measurements must be taken to restrict any possible rise of psychoterror. Meeting focused on preventing conflicts in the workplace and determining a useful prevention is advisable. An important factor of prevention is a well-elaborated programme of adaptation process for new employees. Also the ethical codex of the organization is an important value, where we can usually find clear definitions of human behavior in organizations. And finally all people should accept the responsibility for their own activities.

Legal solutions of social – pathological phenomena in organization

The prohobition of discrimination because of any reasons, direct or indirect discrimination is anchored in the Constitution of Slovak Republic and in other legal statutes. In the labour law the very first article on basic norms of labour law there is the Labour Code[1)] the individual has the right to satisfying work conditions and this right has no limitations. Furthermore the second article of basic norms determines the rights and obligations resulting form labour relations and must be in line with ethics and nobody is allowed to abuse their rights and obligations in order to harm other participants of labour relations or coworkers. Also the 9th article of basic norms secures the right of the employee to claim the rights in court if violated and consequently there is the protection from being discriminated or hurt after claiming their rights.

Legal protection of an employee whose rights have been violated does not have to be sorted out by legal means. As we have already mentioned, prevention is the best protection from bullying in the workplace. Just a direct and open communication with the surrounding and solving conflicts right at the beginning can decrease the probability of becoming a victim of bullying. If these measures are not sufficient it is necessary that the employer has a concrete system of measures against bullying, with clearly defined rules of behavior in the workplace, obligatiory norms, violating of which or not respecting will be prosecuted. When dealing with discrimination the respondent has to prove that there was no discrimination. The Labour Code in the § 13 defines the employer´s obligation to perform improvement, eliminate the bullying and eliminate the consequences of bullying in case an employee files a complaint. The victim of mobbing can contact the staff agency of the employer, union trade or labour authorities. The last chance is to claim rights to protection from mobbing in court.

Conclusion

[1] Act No. 311/2001 Coll. Labour Codex

Good managers should be aware of the relations in their workplaces to be able to notice possible signs of aggression from the start. They must try to prevent them and create an effective group of their subordinates, where justice, fairness, trust, authority, respect and sympathy rule.

A notable number of organizations still ignores the phenomenon of psychoterror. They do not realize that psychical war is expensive and does not prosper. Psychoterror victims usually do not have other chance of eliminating the psychical terror and tension and consequent health degradation and in some situations also psychical health than quitting. Legal solutions of this problem are the last possible solutions. The moral and value failure of a person is an important aspect of this situation.

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THE IDENTIFICATION OF THE COMPONENTS OF SCHOOL INADAPTABILITY

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Abstract:*Perceiving school as a simple object, as being "inanimate", by the educational message and its capacity of love for learning and knowing the world, will have in time more or less visible repercussions in individuals' personal development, which only attended school, or which really knew, as the majority, "to drink from the spring of knowledge".*
Under such spiritual connotations, more or less metaphorical, we try to: understand, be aware of, accept, but also identify those elements which determine at a certain point the induction of school maladjustment. Tracking down in/at time of school maladjustment components, will release a new attitudinal behavior from the two actors (the pupil and the teacher) determining personalized logistic practice, decoding school evolution under all its aspects, receiving quality and efficiency.

The child is a being and not an object in what he deontologically represents, the moment when the evaluation starts but also the growth and development of the one who, through his entire universe, is "everlasting youth". He is the light in the darkness of life, and his smile sends sadness away. Also, he starts learning how to write, read and count, when we are able to bring school close to him.

That is why perceiving school like an inanimate object not able to convey love for learning will eventually have more or less visible effects in the development (as an individual) of the one **that only pursued the courses of that institution,** or **really knew** "to drink from the spring of knowledge".

Starting with such metaphors, we shall try to understand, be aware, accept but also identify the elements that, at a certain point, determine the occurrence of school inadaptability.

The one that we shall deal with is the child between 6-7 years old – the big pre-school child and 10-11 years old the last step of the small school child, that is the check out, in such a form of the **thresholds** – pre-school (preparing group), small school child (Ist grade) and small school child (IVth grade), middle school child (Vth grade) that can determine, wherever they find "ground for that" attitude-behavioral mutations of the respective child, making us aware of the base for **school inadaptability.**

In a certain context, making the profile of the **big school child,** Schiopu U. and Verza E. (1981), remarked what is very important for us in this case, namely the fact that:
"He seldom takes into account the others' ideas and sees things his way, having the impression that this is reality and that things only exist according to himself. Further on, the moral rules come from the authority, the child has respect for the adult and does not contest the authority of his parents. He arrives to the point where he accepts both the compulsions and the interdictions and punishments, even if he does not see a link between mistake and sanction."

Also linked to the same period previously dealt with, Gesell (according to Pasca M.D. – 2006) – **the seven years old child** is in the period of assimilating new experiences, concentrates on his own person, carefully listens to what he is told, does not accept to be interrupted from his "meditations", is open in his relationships with the other ones.

At this, the small child comes into direct contact with the structural elements that compose: the rule, the implication, the awareness raising, the learning act (including the homework), the class community as well as the capacity to perceive **time** in its didactic form: class – pause – school day – school week – holiday – school year, being a few of his attitude-behavioral connotations towards what school and the entire educational act really mean and represent.

As a completion to the picture of knowledge, Erikson E.N. says about **middle childhood** (activity-inferiority) that it is the age covering ontogenesis between 6-11, being marked by the beginning of the school process, respectively by a crucial event for the destiny of the individual. Now the fruits of the school activity become determinant in the sense that a series of failures give him complexes, and successes will develop in him not only the taste for this activity, but also a competitive emulative spirit.

Gesell (according to Pasca M.D. – 2006) completes the previous observations, emphasizing that when **10 years old** the child becomes relatively balanced, well adapted to external requirements, calm, sure, lacking stress and tension, impressions through the clear understanding of what he has to do, manifest coherence, stability, continuity and erseverance in the achievement of goals.

And then, after this cognoscible identity, at what moment can we talk about school inadaptability. Certainly, the moment when the child we deal with faces a **problem** that he cannot handle. In this context, because it is easier for him to just sit and wait, the **pupil** behaves like he "cannot" and "does not know how" to do things, and he lets the unknown things gather. Thus, we can identify a **first component** of school inadaptability, that of **non-involvement**, that's why we, as didactic staff members, must make time **to listen him,** because **he too has the right to have an opinion.**

In this context, the teacher should make appeal to the six rules, not forgetting that both parts (he and the child) are implied in the problem solving process: Faber A. , Mazlish E. (2002):

1 – try to find out which are the child's feelings and necessities
2 – resume the child's point of view
3 – express your feelings and necessities
4 – invite the child to analyze the situation together with you
5 – note all the ideas without evaluating them
6 – together, decide which ideas you like, which ones you don't like and how you plan to put them into practice

The existence of duality makes more accessible the periods that are constituted by some as being **a threshold**, that represents a difficulty in "passing over" it. At this moment we should raise awareness of the fact that it is **not the parents** that attend the first or the fifth grade, but **their child,** and **he** has to positively relate to the teacher, **not** the mother or father. Even if at first sight this does not seem to represent something, it may also be a **new component** of school inadaptability, because, aware or not, the pupils' very parents artificially create the threshold and the problem.

The entire specialized literature stipulates in different forms and conditions how much the small school child is influenced in his harmonious development by: heredity, environment and education.

From this well known triad we will further on make reference to the **family** segment alone as main factor in the occurrence of **affective carencies** that set into motion **other components** of school inadaptability, "accounting" the fact that "he, the child, is a being and not an object".

It is the moment when, from a psycholinguistic point of view, upon the child become pupil (6/7-10/11 years) there are words that trouble him, even making him lose: his identity, stability, safety, but most of all

belonging, because we talk about: **divorce** and **emigration.** From our point of view, these situations represent real **carential deficiencies.**

Thus, in the case of **divorce**, the child does not know whom he belongs to, who wants him, how to behave, whom to listen to, gradually developing **conducts of behavioral risk** and they **find their peace** only when they compare to another group of class mates that live the same drama, like him. They most frequently ask questions like:

- Your parents are in the process of divorce as well?
- Which one do you live with?
- Who do you like more?
- Where do you go on week-ends?
- Do people frequently ask you about your parents?

Rhetorically, we can ask: is this state not **another component** of school inadaptability? Certainly **yes,** when the phenomenon of school inadaptability does not only resume to the value of qualifications and school graduation, in fact, the implications being much deeper, and in some cases we can have psychical trauma.

The other words: **left abroad (emigration),** already subtitled as "Euro kids", quoting the period of children "with the key at their neck", have a special degree of drama, often driving them to the brim of despair, and they get to run away from home, be irritated, independent and even, in special situations, commit suicide, because in their perception, **money is not a substitute for parents** (mother and/or father). They rather see this as an excuse for irresponsibility.
Such a child primarily wants to:

- Be loved
- Be taken care of inside the family
- Have his own identity and uniqueness recognized

In the opposite case, **the money civilization** puts its fingerprint **through:**

- Personality disorders (mental illnesses, affective carencies, low self esteem and image)
- Behavioral disorders that gradually forerun the phenomenon of juvenile crime (disobedience, running away from home or school, theft, robbery, murder attempt)
- Differencies in the elements of socializing and community integration
- The signs of a precocious maturity at the level of life concepts
- The feeling of loneliness, uselessness and responsibility
- Elements which lead to the depersonalizing of the family institution
- Physical and emotional abuse from the reference groups (gang, religious sects, etc)

The situation, if we could represent it this way, has the connotation of a seismic wave (earthquake) that determines behavioral changes at the child development level, endangering even his situation of normality, the school representing in this issue only a "passing activity" as inadaptability, particularly the social one, has already been set into motion.

Would it be a solution to take the child abroad for the reunion of the family? What shall we do about the language or behavior handicap? Is this the best solution? We do not aim to enter the social-economic field, but the system structures have effects that, in time, will prove to be unmeasurable. Why? Very easy. The child in question does not need a parent supplement, or canteen food. **He needs** love, family, stability and belonging to the community's moral values. It is thus hard for a parent to get through this when his own child is his judge.

Besides the things mentioned so far, a special place as a **component** of school inadaptability is held by the **hyperactive child** who, through his specific conduct, loses the rhythm and educational logistics from the class time, and towards the end of the year becomes a problem child/pupil. It is necessary to act upon this problem in three directions, namely:

a) Inside an with the **family** for:

- The analysis of the problematic situation occurred
- The diminishing of negative experiences in the parent – child relation
- The influence of behavioral problems in a negative way

b) In **school:**

- Talks with the didactic staff (teacher)
- Fighting behavioral problems through cooperation with the didactic staff member in question
- Getting rid of causes that lead to low school performances

c) With the **child:**

- Training of attention focus
- Application of specific therapies to the psychological diagnosis undergone
- Training of social competencies

Taking into account the ones mentioned above, the teacher must know that the small hyperactive pupil has problems because he's confronted with new requirements such as: quiet, patience and focus, to which he does not have the ability to adapt properly. Such children often have low school performance, manifest difficulties in acquiring the reading and writing skills, and in some cases they repeat the school year or abandon school.

Our journey of investigating **component identity** that aim to school inadaptability, resumes in a first phase to the things mentioned previously, and we are aware that the "list" can go on. We consider that the most important aspect is **to act in a motivated way** for the annihilation of school failures, starting from the very check out of the elements of school inadaptability, arriving to the normality phase, characterized as a continuous state of the small school child considered as was mentioned at the beginning of our attitude journey "a being and not an object", always acting in good knowledge of the cause, respecting and loving him at the same time.

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DETERMINATION VERSUS SELF-DETERMINATION IN THE STRUCTURE AND DYNAMICS OF SELF

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ABSTRACT: *The paper looks in a critical way to the relation between determination and self-determination in the structure and dynamics of Self, relationship that is paramount in the formation of the personality. By one's activities, objective external determinations turn into internal determinations, acting towards one's adaptation and differentiation. We see Self as a real landmark in postmodern individual's attempts to fight depersonalization and alienation, in his effort of self-creation and personal achievement. Cultivating youngsters' interest in this dimension means, in the long run, their preparation for life by cultivating self-control and self-regulation, independence, in brief, the art of self-support and self-teaching.*

Keywords: *dynamics of self, self-conscience, determination, self- determination*

PAPER: 1. POST-MODERNITY AND THE LACK OF BENCHMARKS

For many sociologists, historians and philosophers, post-modernity is an age of plurality and end of unity as a consequence of the many ways of understanding things, nothing meaning a priori anything fixed. This situation is felt by the individual as "letting loose a plurality of life forms we can choose between, or that we can make live together, as it already happens" [1].

Post-modern human being has no longer interpretation benchmarks to rely on. What results, in Bruckner's view, is a state of enchantment and chaos, each one receiving the task of creating oneself and finding a sense in life. This seems to be "the greatness and curse of post-modernity", in the same author's opinion. Still, in his becoming, man needs landmarks to give sense and direction to the existence. In principle, man sees the world and himself according to standards and criteria that evolve, built by internalization of certain social values deemed desirable by the community the individual is part of.

Psychologically, the way one sees the environment starts with the way one sees oneself, with the self-knowing and self-appraisal turning to self-knowledge and self-evaluation. Thus, as Self expresses the individual's self-reflexive hypostasis, it is also the object the individual (Ego) turns to for evaluation and knowledge. Self becomes a benchmark in the development of the personality, determining the attitude and values towards oneself and towards the world.

Self is a personal construct, but socially and culturally conditioned through social learning. Because of that, it becomes simultaneously an interior landmark and exterior benchmark, integrating the individual in the society without dissolving one's integrity and individuality. It gives man the sense of continuity in time and also of the place in the social field. As for man's need of meaning, it is "the main motivation of every man's life", as stated by logo therapy titan V. Frankl [3].

As a psycho-individual reality the Self includes in its structure at least three elements: one's image about oneself, the consciousness of being appraised by others and the corresponding feelings about that fact. The interactions of the three gives what we might call consistency, essential for everyone when adopting attitudes about one's existence, oneself, one's environment. That is why we see Self as a real landmark in the post-modern individual's attempt to cope with de-personalization and spiritual destruction, to self-build and have success.

2. EDUCATION FOR SELF-MANAGEMENT

When it comes to self-knowing, this is neither easy to do, nor easy to conceive. As a psychological reality, Self is easier felt than defined. Still, seeing its main features: identity, subjectivity, self-image, we can better understand its structure and dynamics. This feat supposes active involvement, both cognitive and affective. The individual engages in permanent information processing on oneself, based on which one makes up a certain self-image, appraises oneself and builds a self-concept. The process comes with feelings that give one the sense of one's place and value in life, in society and in relationships.

In the process of self-knowledge, adolescence is unanimously seen as a moment of paramount signification and relevance for later development. Adolescence, seen by J. J. Rousseau "the stage of a second birth", brings with itself an increase in personality development, in deliberative inner life, in the development of self-conscience, in responsibility and affective life.

To prepare youngsters to see – *timely and accordingly* – the resources they have and their individual value at a certain moment means to educate them for self-knowledge. Cultivating their interest in this dimension means preparing them, on the long run, for life by cultivating self-control and the ability to self-regulate, independence of action, initiation in the art of self-teaching and self-assistance. The final goal of the teacher should be to bring the young to self-assistance, so as to save and develop their own thinking and acting skills, to solve optimally present challenges and to see and manage future ones. In modern pedagogy, this is named "own resources management", a long-term skill. The first steps could mean self-knowledge, important premise towards self-fulfillment. The goals are successful academic learning, optimal career choice and adequate socio-productive integration.

Self-development is an intimate process, hidden to others, many times youngsters not realizing the consequences of their actions and not realizing that they self-teach in the process. They must be helped to cultivate that meta-disposition that allows them a certain distancing from themselves and from the very experience, a reflexive conscience of thoughts and emotions that brings a certain control. That self-consciousness means a "*non-reactive, non-prejudiced attention on the inner state*", that brings with time the development of new personality features, such as autonomy, good psychological health, positive attitude towards oneself a.s.o.[4]

Modern psycho-pedagogy should find concrete ways to teach youngsters first "*how to be*" and only then "*how to become*", by active involvement in their own orientation and a permanent and consistent dialogue with themselves. In looking for sense and landmarks, young men need to consciously harmonize interests, skills and motivations with their learning abilities, their social needs and aspirations.

3. DETERMINATION vs. SELF-DETERMINATION

Structuring and affirmation of personality is a vast, complex process encompassing many sources, where "the system of Self" takes a central place. Very personal, "the Self system" expresses in adolescence as a dimension that organizes and structures the personality, giving it identity, orientation and sense. Self is an integrating concept that facilitates a better understanding

of the modes of individual and personal structuring of the psychological processes and functions at individual level.

A complex structure, Self comes up in individual ontogenesis, in and through social experience, in and through education and socialization. In the process of the forming of the personality and personal identity, Self builds as a relatively stable psychological structure that includes knowledge, faiths and convictions, attitudes, values, mental models of action. The Self contains elements both innate and acquired, conscious and unconscious, but fundamentally it is acquired through social and cultural exposure all along personal history. Its dynamics assumes both external determinations – influences from outside – and self-determinations – initiating and doing activities, getting in relationships as a form of personal freedom.

In the process of adaptive and anticipative socialization, one assimilates norms, attitudinal modes and behavior models seen as socially desirable. By their internalization, inside the personality are established certain structures we might call Social Self. The peculiarities of crystallization, through own effort and action, of these attitudes and behavior models determines the constitution of the individual, or personal, Self. It is the expression of the individual structural differentiation through which men becomes a psychological individuality. As a result of the interaction social – individual Selves, the personality nucleus appears, the Total Self, a specific bio-psycho-socio-cultural structure, playing an essential part in its dynamics. Thus, the Self constitutes as a result of the interaction between external forces (social – formative) and internal forces (expressing personal requests and needs).

The relation between determination and self-determination is an essential one in the becoming of the personality. By one's activities, constructive and self-building, objective forces turn into internal determinations, acting not only in an adaptive way but also in a differentiating one. By acting and relating to others, the individual seeks the most adequate ways to satisfy his needs and desires, including here the personal construction. The psychological balance and the social integration depend on the individual's possibilities to match as well as possible the driving forces from the environment and society with his own. The better that match, the higher Self consistency is obtained, expressed in just self-knowing and self-appraisal, resulting in optimum balance. Self consistency is "a quality of personal identity resulting in integration, coherence and compatibility of self-knowledge and self-appraisal manifested in quite constant attitudes and behavior" [5].

Two elements are essential in determining the consistency of the Self:

a) **Self-image / self-knowledge**: landmark, orientating part of the personality that attitudes and behaviors are based upon

b) **Self-appraisal**: element of self-image forming process, giving value to persons, function that helps develop orientating attitudes for activity and behavior.

The child develops a certain sense of Self, of what makes him different and unique. It is not consistency of Self as such, as a child experiments several Selves. The lack of consistency is obvious in behaviors and, more than that, in the circumstances generating cognitive and affective dissonance as expression of value- and norm-based conflicts. The adolescent's Self is rather mobile, even labile, than consistent, especially so in puberty. All these mark the learning process. The interests of the child at puberty have a place in the "social Self", and as such learning

will include present-day stars and hobbies, more than history in school for example. Anything relevant for Self will be acquired and assimilated, this type of learning being called "*biographic learning*" [6]. We can deduct that, for an active involvement of the young in then learning process, we must get his "engagement". In this sense, we must first know what G. Kelly calls "the personal constructs" of the young involved and especially to activate the instinct of self-expressing. Some say this is an as fundamental instinct as sex or hunger. Any one experienced a situation where, while apparently listening to a speech, was in reality delving with one's own thoughts on the issue at hand or eager to express the opinion. A teacher knowing all that could put the young's thinking to good use by cutting on the speech in the favor of free dialogue. The teacher could thus see the perceptions and subtle visions of the student, both of them being gifted with powerful feedback. Of course, this would mean for the teacher to give up teaching and start educating, in a Socratic spirit. One of the greatest benefits of this way is that it makes the student discover his own visions and put these into his own words. "*There is no better way to make such a long-lasting impact*" [7].

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THE PARADIGM OF EGO – THE FUNDAMENTAL PARADIGM OF EFFICIENCY

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ABSTRACT: *The present research starts from the assumption that the paradigm of Self is the fundamental paradigm of efficiency, fact for which self-competence and social competence are the base for the professional competence. Trying to study the reality of Self also from the subject's own perception, of the sense he gives his own Self and the events it involves in, we will treat things in a phenomenological way. This approach values the epistemological role of conscience, the importance of living and experiencing. The paper stresses the importance of the subject's convictions about himself, the world, the others, own prejudices, the subjective perceptions in decoding the paradigm of Self and the objective reality.*

Keywords*: ego paradigm, the paradigm of efficiency, phenomenological approach*

1. EDUCATION – THE NECESSARY UTOPIA

Members of the International Commission for The 21st Century Education think that, in order to cope with the communication age, education must give each individual the resources needed for discovering and enriching each one's own creative potential. Teaching must be organized around four fundamental learning types that are pylons of knowledge: learning to know, getting the tools for knowing; learning to do, the individual in relationship with the environment; learning to live with others, cooperating; learning to be / become, integrating element, result of the first three.

The educational system tends to favor gathering information (learning to know), against all other competencies. But today it is vital to set education in a larger image as a tool of an active, successful life, a process strongly individualized and, at the same time, of building social interaction network. "Individual development (…) is a dialectic process that starts with self-knowledge, to open later towards relationships with the others", the Commission report shows [1].

Human development and social existence demand a continuous information exchange and negotiating senses between individuals. At a closer look, the experience of our life is integrally modeled by education in its largest sense and by communication in its broadest meaning. Education, this "necessary utopia", to quote J. Delors, is the paradigm by which we perceive the world and ourselves, while communication is the tool with which we decode that paradigm. We have, on one hand, the internal communication – those things we imagine, we tell ourselves and we feel inside, and, on the other hand, the external communication – words, voice tones, facial expressions, attitudes and physical actions through which we manifest in the environment. The level of skillfulness in intrapersonal and interpersonal communication seems to be the

key factor of personal success. Leaders in the science of personal development, such as Anthony Robbins (2002, p.18), think that "all we do in life is determined by the way we communicate with ourselves". From this perspective any communication is in fact a process of building an universe of significations, both at individual and social level. "Through communication, modern human being analyses himself and those he interacts with and – lastly – can find his own way of investigating the surrounding world" [2], thus getting functional autonomy, trademark of a mature, independent personality.

2. A NEW TYPE OF CONSCIENCE

A new current grows stronger nowadays, about personal development and growing self-aware. "The new type of conscience necessary to solve personal, professional, international or organizational problems is, I think, self-conscience or self-knowledge, linked indirectly to self-respect" [3]. Self-knowledge is more than simply acknowledging facts, it includes the necessary forces for developing a different way of being or of seeming to be. It combines cognitive moments with valuing moments, self-appreciation being a valuing action of self for self.

A peculiarity of self-knowledge, implicitly of self-image forming, as a specific self-knowing process, is the presence and importance of subjective-affective factor: feelings, emotions, and subjective self-appraisals, dominated by desires, needs, ambition, impulses and personal goals. Self-appreciation is based on rational knowledge and on the action of fundamental instincts of Self: appreciation, prestige, self-affirmation, personalization. In a certain measure this is natural, as self-appreciation supposes not only to build relations between knowledge and existence, but also to trace the lines along which existent becomes possible. Organizing information about oneself depends on the emotional attitude towards oneself, on the self-respect, on the tendency to see oneself in a better light.

The present paper starts from the premise that the paradigm of Self is the fundamental paradigm of efficiency, fact for which self-competence and social competence represent the basis for professional competence. Seeing these premises, we appreciate that for the students in socio-human sciences it is very necessary to cultivate self-competence and social competence, as a solid foundation for the professional competence. In this professional domains, their main resource will be the human one. In order to fully make use of the professional competence they will need psychic and emotional balance, clarity of the personal identity, of their intrinsic value, but also of the ability to relate to others, communication and teamwork skills, ability to motivate and persuade. We appreciate that giving the student life skills (such as self-competence and social competence) is to give him tools for personal and professional continuous development.

Fig. 1. Key competences for performance

Let's decode each level of the pyramid above, from the perspective of the newest personal development school, coaching:

• **Self-competence – being in agreement with oneself**

Clarity in personal roles, balance between private and professional lives, psychological and emotional stability, courage, self-control, independence, access to creativity and intuition

• **Social competence – being in agreement with others**

Communication and teamwork abilities, leadership, ability to motivate and persuade

• **Professional competence – being in agreement with the activities**

The discovery of one's owns abilities, talents, and the pleasure to learn and think in theories, methodic competence, and culture.

Self-competence and social competence represent, as we see above, the basis for professional competence in all we accomplish. All these competencies come from the multiple experiences we get involved in, either with the significant others and the world or with ourselves.

By the mechanisms of self-knowing and self-appraisal, by auto-validation come complex psychological states as self-conscience, self-acceptance, self-valuing, self-efficiency, trust and optimism, all making up a solid foundation for professional performance. These states, that we will call resource states, provide the energy needed for the transfer between pyramid levels towards performance and success. Having the conscience of individual value, of the resources at hand and of the practically unlimited potential, each of us can train, fully aware, to develop professionally and personally.

3. THE PHENOMENOLOGICAL APPROACH

Man is a being in a continuous search for meaning. He fills each experience with sense and signification, making each one unique. Loaded with subjectivity, this feature of human experience cannot be altered. The phenomenological approach values the epistemological role of conscience, the importance of living and experiencing. Phenomenological psychology studies "the way individuals understand their own actions and consciously see the associated emotions" [4]. In trying to study the reality of Self from the perspective of the subject's perception, of the meaning he sees for his own Self, we will take a phenomenological approach. The subject's beliefs about himself, his prejudices, his distorted perceptions, the errors in perception and judgment, the contextual significations given to the events

give us, in a phenomenological approach, an image about what the subject is.

Self-programming for success starts with taking conscious contact with the dynamics of Self. By understanding the way it works, the processes that define it, the mechanisms inside, we can acquire a certain degree of control over it. With some effort, we can re/program the Self at will or introduce new programs in accordance with present needs and skills. New programs mean new thinking and behavior models, new strategies towards present goals. We thus become aware of the fact that we have the responsibility for our state of mind and for the direction we evolve in.

The notion of self-conscience got new meanings both through philosophical thinking history and science. In philosophy, when self-conscience is about the reflexive activity by which an individual represents himself as a person to whom "intentional predicates of faith and desire, and the host of related words" [5] can be applied. The efforts of the specialists focus on understanding the way one applies these mental predicates to oneself, predicates seen as the origin of action and conscience.

Adepts of mental philosophy and philosophical psychology state that based on the behavioral interpretations and conscious introspection, intentional descriptions can be applied to oneself. This intentional attitude that determines the reflexive activity favors self-descriptions, being proof of the cognitive-teleological consistency of the human being. Generally, intentional descriptions unify one's autobiography with one's plans for life and future behavior. This explains that human identity is seen by Dennet (1991) as "center of narrative gravity" [5].

In the need for meaning, man assiduously searches his identity and place in the world that forces a double opening to "Ego-system" and "Eco-system" with the goal of taking control on both internal and external reality. The personal striving for sense implies one's ability to represent his own skills at ever superior levels. This favors not only flexibility in solving problems, but also the conscious knowing, specific only to human beings. In computational terms, this "representative redescription" could be seen as a move from procedural knowing to declarative knowing. Initially implicit knowing of a certain behavioral ability becomes explicitly represented to a superior level, thus object for conscious change and manipulation. Self-examination implies, thus, one's ability to take into account the facts and change one's actions.

But these are nothing but schematic ideas, vague descriptions of man's ability to generate explicit representation about one's behavior. They correspond largely to empirical researches on self-conscience in the 20th century, inside philosophy and psychology of personality. Their merit is to have given impulse to researches in the second half of that century. Some 2000 papers were published on the issue of "the conscious being" – the Self. Their object is the structure and components of Self (self-image), the processes and operations involved in self-knowledge, self-appraisal, self-control, the degree that self-image is adequate and the role these have in regulating individual behavior.

In the last years, phenomenological approach gained footing in the socio-human sciences, coming as a reaction to the positivist paradigm seen by some specialists as inadequate to looking into human phenomena. The main critic to positivism is,

first of all, that it ignores the epistemological role of conscience. Conscience is a filter of reality. It makes human perceptions filled with subjectivity, thus making meanings of events unique to each person. Man co-creates the significance of the world he lives in and this is worth studying from a phenomenological approach. Reality does exist independently from conscience, but it can be known only through the mediation of the human being, who takes conscious contact with reality. The map – that looks more like the cartographer than the territory – is worth looking into.

Phenomenological psychology studies the life experiences, "the way one understands one's actions and consciously sees the associated feelings" [4]. What might that mean for the study of the paradigm of Ego and its dynamics? According to the phenomenological paradigm, the psychologist's task is to describe the nature of this dynamics as seen by the subject and understand the meaning he gives to processes associated to it. Beliefs, errors in everyday life are more important than theoretical abstractions. The psychologist has to explain implicit structures and develop the meaning of human experiences [4]. Thus, the phenomenological approach in psychology is not about behavior study, but about the study of the subject's experiences of life. Phenomenology rehabilitates the epistemological role of conscience, the main filter the subject uses in perceiving the objective reality and in deciphering the paradigm of his own Self, the main paradigm of efficiency.

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THE RELATION BETWEEN SOCIAL COMPARISON AND COACHES' ORIENTATION TOWARDS COMPETITIVE SITUATION

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ABSTRACT:
How coaches behave depends on the representation they have towards their role and towards the competitive situation itself. The aim of this study is to analyze the relationship between the coaches' orientation towards the competitive situation and the way they define their relation with the competitors. Based on combining conceptual elements from social dramaturgy, achievement goal theory and social comparison theory, the study focuses on coaches' social representations upon sport context and actors. The results of the qualitative research show that the differences between self-improvement and domination type of goal orientation are determined by the nature of social comparison the coaches' use towards their competitors. When faced with a downward or lateral comparison, coaches tend to use an orientation to domination, while in case of upward comparison they prefer a self-improvement goal orientation to minimize the impact of the competition result on the level of self-esteem.

Keywords: *social comparison, goal orientation, domination, self-improvement, competitive situation, sports*

1. INTRODUCTION

The emergence of social role and practices that have been institutionalized inside the sports' field means that nowadays sports represents more than recreation, competition or healthier lifestyle. Due to its autonomy and complexity of structural and dynamic aspects, sports can be approached as a social field per se, in bourdieusian terms [1].

This study is focus on the relationship between the representational sphere and the corollary sphere of action. Based on a general framework of social representation [2], it can be said that the social actors' representations upon the social field of sports is determinant in understanding their attitudes and behaviors inside this micro-universe of sports. Moreover, when speaking of competitive situations, there is an important distinction between the objective competitive situation and the subjective competitive situation [3]. If the first one is defined by evaluation criteria known by a least one person who can evaluate the performance (i.e. standards of performance, the level of performance in the past, etc.), the second one refers to the way people perceive, accept and redefine the objective competitive situation. This last dimension of the sports' competitive situation will be the central component of the present study.

Starting with the fifties, Stone [4] understood the dual dimension of sports as performance and competition. These two major frameworks of sports' field representation can be associated with the dichotomy between the dramaturgical model of sports as spectacle [5] and the belligerent model of sport as confrontation of opponent parties. Each perspective implies a different logic of redefining the roles of the actors

inside the sports field, different expectations, attitudes and behaviors.

The aim of this study is to analyze how coaches, as central actors in the dynamics of sports' social field, define the competitive situation, taken into consideration the way they refer to the competitive context, but also the way they refer to the opponent teams.

2. ORIENTATION TOWARDS ACTION

Engaging in a sport competition, like in any other human activity, raises the question of the reason behind. The answers to "Why?" questions are correlated to the discussions about goals as fuel for every action inside and beyond the sport field. Thus, according to Burton and Naylor [6], the notion of goals can be approached in two fundamental ways. First, goals can be considered as a direct motivational strategy, closely associated with motivational aspects. Therefore, they work as specific standards of performance that have impact on a person's behavior in terms of attention and effort. The second way in which goals can be studied is based on considering goals as cognitive drivers for involvement in activities.

In this second case, achievement goal theory [7] considers that goals are strongly related to the personal meaning of ability and success, which, in turn, influences cognitions, behaviors and affective responses of a person. Moreover, the main differences between social actors are determined by the way in which they perceive and define things and the criteria they use in evaluating the relevance of any information in reaching their goals.

According to Nicholls, there are two complementary perspectives in dealing with goal achievement: task involvement and ego involvement [7]. While the first one is concerned with the felling of fulfillment and the improvement of self-performance, the second one is concerned with demonstrating superiority over others. Re-contextualizing the two perspectives for the sports' field, we can speak about the differences between focusing on your own performance and its improvement compared with your previous levels and focusing on winning against your opponent, regardless of the level of performance implied. Each approach is based on different aspects of the Self [8]: if task involvement means self-fulfillment, using your own performance as a referential point, ego involvement means focusing on being better than others, who become the reference point in evaluating your competence. That is why, when athletes are task involved, the probability to help each other in trying to improve their own performance is bigger and they tend to appreciate and easily adopt respectful attitudes and fairness [9] in competing with an opponent. On the other hand, when faced with an ego involvement orientation, the athletes may be so interested in showing their superiority towards the opponent that they might go for less moral means in reaching that goal. However, although the achievement goal model is a dichotomist one, as Duda notices [10], in reality, most of the athletes' goal orientation covers both aspects: task and ego involvement. So, it is better to speak in terms of dominant and secondary orientation in analyzing the relationship between the two and the dynamics of this relationship.

The main critic of this achievement goal approach is that it neglects the social aspects of activities. That is way a complementary concept was proposed to balance the goal orientation one: *social orientation* [11]. Competence is therefore discussed in terms of relationships with the others, implying aspects like: social recognition, cooperation, feedback, interdependency, social support, etc. Besides goals regarding performance, people can be interested solely or at the same time in these aspects regarding the social dynamics of the relationships.

3. SOCIAL COMPARISON

Sports competitions are defined by their evaluative nature, the situation of putting face to face at least two opponent parts being defined by an explicit or implicit comparison process between the actors. A competitive situation means referring to the level of expectations, to the results achieved [12] and

to the other actors involved: opponents, teammates, coaches, referee or supporters.

The social comparison mechanism [13] is based on the fact that the social actors are continuously involved in a self-evaluation process in order to place themselves on a position according to a particular set of characteristics they value. *Alter* becomes the reference point in this bidirectional process of self-defining in reference to the other and of defining the other in reference to self.

It has been noticed that, when speaking of the social comparison process, there are two general tendencies: individuals frequently prefer to use inferior terms of comparison, as a protective mechanism for the self-image and, in most cases, they chose persons that are relevant for them [14]. Therefore we cannot speak of the social actor as a neutral observer of the reality, but as subject that is actively involved in redefining it. Moreover, even the two main orientations: goal and social orientation imply a type of social comparison, placing the individual in relations with the social actors inside their field of action. If we were to look at the dimensions of goal orientation, from the comparison perspective, we can correlate them with the distinction between temporal and social comparison [15]. Thus, the task involvement of a sportsman is a type of temporal comparison, focused on whether the performance of the individual improved or deteriorated over time. Similarly, ego involvement in reaching a goal is based on a social comparison towards the opponent you want to demonstrate your superiority over. That is why, in trying to understand the coaches' representation regarding competitive situations, the analysis of their general orientation should also take into considerations if and how the comparison process is involved.

4. METHODOLOGY

For understanding the way coaches' define competitive situations and the mechanism of representation behind this image, a qualitative study was chosen as research method. The theme of the representation of competitive situations and coaches' orientation towards sports' social field was just one of the three-part interview guide, in which the role of coaches' and the social imaginary of winning and losing were also approached.

The 12 semi-structured interviews were taken between November 2010 and February 2011. The participants were all handball coaches (A1 to A12), half from the First and the other half from the Second League of the Romanian Feminine Championship. Upon consent to participate in the study, each participant was interviewed separately and the interviews lasted, on average, around fifty minutes.

Before discussing the results of the research it is important to mention the reason for choosing this sport-area and the implications it has for the data analysis. Speaking of Romanian sports for teams, handball - especially the feminine teams - was the one that achieved the highest performance in the last years in international competitions. Moreover, the game design, using the criteria proposed by Orlick [3], is the most similar to the business organizational design: cooperative means and competitive ends, which means that some findings could be tasted and transposed into the business area too. When speaking of a handball match as a competitive situation, this dichotomy: cooperative means (inside the team) and competitive ends (winning against the opponent team) should be understood in terms of a game in which one team's win means the other team's defeat.

6. FINDINGS DISCUSSION

The way coaches define competitive situation was explored at three inter-correlated levels: the general frame of handball as sport domain, the contextual level of a typical

handball game and the aspirational level of a "good handball game".

Although the activity of a coach and its team has three main frames of action: the public competition context, the training one and the extra-sportive activity component, when explicitly ask to define the competitive situations mentioned earlier, coaches use a metonymic representation mechanism. When speaking of handball as general frame of action, coaches tend to refer strictly to the contextual unit of the competitive situation: the game itself. Moreover, they narrow down the discussion to the dramaturgical aspects of sport performance [5], the public scene of the game against the opponent team. In doing so, the way they reconstruct the competitive context depends on the social actors they focus on: the teams and their game-confrontation or the public and the impact that the competitive situation has upon it.

If the focus is on the game dynamics and the relation between teams, the dominant representation of the competitive situation is related to a goal orientation perspective, expressed either in terms of zero-sum game – *"It is a game between two teams that wish to win probably one as much as the other."* (A5)- or in belligerent terms, using the metaphor of sports as war substitute [16] – *"The power of a nation is decided on the battlefield, but in peace times it is transposed on the handball field. For me is a fight in which, in the end, the best one wins; like a real battle in which you protect your field and then you go and try to conquer your enemy's one."*(A1) Both approaches outline the existence of two opposite positions: the winner and the loser as a natural outcome of a symbolic process of overpowering the opponent.

Even if the goal orientation is the dominant one in defining the competitive situation, coaches secondly refer to aspects regarding the competition as a spectacle. There are two ways in which this spectacle approach is build: a transitive one, focusing on the impact that the game has on the audience – *"When a viewer or a TV-viewer watches a game, he has to see moments which must convince him and attract them to come to the next game as well."* (A3) or a reflexive one, focused on the way coaches live the sport performance – *"A handball game is an aggregation of feelings and emotions that you come across in live, probably, in the moment you fall in love."* (A4). These representations are both based on the emotional level of experiencing the competitive situation and highlight the intensity of these feelings.

At the other two levels of defining the competitive situation – contextual and aspirational ones - the goal orientation's domination is even greater, references to the spectacle dimension been ignored. There are two main frames of defining a handball mach: a strategic frame and a comparative one. The first one associates the game with the output of a strategic script and, therefore, the level of performance depends on the degree of following the instructions and keeping to the prepared script actions - *"A good match means following the prepared game-tactic or at least seeing that the athletes try to put in practice what the coach asked from them before the game, during the training period."(*A4). What is the most important task of the team in a competitive situation is to follow the tactical schemes that have been prepared for each game, the training activity acting as a rehearsal for the actual confrontation between the two teams.

The second frame is based on the comparison process. The design of a sport game has a comparative nature in itself. However, depending on how the coaches evaluate the opposite team and the winning chances their team has in the game, they chose the type of goal orientation they base their definition of the competitive situation upon.

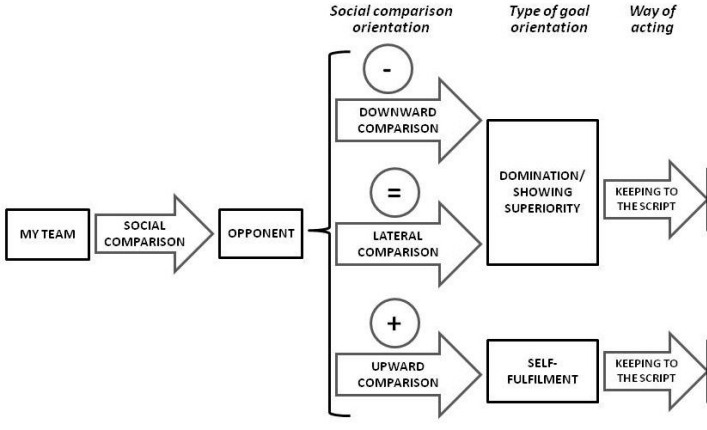

Fig. 1 Social comparison's impact on coaches' goal orientation

In speaking about a competitive context, coaches' implicitly refer to the perceived level o the two teams' value, evaluating the differences between them in terms of expected levels of performance. Thus, when faced with an equal or an inferior opponent, the coaches went for an ego involvement attitude, interested in demonstrating their team's superiority over the opponent team –*"A good game is the one during which you watch how your athletes try to put in practice what you have told them before the match and the result is a positive one."(*A6). Winning is a must-achieve outcome through which the team confirms the performance expectations and reaffirms its position within the overall hierarchy of the competition. However, in case of a better opponent, as it is perceived by the coach, the goal orientation is a task involvement one, centered on reaching the maximum potential of the team. Coaches are interested in the improvement of their team performance, compared with its past performances and its potential, although the team loses the game – *"The result is important, but depends on the opponent. If I consider that my team has engaged and did all they could to win, that is important for me in defining a game to be good or bad, not the result itself."* (A1) The poor chances of winning, based on the obvious superiority of the opponent – as it is perceived by the coach, move the focus from winning the game to team doing its best. This kind of redefinition of the goal orientation is, in fact, a protective strategy and it allows the coaches and the teams to maintain a good level of self-esteem, regardless of the final result of the game. Self-fulfillment orientation can be seen as a type of rationalisation coaches use to cope with expected defeat, a way of getting beyond the winner-loser frame and motivating the team to involve in the competitive situation of a game that is difficult or even impossible to win at a first glance.

Finally, it is important to mention that, at all levels of defining the competitive situation, even if coaches refer to social aspects of the team's dynamics, these are seen as instruments for achieving the coaches' goal, whether it is an ego or a task involvement one. The social dimension of a competitive situation is important if it serves the expected aim of the team and, therefore, is subordinated to the dominant goal orientation one.

5. CONCLUSIONS

The way coaches define the competitive situation is closely related to the type of comparison they use in evaluating their team in relation to the opponent one. In case of downward or lateral comparison, ego involvement is preferred in order to affirm their team superiority and performance. However, in case of upward comparison, the task involvement and the focused on the improvement of their own team, regardless of the game result, works as a protective strategy and a rationalizing mechanism coaches use for dealing with defeat and maintaining their self confidence. Thus, when speaking of goal orientation and coaches' attitude towards a specific competitive situation, it is important to analyze the way they perceive the performance balance between their team and the opponent one.

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PERCEPTIONS ABOUT THE MASS MEDIA AMONG THE STUDENTS FROM REPUBLIC OF MOLDOVA

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Abstract *The last decades revealed the importance of mass media in a society. Regarding the Republic of Moldova the role of mass media is influenced by some particularities of the economic, politic and social activities. Moldova is among the poorest states from Europe and its political situation is still unstable. On the markets of mass media from Moldova there are in competition different categories of participants: domestics and foreigners, public and private entities. This paper presents the results of an investigation among a group of students from the Republic of Moldova regarding their perceptions about mass media. Such results could contribute to understanding the impact of mass media for an important segment of the Bessarabian society.*

Keywords: *Mass Media preferences, Trust in Mass Media, Bessarabian Students*

1. INTRODUCTION

The major impact of mass media in a society was approached in several scientific papers. Some of them revealed the strong relationship between the use of media and the political attitudes [1,2,3]. Others proved the growing role of mass media news in politics [4,5,6,7]. In this context the freedom and the objectivity of media are considered to be among the main obstacles to autocracy and corruption [8,9]. The freedom and the objectivity of media depend not only on the control or influence of the government but also by the ownership of media [10,11,12].

In this paper we investigate the perceptions about the mass media among the students from the Republic of Moldova. As an independent state, Moldova has a quite short history. For centuries its territory belonged to the medieval principality of Moldavia. In 1812 the east half of Moldavia, later called Bessarabia, was annexed by the Russian Empire.

In April 1918 Bessarabia united with Romania. In June 1940, as a consequence of Molotov – Ribbentrop Pact, Bessarabia was annexed to the Soviet Union. For almost three years, during the Second World War, Romania regained Bessarabia but finally the territory was reincorporated to the Soviet Union as the Moldavian Soviet Socialist Republic. In August 1991, in the context of the Soviet Union disintegration, the Republic of Moldova declared its independence. Since its independence the political situation from the Republic of Moldova was quite unstable.

The concepts of the national language and even the Moldovan nation are still objects of controversies. Many citizens of Bessarabia consider themselves as Romanians, speaking the Romanian language. However, their vision

is not shared by the authorities from Republic of Moldova.

Some parties are favourable to strong relations with Romania and European Union, while other parties prefer the relations with Russia. From 2001 to 2009 the Republic of Moldova was ruled by the Party of Communists, a political formation favourable to strong relations with Russia. In April 2009, after the disputed parliamentary elections, some non governmental organizations and opposition parties organized protests in the capital of the country Chisinau, forcing the communists to leave the power. Since then a coalition of the pro European Union parties obtained a fragile majority in the Parliament. For the next years there are expected new elections with decisive results for the future of Moldova.

Since the independence, some significant transformations occurred in the Republic of Moldova media. Some economic, demographic and politic particularities influenced this evolution. In terms of Gross Domestic Product Moldova was the poorest country in Europe. From its 3.5 millions of citizens about 70 percent are Moldovan or Romanian people, while Ukrainian and Russian people represent about 30 percent. There were accusations that, although media was formally free, the government influence was substantial.

This paper presents the results of an investigation in which 54 students from the Republic of Moldova were questioned about mass media. Obviously, this sample is too small for generalizing. However, its results could help in understanding the impact of mass media on the Bessarabian society.

2. DATA AND METHODOLOGY

In our investigation we used a sample of 54 Bessarabian students from a branch of a Romanian university localised in Cahul (a town from the Republic of Moldova, closed to the border with Romania, with an estimated population of about 40000). All of them are Moldovan (Romanian) natives but they also studied the Russian language in school. Their ages are between 18 and 20 years.

Our investigation occurred between January and April 2011. We collected data from individual interviews. We approached as main subjects:

- mass media preferences;
- trust in mass media.

3. EMPIRICAL RESULTS

We asked the 54 students about how often they watch television, how often they listen to the radio or how often they read magazines. Their answers indicated an obviously preference for television (Table 1).

We transposed these answers on a rating scale from 1 to 5 (1 for "very low" and 5 for "very high"). The descriptive statistics resulted confirmed the supremacy of television and radio over magazines (Table 2).

Regarding television the students indicated various channels. Some of them are from Moldova, like Moldova 1 and Publika TV, others are Romanian, like TVR 1 and PRO TV or Russians, like Prime and TNT.

35 students (64.8 percent) considered that Russian television channels are more attractive than the Moldovan or the Romanian ones. They explained they were interested mostly in the entertainment programs. In their opinion the Russian channels provided a better quality entertainment programs than the Moldovan and the Romanian ones.

Regarding the radio students answers indicated a net preference for the Romanian channels, especially Kiss FM and Europa FM.

They also listen to Moldovan channels and seldom to Russian or Ukrainian channels.

From the students answers it resulted they preferred mainly the local magazines. Some of them read the online editions of the Romanian magazines.

The interviews revealed that no student trusted the public television or radio from the Republic of Moldova. Both of them practically ignored the protests from April 2009 and the students considered that as an evidence of the total control of authorities over mass media. Students also believe that private mass media from Bessarabia is serving owner's interests. 43 students (79.6 percents) trusted in the objectivity of public mass media from Romania and they used it frequently as a source of information about the Republic of Moldova. However, only 8 of them (14.8 percents) considered that private mass media from Romania as objective. 14 students (25.9 percents) trusted in the Russian private mass media and they used it as a source of information about their country.

We also questioned the students about the impact of mass media in politics. It resulted that all of them were informed about politics mainly by the television. It also resulted that a significant number of students were interested not only in the political situation from the Republic of Moldova, but also from Romania and Russia (Table 3).

The students interested in the political situation from Romania explained they considered this country as the main supporter of the Republic of Moldova strengthening relations with the European Union. The interest for the political situation from Russia was justified by significant economic relations between this country and the Republic of Moldova.

4. CONCLUSIONS

In this paper we approached the perceptions of a group of Bessarabian students about mass media. We found that television was more preferred in comparison with radio or magazines. It also resulted that students attended not only Moldovan mediums but also Romanian and Russian ones.

Such preferences could be explained by Republic of Moldova's past. Belonging to Russia and then to the Soviet Union contributed to the attraction for the Russian television from the Republic of Moldova.

The common language and the recent strengthen of relations with Romania has also a significant impact on the students' preferences. These aspects could be taken into consideration in understanding evolution of society from the Republic of Moldova.

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APPENDIX

Table 1 - Students preferences for mass media

Medium / Frequency	TV	Radio	Magazines
Very High	33	27	4
High	15	19	9
Moderate	6	5	23
Low	-	3	16
Very Low	-	-	2
Total	54	54	54

Table 2 – Descriptive Statistics of Students preferences for mass media

Indicator	TV	Radio	Magazines
Mean	4.500	4.444	2.944
Standard Error	0.094	0.082	0.131
Median	5.000	4.500	3.000
Mode	5.000	5.000	3.000
Standard Deviation	0.694	0.604	0.960

Sample Variance	0.481	0.365	0.921
Kurtosis	-0.131	-0.547	-0.094
Skewness	-1.057	-0.580	0.380
Sum	243.000	240.000	159.000
Count	54.000	54.000	54.000
Confidence Level (95.0%)	0.189	0.165	0.262

Table 3 – Students' interest about the political situation from the Republic of Moldova, Romania and Russia

Country / Degree of interest	**Moldova**	**Romania**	**Russia**
Very Interested	42	21	14
Quite Interested	12	33	22
Not Interested	-	-	18
Total	54	54	54

PANEL 3. *Work psychology, transport and services*

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HUMAN FACTORS IN AVIATION: CREW MANAGEMENT

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***Abstract**: Human error is a major cause of aviation accidents, representing about 80% of them, while only 20% are attributed to technical problems. While flight safety has improved considerably over time and the number of aviation accidents has decreased, our desire to have a 100% safe flight is still far from being achieved. If technologically progress has been enormous, the human factor remains the weak link in air transportation. Although in the phases of selection, training and monitoring crew activity there have been taken measures in order to improve this negative performance, the human factor is still the main cause of the aviation events. The explanation for this is not the inefficiency of the selection or of the training programs, but the considerable increasing in the amount of information to be processed and the shrinking of the response times, mainly due to airspace congestion and aircraft speed performance.*
To safely fly an aircraft, knowledge and skills are not enough. A pilot, especially if flying a multicrew aircraft, has to work on attitude, communication, team spirit, discipline, workload and stress management.

***Keywords**: human factors, flight safety, crew management*

1. INTRODUCTION

Since the beginning of the aviation, flight safety was a major concern of the public opinion. Although these days air transport is the safest way to travel, any accident or incident involving an aircraft will keep the front page of the newspapers. Despite the technological progress, accidents are still happening in aviation. The main cause: the most sophisticated and sensitive factor involved – the human one. Statistics showed that around 80 percent of aviation accidents are caused by a human error. Figure 1 shows the top five causes of accidents as it resulted from a study conducted by the Flight Safety Foundation.

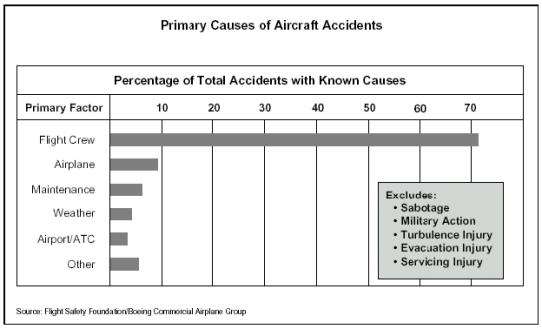

Fig. 1: Primary causes of aircraft accidents. Source: Flight Safety Foundation – Flight Safety Digest, vol. 15, no. 1

Then why are we still using human pilots? Well, this is an endless discussion, but we do this mainly because a machine has the bad habit of doing what you are telling to do, not what you want to do, and it has no adaptability, meaning that you have to program it for an infinite number of situations. Given that, let's get back to human pilots and see why they are making mistakes and how can we train them not to make them.

Despite the fact that accidents rarely resemble each other, investigations showed that we can talk about a set of "typical aircrew error". The top of this "standard mistakes" consists of the following:

- Loss of situational awareness;
- Violation of the flying rules and regulations;
- Failure to follow the commonly known safe procedures;
- Poor judgment or decision making;
- Preoccupation with minor mechanical problems;
- Inadequate leadership.

As you can see, in this top there are no knowledge related errors. This is because all flight crews are tested periodically in terms of knowledge, motor skills and medical fitness. The only thing that was missing until recent years was the training in complementary fields like attitude, stress management, communication, team work, etc.

It was a time in aviation when everybody believed that to fly safely all you need are motor skills and solid knowledge. Unfortunately, practice showed that it wasn't enough. For many years, the quest for training "the perfect pilot" was focused only on technical skills, ignoring completely non-technical competences. This deficiency in pilots training was revealed when accidents investigators discovered that highly trained crew members made judgment errors or had an inappropriate response to a situation.

When we talk about technical skills, we refer to three main categories: knowledge, motor activity skills and procedural activity skills. For a pilot, knowledge is the information base containing all policies, rules, laws and regulations regarding airspace, weather and equipment, along with the aircraft performance and limitation. Motor skills represent the sum of abilities involved in aircraft and system control, as well as visual acquisition and interpretation of the information and hazards. Procedural skills refer to competences regarding standard communications and normal / emergency operating procedures.

Non-technical skills, also called "soft skills", were initial neglected and not included in crew members training programs. Accidents history showed that those skills are equally important, even though are not so aviation related. Non-technical skills are also split into three categories. The first category is represented by cognitive skills. This includes all skills related to planning, preparation, decision making process and situational awareness. The interpersonal skills form the second category. The interpersonal skills category includes all abilities regarding communication, teamwork, group climate, leadership and conflict resolution. The last category regards emotional climate and stress. As you can see even from the first glance, non-technical skills are important. So important that there were studied for a long time, and improvement techniques were applied in different economical sectors based on team work, except aviation. This happened, like I said, because aviation was considered a very technical sector, requiring more motor skills and knowledge and less or not at all "soft skills".

2. COGNITIVE SKILLS

Situational awareness can be defined as the accurate perception of all the factors affecting the aircraft and the crew, including knowing what has happened in the past, what's going on now, and how these affect what might happen in the future. In order to achieve and maintain a good situational awareness, a crew must work on some critical success factors. The first one is knowledge, doubled by experience and training. This is not referring only to aircraft handling and operating procedures, but also to be familiar with crew performance and limitations at any given moment. The second one is attitude – an open attitude, which allows the pilot to deal with personal weakness. There are some typical hazardous attitudes that can lead to loss of situational awareness or to critical errors:

- ANTI-AUTHORITY: "Don't tell me!" Some people just don't like to be told what to do. They think that rules, regulations and procedures are silly or unnecessary.

(Antidote: Follow rules, because there are usually right!);

- IMPULSIVITY: "Let's do something now!" This "act now, think later" attitude is quite dangerous, because an impulsive action can do more damage than the initial problem. (Antidote: Not so fast. Think first!);
- INVULNERABILITY: "That could never happen to me!" This kind of attitude leads to superficiality in mission preparation. (Antidote: "It could happen to me!");
- MACHO: "I can do it!" Trying to prove self. It is a sign of insecurity. (Antidote: Taking chances is foolish.);
- RESIGNATION: "What can I do about it?" (Antidote: "I'm not helpless. I can make a difference!").

Those dangerous attitudes are the target of psychological exams for aeronautical personal, but there are some cases when it is impossible to detect them from the beginning of the selection process. That is why all crew members must be able to detect and correct this kind of hazardous attitudes.

The personal health is another factor that influences the situational awareness. It is a well known fact that a good health condition sharpens the senses, while a bad one leads to a diminution in capacity. Any minor health problem can lead to a serious threat to flight safety in some circumstance. Nowadays is famous a personal health check-list, called "I'M SAFE". Its name comes from the initials of health status items to be checked: Illness, Medication, Stress, Alcohol, Fatigue and Eating. Those are the primary factors that should prevent an airman to fly. The first auditor of a pilot health status is not the medic, but the pilot himself.

Another factor that leads to an increased situational awareness is crew coordination. It may seem obvious, but it is important to state that crew coordination can make the difference especially in an abnormal or emergency on board situation. To obtain a good crew, you have to train those men to work as a team in order to get benefits from their joint efforts. Like I said, it may seem obvious, but it is incredible how many air operators ignore this factor. Even though there are good crew training courses, some mandatory (depending on license type), companies are sometimes mixing the crew members depending on their needs, and more or less, the crew homogeneity is losing. The last three factors that can influence the situational awareness are closely related to each other: inquiry, assertiveness and analysis. Inquiry is the active questioning, investigation and use of aggressive scepticism. Analysis consists in continuous evaluation of all mission parameters in order to keep the plan updated. Assertiveness is used in the sense of obligation to speak-up. Given the specific of aviation job, every crew member is not just entitled, but also obliged to speak-up his concerns. However, there are some situations which can make an aviator hesitant to speak up when faced with a potential safety problem. The excessive professional courtesy is one of these cases. It manifests by hesitancy to say anything for fear of insulting the other pilot's skills, especially if that pilot is a friend or superior. For example, the statement: "we might be a little slow", when a stall is imminent represents a dangerous case of excessive professional courtesy. Another barrier could be the "hallo effect". This appears when the pilot committing error is an expert or has a lot of experience. Instead of thinking "he knows better", the crew member should state his concern. There is also the reversed situation, called "the co-pilot syndrome", when the more experienced crew member choose to ignore the warning coming from a younger colleague. This is another case when assertiveness is mandatory in order to regain situational awareness. To overcome this

mind traps, there are five steps: opening, state concern, state the problem, offer a solution and obtain agreement. In case that this approach doesn't work, the proven method is the "This is stupid!" statement. Using this line, a crew member will get immediate attention by using the shock effect and will get others to listen to his perception regarding a potentially unsafe situation.

Loss of situational awareness can occur from many causes. The most frequent ones are: fixation, ambiguity, unresolved disagreement, complacency, euphoria, and distractions. Among these, the most interesting is fixation. Many aircraft accidents had as a main cause fixation. It usually starts with a minor malfunction which is getting the whole attention of the entire crew, while nobody is paying attention to the operational procedure and aircraft flying. It looks so stupid that you think that it is impossible to happen, but experienced crews manage to cause accidents in this way. One of the most famous incidents of an aircraft disaster attributed to fixation was the crash of Eastern Air Lines Flight 401 near Miami, Florida on 29th of December 1972. The pilot, co-pilot, and flight engineer had become fixated on a faulty landing gear light and had failed to realize that the autopilot buttons had been bumped by one of the crew altering the settings from level flight to a slow descent. The distracted flight crew did not notice the plane losing height and the aircraft eventually struck the ground, killing 101 out of 176 passengers and crew.

Planning and decision making process is an important part of an aviator's job. Unlike other jobs, in aviation decision making process is a group duty, meaning that all crew should participate to this process, and any changing in the initial plan should be communicated and acknowledge to / by the whole team. This is particularly important during abnormal operations or in an emergency situation, where conditions affecting the progress of the flight and the safety of the aircraft are likely to change rapidly. In these circumstances, regular updates on the status of the flight allow each individual crew member to be sufficiently aware of the situation and needs of the moment to contribute in the most effective way to the decision-making process. The degree of intervention of each crew member into the decision-making process may vary depending on the mission, on-board function, and, of course, social norms and organizational culture. Anyway, regardless of all this, assertiveness is the main privilege and also obligation of all crew members. This is because the decision-making process can be affected by many factors, like a sudden loss of judgment. Here are some examples:

- HELICOPTER MIND TRAP: "This thing can be set down anywhere, so if it gets too bad I'll just land...";
- AIRSHOW SYNDROME: "I've got to put on a really good show! Can't let'em down...";
- PERCEIVED PRESSURE: The illusion that either peers or superiors are pushing you to go ahead with a flight;
- HALO EFFECT: Maybe this pilot used to be really great, but is he still? This is expired experience!

3. INTERPERSONAL SKILLS

Interpersonal skills refer to all abilities related to interaction between crew members, and I sustain that the most important process related to human interaction is communication. A good level of communication is important anywhere, but in aviation is almost vital. Communication is also social and culturally related, although in aviation industry is instructed on importance of good communication. There are three levels of communication: poor, good and effective. We consider a communication as poor when the message sent is not even received, resulting in confusion. A good level of communication is when the message is received, but the receiver has not responded with the desired action. When the message is not only received, but also had resulted in the action desired, we call the communication effective. The communication process consists in the following: the sender is encoding the message (words, signals, etc.), then is transmitting the encoded message and receiver is decoding the message. The encoding and decoding

processes are subjective ones. All encoding and decoding is passed through the filters of each person personalities: the sum total of his / her past experiences. If vast differences exist in personality, then this encode/decode will result in loss of communications and frustration. There are several hazards which reduce the quality of communications:

- transmission failures (the sending of unclear or ambiguous messages, language problems);
- transmission environment difficulties (background noises or distortion of the information);
- receiving failures (the expectation of another message, wrong interpretation of the arriving message or even its disregard);
- physical problems (impaired hearing or wearing of the oxygen mask).

In order to reduce communication failure, a standard phraseology is mandatory in all aviation communication, and feed-back is assured by read-back of all important messages and simple acknowledge for the rest.

The others interpersonal skills are team-related. The goal of teamwork is achieving synergy, meaning that the output of the team is greater than the sum of outputs of each individual. This is the main role of crew coordination trainings, not the fact that every member will know what to do and when. An air crew is basically the same like any other group, some will say with closer ties because of the special nature of the job. Usually, the formal authority in air crew is the same with the informal leader, because there are no shortcuts, and the captain is the most experienced (and, hopefully, respected) crew member. Anyway, discipline on board of an aircraft is not like in the military and every crew member can participate to the decision-making process (as far as the veto right in some cases regarding flight safety). This is why I will not insist on leadership and get strait to conflict resolution. Like in any team, in an air crew may be conflicts. Of course, there is nothing worse than a conflict on flight deck. But when occurs, it is better to know what to do and what not to do. First of all, apologizing prematurely is wrong. This will break down communication before solving the problem. I was mentioning before the social and cultural barriers. Well, in the cockpit, they should not exist. It is up to company policy to establish rules that allows airman to lose their cultural inhibition. Other destructive patterns in cockpit conflict resolution are the use of: non-related issues, intimate knowledge, belittling humour, indirect attack or hollow promises. The proper way of solving conflicts consist in taking time to discuss issues. In this discussion, peoples have to define issues clearly, identify points of agreement and points of vulnerability and deal with them in a positive way. Every part has to admit its own mistakes and to be open to the other's reconciliation attempt. If the parts do not agree on the future course of action, the decision factor (captain) should apply the "conservative response rule". This consists in choosing the safest course of action, presuming that both ways could be wrong.

4. EMOTIONAL CLIMATE AND STRESS

The emotional climate represents the way that crew members think and feel about each other during flight. This climate may enhance or reduce performance of the cognitive and interpersonal processes. There are many factors that influence the emotional working climate, like clarity of tasks, other members' degree of participation, recognition of merits, effectiveness of communication, expectations, perception of safety, etc. The emotional climate depends on company policies regarding command authority, job description, freedom of speech, etc. (those could be as well

social and cultural norms) and, ultimately, depends on each team member's attitude.

A big influence on performance has the stress, not only by the emotional climate point of view, but also from human physical and cognitive limitation. Stress is the reaction of the human body when it adapts to stressors. A stressor could be eventually everything that forces us to cope. Stressors could be environmental, personal or organizational. Examples of environmental stressors are: light, dark, cold, heat, humidity, living or travel conditions. Personal stressors could be intrapersonal (hereditary traits) or interpersonal, like conflicts, mistrust, lack of support or poor communication. An important chapter of personal stressors is represented by the private life. Family problems, financial concerns, health care, lack of time for personal use are just a few examples of private life stressors. A significant amount of stress is experienced at workplace. Organizational structure, people management, workload, job ambiguity, salary, work satisfaction, time pressure are all organizational stressors. Practically everything we experience in life can be a source of stress. Each of us is affected differently by these things. Stress has a major impact on human body which transmits signals. The most noticeable signs of stress are headaches, heartburns, cramps and fatigue. Human body response to stress is basically preparation of the primitive response "fight or run". This preparation consist in increasing heart rate and adrenaline flow, pituitary gland secreting ACTH (a stress hormone), liver secreting cholesterol, kidneys increasing their activity, blood vessels constriction and brain increasing alert. In order to avoid extreme stress, people should know some basic stress management techniques. Organizing work is the first to do when dealing with stress. This allows taking control of time and energy used in work process. Communication is also important. Declaring the state of overload and asking for help is the right thing to do. And, eventually, saying "no" or "not now" is a solution. In aviation is a well known dictum saying that you have to "take time to make time". A rush and under pressure decision could lead to catastrophic consequences.

Other ways of decreasing stress level are: making brakes, using relaxation techniques, building a good psychological condition by surrounding with positive and enjoyable people, and taking care of physical condition (which helps body to resist better to stressors).

An important amount of organizational stress is caused by work overload. Regarding work performance, we can distinguish three types of workload: underload, optimum load and overload. We might not always have full control over total workload, but we can recognize its effects and take some action. When the workload is optimum, everything is good: people are creative, rational and satisfied. When the workload is too low, boring, fatigue and frustration appear. The trouble begins when the workload is too high. It may appear dangerous disorders like sudden loss of judgment, irrational response to problems, exhaustion, illness and low self esteem. The workload levels are different for each individual, each having a different optimum. This optimum level of workload is also variable depending on task: a simple task can be performed under high workload, while complex task are less compatible with overload situations. So, how air crew perform under overload situation? First, they try to work faster, do more in the same time frame. This is a circumstance that potentially leads to slips and mistakes. The overall view of the flight is lost, and so it is the scope of the mission. The flight manner becomes responsive instead of anticipative. Attention becomes tunnelled and the fixations may appear. And the most dangerous thing that appears is reversing to old habits (good or bad). The role of intense training is to wipe off old bad habits and establish new and better ones. High workload is not easy to be recognized, especially because the subject is usually too deeply immersed in the situation to fully perceive it. Signs of overloading are:

- difficulty in sticking to normal performance standards (heading, altitude, hearing radio calls, etc.);
- errors or erratic (unpredictable or inconsistent) performance;

- uncertainty, indecision, discomfort, loss of good instrument scan, tunnel vision and fixation;
- time distortion (a few seconds seem like eternity, half an hour goes by in a flash and feels like five minutes);
- hesitant or confused speech (often apparent on ATC tapes just before an accident…).

To be protected against work overload, you have to enhance personal workload limit (by constantly improve knowledge, attitudes and skills) and perform a good pre-flight preparation (because knowing what to do means buying you time in an overload situation).

5. CONCLUSIONS

Aviation can be compared with a team sport. It doesn't matter just how good you are, but how can you play in your team. If we put trained crews in cockpit instead of talented people, chances to have a safe flight are considerable increased.

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SMOMELP
STUDENTS MOTIVATION REGARDING MANAGERIAL ENTRY LEVEL POSITION

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Abstract: *Consistent with the current challenges posed by Romania military integration in the Euro-Atlantic structures, an increase in professional performance of the military is more than a necessity. In line with this demand, the current project is aimed at investigating the factors that affect motivation among Air Force Academy students and discover the best means by which to improve their prospective professional performance. The methods to be used consist of: redefining the role of the platoon commander, developing and implementing a mentorship program, identifying the optimal profile of the military leader at the entry level, and establishing the demotivating factors leading to poor performance alongside study years. In terms of innovation, it is for the first time that a mentorship program is designed to be implemented in the Romanian military.*

Keywords: *motivation, military students, project*

The mission of Air Force Academy " Henri Coandă" Braşov (AFA) is to continuously generate professional human resources for the Air Force and other national and international military and civilian structures. The Academy's training objectives are:

- Acquiring intellectual skills;
- Developing communication skills in a foreign language;
- Gaining leadership skills;
- Initial arm specialization.

This paper is about an open-mind exercise, as in "what if…" The team imagined that we only need a good project, defined by well scheduled activities, to achieve our goal (to generate optimal motivated human resources for military career), because all funds we need have already been approved.

Consequently, suppose that the Air Force Academy requests funding for a four year project aimed at enhancing the quality of the academic process within the Aeronautical Management Faculty.

The output envisaged for this project includes: changed curricula, as well as an ongoing curricula improvement program, redesign of the platoon commander's job description, redesign of annual performance assessment of students. The direct beneficiaries are the students that will graduate. The indirect target customers for this project are: operational units from the national

defense system and prospective employers of the graduates.

The departments and specialists involved are:

- Air Force Academy staff;
- Human Resources;
- Management of Education;
- Student Battalions;
- Faculty of Aeronautical Management;
- Psychologist;
- Subproject managers.

SMOMELP representative will manage communications to satisfy the requirements of and resolve issues with project stakeholders.

Organizational planning involves identifying, documenting, and assigning project roles, responsibilities, and reporting relationships.

- **Project sponsor**

The sponsor of this project should be Air Force Headquarters.

This institution has always been interested in enhancing the educational quality process for cadets in order to sustain the professional development for every military leader. Air Force Headquarters is focused on military units benefiting from optimal motivated commissioned officers. This can only be met in practice by: carrying out an investigation into the optimal profile for managerial entry level positions to be filled by Air Force graduates; establishing an individual profile for freshmen and hence a professional development path; establishing a mentorship program in order to attain the previous objective.

Therefore, this four year project undertakes to achieve the aforementioned. Consistent with the above observations, the Air Force Headquarters will act as a sponsor for this project, as it follows:

- will provide the statement of work for the project team-members;
- will support research endeavors by granting all necessary approvals;
- will allow project team to use the infrastructure available within Air Force Academy;
- will finance the project during four fiscal years.
-

- **Defining the problem**

The main problem is the decrease of military students` motivation during the period of study and, as a direct consequence, the graduates do not perform as expected and in accordance with the standards required by Air Force Headquarters.

That observation was statistically verified through a study made in July 2009, upon the request of Human Resources Management Directorate. According to "Characteristics of students` professional motivation from military academies", a study undertaken by the Sociological Department, in the actual context, 40% from military students would not opt again for a military institution and 38,5% are dissatisfied with the content of educational curricula.

In addition, it was pointed out that 'leadership' requires competitive, mental and relational skills without which a graduate in a managerial entry level position may not have motivation to achieve professional performance required in military organization.

In this respect, the aim of the Air Force Headquarters is to meet the societal need of professional graduates by acquiring new knowledge about their motivation dynamics, redefining platoon commanders role, implementing a mentorship programme and, as follows, improving their public image.

At a global level, research in the field of individual development has gained importance. Therefore, substantial funds have been granted for investing in such modern

investigation. One example is: Yale-New Haven – Social competence promotion program, Roger Weissberg, University of Illinois Chicago, research consisting in the evaluation performed in public schools of New Haven, by independent observers, as well as depending on the students and teachers reports compared to another control group. The study revealed the following aspects of the assessed subjects: improvement of problem solving ability, higher involvement in human relations, a better impulse control, improved behavior, interpersonal efficiency and improved popularity, increased adjusting abilities, a better ability to master interpersonal issues, a better adjustment to anxiety, less offending behavior, better abilities of conflict management (M.J. Elias and R. P. Weissberg, School-Based Social Competence Promotion as a Primary Prevention Strategy: A Tale of Two Projects, Prevention in Human Services 7, 1 (1990), pp.177-200).

Currently, the AFA runs another research project with international financing: *Qualitative dimensions of the career management of military officers Romania: methodologies for counseling and to optimize the recruitment process support tools for process selection*, process development and training correlation with labor market requirements in the grant funding won by the Land Forces Academy, in partnership with the Air Force Academy, Academy Navy and National Defense University.

- **Goals and objectives**

Goal: to enhance students` motivation for performance in order to connect military instruction with leadership requirements.

AFA intends, through this project, to identify and reduce the influence of factors that affect students' motivation during the 3 years of study. The chosen strategy is based on actual requirements and objectives of the primary beneficiaries of the educational process and continues to redefine the role of platoon commander, together with profiling the management functions under the first hierarchical level.

The objectives to be reached during this four year are:

- A minimum 30% rise in students` yearly motivation at the end of the recruitment and selection process for platoon commanders, consistent with the optimal profile established for this position;
- By September (first year), a new methodology for recruiting and selecting platoon commanders will be in place. The methodology will include: redesign of platoon commander's job description and a list of necessary skills to fill in such a position;
- By September, the schedule of academic and military instruction activities will be redesigned and approved in accordance with the time ratio allocated to academic activities/military instruction;
- By September , new SOPs to evaluate students` activities will be in place;
- A minimum 30% rise in students` yearly motivation for performance as a result of developing and implementing a mentorship program;
- By September, an optimal profile for managerial entry level positions will be

developed, consistent with beneficiary requirements;

- By September, the instruments necessary to establish students` individual profile will be developed and implemented;
- By September, a mentorship program, based on optimal profile and individual profiles, will be implemented.
- A minimum 30% rise in students` yearly motivation for performance as a result of psychological support to increase the specific target's involvement in academic activities and sports competitions;
- By September (last year), the dynamics of students` participation in sports competitions on a volunteer basis will be statistically established;
- By September, the dynamics of students` participation in academic activities will be statistically established;
- By September, the dynamics of students` participation in extracurricular activities on a volunteer basis will be statistically established.
- By September, the instruments necessary to identify students` expectations related to educational process will be developed and applied;
- By September, a list of suggestions consistent with the findings will be drawn up and submitted for further action.

- **Activities description**

- Redefine the role of a platoon commander - initiate a recruitment and selection process for platoon commander – this activity will be accomplished by designing a recruitment and selection methodology; its aim is to redesign job description for platoon commanders and to list the skills necessary to fill the afore mentioned position; this work package is running in the first part of the project and has as aim to strengthen the role of platoon commander in the educational process. Authority knowledge, managerial skills and personal conduct will make it a model worth following;
- Change the schedule of activities – considering the current imbalance between the ratio of academic activities and the ratio of military instruction, reflected in the overall schedule of activities, we aim to compute the number of hours necessary to conduct a military instruction in accordance with student's needs, to identify the extent to which the curricula need to be changed, consistent with the newly computed hours of military instruction, to implement an objective evaluation system of the activities that students need to accomplish and to investigate students opinion on actual evaluating system;
- Establish Standard Operation Procedures (SOPs) for duty activities based on standards of performance. This activity involves the following steps: to elaborate a list of duty activities based on military regulations, to establish clear standards of performance for each duty activity and special categories (i.e. minimum, medium, maximum standards of performance) and to establish SOPs;
- Identification of the skills needed for managerial entry level in order to identify the optimal profile for managerial entry positions of AFA graduates we intend to distribute a questionnaire to the end beneficiaries of our educational process (i.e. operational units). The optimal profile will be developed consistent with their demands and necessities;

- Identification of initial individual profile from perspective of managerial entry positions needed - based on the optimal profile developed in the previous stage, we design and validate a set of psychological tests. Their aim is to establish freshmen's individual profile. Moreover, based on it each and every 1st year student will delineate the steps needed to take in order to conform to the minimal requirements of the optimal profile by the end of the 3rd year;
- Implement a mentorship program to follow the personal development path - consistent with the individual profile established at the beginning of the 1st year and in accordance with the requirements of the optimal profile a personal development path is established for each freshman. Based on this a mentorship program is designed and implemented. Its results should be visible at the end of this project;
- Establish dynamics of competitive skills during those three years of studies, which means to establish the number of participants involved in sports competitions on volunteer basis. This will serve as a predecessor for the very next activity;
- Establish the dynamics of scholarship performance, meaning the academic performance scores of freshmen and seniors. This will serve as a predecessor for the very next activity;
- Establish the number of participants in extracurricular activities

During the three years of study, we will identify the extracurricular activities as approved by AFA and contrast them with those favored by students. Moreover, we will establish the number of freshmen and seniors involved in extracurricular activities on a volunteer basis. We will identify dynamics and make suggestions to improve the list of extracurricular activities approved by AFA, to identify possible sponsors and specific means by which students' educational performance can be acknowledged and promoted.

- Identify students expectations related to educational process, which means to draw up a questionnaire (to validate, apply, sum up the questionnaire findings and to make suggestions consistent with conclusions) to identify focused expectations of freshmen and seniors, by using a Likert scale, related to the educational process in terms of quality, instruments, evaluations, their professional status upon graduation, as well as their life quality as students;

- **Outputs description**

In any project output description contains documents about product requirements and characteristics of the product or service that the project will undertake to create. The product requirements will have less detail during the initiation process and more details during later processes, as the product characteristics are progressively elaborated. These requirements should also document the relationship among the products

or services being created and the business need or other stimulus that causes the need. While the form and substance of the product requirements document will vary, it will be still detailed.

SMOMELP has, as final results, the following products:

- Methodology for selection and recruitment of platoon commanders, based on the new job description and skills test for them also to become military instructors
- SOPs for regular duty activities
- Annual evaluations of students
- Students database, consisting of students' ID, individual managerial profile, scholarship performance and extracurricular activities, periodical evaluations
- A Mentorship Course that will be piloted on 20 teachers and military instructors
- A mentorship manual which will be elaborated in accordance with the research regarding the individual managerial profile and will have the following format: introduction to mentoring culture, pairing up apprentices and mentors, setting the rules of engagement, mentoring guide, case studies; mentorship curricula

- **Costs**

Estimated costs are minimal, because the funds will be provided by the project sponsor following the legal procedure regarding the Annual Plan of Public Acquisitions. The project costs will be budgeted for 4 years and consist of: direct costs (paper, editing a mentorship scientific book, toner for copy machines and printers, participation taxes, CDs), no personnel costs (the team project members are AFA employees and the research and work will be performed during the regular duty program with approval from AFA HQs), and no administrative costs (all the activities are based on AFA and AF HQs infrastructure).

- **Risks**

There are many definitions of *risk* that vary by specific application and situational context. The widely inconsistent and ambiguous use of the word is one of several current criticisms of the methods to manage risk. One is that risk is an issue, which can be avoided or mitigated (wherein an issue is a potential problem that has to be fixed now.)

Risk is described both qualitatively and quantitatively. In some texts risk is described as a situation which would lead to negative consequences. Qualitatively, risk is proportional to both the expected losses which may be caused by an event and to the probability of this event. Greater loss and greater event likelihood result in greater overall risk.

There are many formal methods used to assess or to "measure" risk, the latter being considered as a critical indicator of the human decision making process. Huge ethical and political issues arise when human beings themselves are seen or treated as "risks", or when the risk decision making of people who use human services might have an impact on that service. The experience of many people who rely on human services for support is that the so called "risk" is often used as a reason to prevent them from gaining further independence or fully accessing the professional advantages. Therefore, those services are often unnecessarily risk adverse.

A risk is a potential problem, a situation that, if materialized, may adversely affect the project. All projects have risks, and all risks are ultimately handled: some disappear, some develop into problems that demand attention and a few escalate into crises that destroy projects.

The goal of risk management is to ensure that risks never fall into the third category.

- **Communication**

Under the pressure of day-to-day activities, leaders often fail to adequately communicate their vision to the organization, and in particular, they don`t communicate it in a way that helps their subordinates determine where to focus their own efforts. Employees want to know where the business is going. While managers are taught to actively communicate, many either unintentionally undercommunicate or fail to articulate specific priorities and thus may not meet their people`s tremendous hunger for guidance.

As follows, communications planning means the process necessary to determine the information and communication needs of the project stakeholders in a timely manner; the sender (SMOMELP representative) is responsible for making the information clear and complete so that the receiver (AFH) can receive it correctly, and for confirming that it is properly understood. The receiver is responsible for making sure that the information is received in its entirety and understood correctly.

- **Closing project**

All the projects come eventually to an end. The final section always includes all the processes used to formally close all activities of the project and hand off the completed outcomes to stakeholders and sponsors.

For SMOMELP project, the closure also emphasizes the fact that it could and it should be continued.

It is worth mentioning that the whole project is in a piloting stage. Therefore, its results are expected to be disseminated in further projects. Thus, we envision that the outcomes are not only relevant for others military branches, but also worth investigating as thoroughly as possible. Besides, the perspective usage of project outputs by the military system, this endeavor yields fruitful results in terms of career development and successful integration of Air Force Graduates into workplace environment.

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A FEW METHODS TO TEST THE SPECIFIC LEVEL OF THE PHYSICAL TRAINING OF THE NAVAL STUDENTS ACCORDING TO THE PROFESSIONAL REQUESTS ABOARD SHIPS

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SUMMARY: *This paper presents only some of the research methods and the results of some scientific experimental investigations made on naval students and a group of the navigating personnel, concerning the necessary level of their physical specific training in accordance with the requests and professional needs aboard maritime ships. The scientific strictness of the applied research methods is demonstrated here by the absolutely impartial results we obtained. The final conclusion of our research is the need that the whole training process of the naval students to be oriented towards to that forms and ways which can imitate the requests and the specific involvement in the life aboard ships, during the best weather conditions and tempest on the sea as well.*

Key words: *Specific physical training, statistic- mathematical processing, the rope pulling, rowing, applied swimming, dressed swimming, applied itinerary, etc.*

INTRODUCTION

As a general point of view, the navigation as well as the process of the specific professional training of the navigators represents an important scientific study and research domain of greatest interest and attractivity. In our over 30 years of professional experience in the area (superior educational activity in the Navy), we tried hard to bring in a substantial contribution in the field of perfectionning the didactical forms and ways to act in order to create real naval officers able to reach the highest professional levels, in order to develop a specific professional action and successfully cope with the difficulties and the bad weather conditions this job is supposed to face at any moment.[1]

THE RESEARCH METHODS

They have been very many of them. Some of them have been assumed from other works of the specific scientific literature. Some others, most of them, bear the seal of the specific domain we use to study: the superior naval education in the activities in the Navy. Missing the necessary room, we'll present here only two of the research methods.

I. THE STATISTIC-MATHEMATICAL INVESTIGATION

[1] We mention the contribution in achieving this work of mr. col. (rs.) psiholog ***Dan NICOLAU***

METHOD, THE ANALYZING METHOD, THE DATA PROCESSING AND INTERPRETATION

During our *objectivation* of the research, we used the statistic-mathematical methods. We had the opportunity to notice, to compare to do statistical processing in order to state very precisely that the positive influence noticed at the experimental group level, compared to that of the witness group, was not hazard but the effectivness of the scientific improving intervention on that group.

During *the rationalizing* process of the research methods, we selected, from that lot of possibilities to process and interpret, generally offered by the mathematical statistics, only those closest procedures that answer best to our research tasks. We present here some statistical methods together with the statistic-mathematical formulas used to reach the goal of our research.

A. <u>The central trend parameter</u>

A.1. The arithmetical average (X). It is a statistic indicator characterizing the common features of a group; Unfortunately, it can hide some individual important features. It is calculated according to this formula:

$$\overline{X} = \frac{\sum X}{n}$$

B.<u>The dispersion parameters</u>

B.1. The standard deviation (б). At a low level dispersion we'll obtain a more representative mathematical average, and the opposite. It is calculated according to the formula:

$$\sigma = \pm \frac{V_{max} - V_{min}}{K}$$

B.2. The standard error of the average (m). It is given by the ratio between *The standard deviation of the distribution* (*б*) and the radical of *the students' number (n):*

$$m = \frac{\sigma}{\sqrt{n}}$$

B.3.The variability coefficient (v). It represents the multiplied with 100 ratio between *the standard deviation (б)* and *the arithmetical average (X);* it offers the level of the homogenousness of each group and makes possible the comparison of the groups to different measurement standards (v). It is calculated according to the formula:

$$V = \frac{\sigma}{M} \cdot 100$$

(A group is considered: *homogenous* (small variability) if $C_v < 10\%$; *relative homogenous* (medium variability) if $10\% < C_v < 20\%$; *non-homogenous* (large variability) if $C_v > 20\%$).

B.4. The statistical significance of the difference between medias (t), ("Student"-test). We used «T» test („Student" test), which we compared to the «t» value from the reference table (Fisher's table), at a significance threshold of 0,05 and also at significance threshold, the number of freedom degrees being equivalent with n = 1. It is calculated according to the formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{m_1^2 + m_2^2}}$$

C. <u>The statistical co-relation parameters</u>

C.1. The co-relation coefficient by the ranks method - SPEARMAN, calculated according to the formula:

$$r^1 = 1 - \frac{6 \cdot \sum D^2}{n \cdot (n^2 - 1)}$$

C.2. The co-relation coefficient by PEARSON method, calculated according to the formula:

$$r = \frac{\sum d_x \cdot d_y}{(n-1) \cdot S_x \cdot S_y}$$

The processing and the statistical interpretation of the scientific investigated parameters gave a maximal level of impartiality and certainty concerning the need to avoid the subjective attitude and the accidental results.

II. THE MULTIPLE TESTING OF THE SPECIFIC PHYSICAL TRAINING

We'll also present here:

III. SOME RESULTS, finally obtained when realizing the estimating tables of the student's value of the training.

1. The specific force, accumulated (arms scapular belt, body, legs) in the endurance conditions. The parameter has been tested by the following specific test: ***pulling the rope*** in an orthostatic position in order to raise a heavy weight.[2]

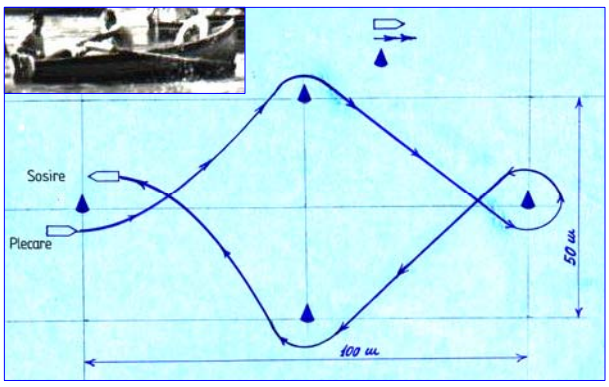
The weight consists in 25 kg., hooked at the end of a rope, passed over a windlass positioned higher, over the weight. In order to lift the weight, the student has to pull the other end of the rope at some 45 degrees ankle. The total number of pullings at 1 meter high is recorded, along 90". The resulting appreciation scale is:

NOTES	Number of raises	The level of appreciation
10	≥ 34	FB
9	32-33	B (28-33)
8	30-31	
7	28-29	
6	26-27	M (22-27)
5	24-25	
4	22-23	
3	20-21	S (18-21)
2	18-19	
1	≤ 17	NS

2. The speed of the execution, the skill, the general coordination, in forcing and specific endurance. This parameter was tested by the following two tests:

2. a. Rowing in the single place boat, called „the baby boat".

The subject rows under his maximum capability level (the length of the rowing is at its highest amplitude, and the rhythm is of 32/ minute). The itinerary of the boat is of a rhumb shape the diagonals of 100 and 50 meters. The subject has to cover the itinerary avoiding the buoys fixed in the water. He has a lifebuoy in his boat, and a partner to help guiding his rowing.



[2] ***„Pulling the rope"*** - The motional act is a compound of the professional activities and of the motional specific dayly requests aboard ships.

They time the time the navigator covers the itinerary with his boat, the appreciation levels (a scale) for this specific test being the following:

NOTES	Recorded time	The level of appreciation
10	≤ 4'15"	FB
9	4'16-4'30	B (4'16"-5'00")
8	4'31-4'45	
7	4'46-5'00	
6	5'01-5'15	M (5'01"-5'45")
5	5'16-5'30	
4	5'31-5'45	
3	5'46-6'00	S (5'46"-6'15")
2	6'01-6'15	
1	≥ 6'16"	NS

We do not have room enough to expose the whole schedule of the special training as we thought it for the experimental group and the differences between the results of them compared to the witness group. Actually, they were exposed on some other different occasions.

As we can easily notice the results of our research were materialized in these tables, strictly impartialized, containing value levels very helpful in the leading of future specific training programs. All that, helping the next naval students to progress.

2. b. Dressed swimming (a shirt and trousers on) on 50 meters, in the swimming pool.

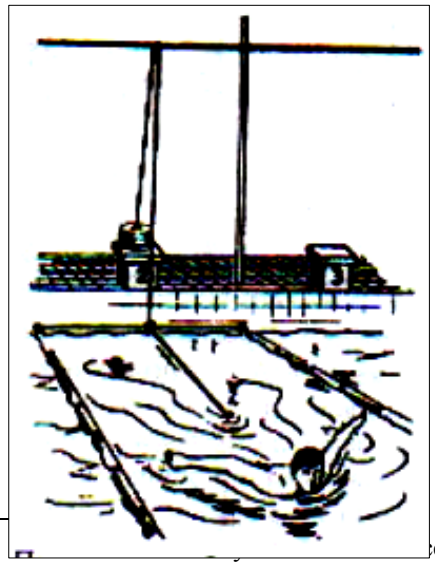
The appreciation scale was the following one:

NOTES	Recorded time	The level of appreciation
10	≤ 1'10"	FB
9	1'11-1'20	B (1'11"-1'40")
8	1'21-1'30	
7	1'31-1'40	
6	1'41-1'50	M (1'41"-2'10")
5	1'51-2'00	
4	2'01-2'10	
3	2'11-2'20	S (2'11"-2'30")
2	2'21-2'30	
1	≥ 2'31"	NS

3. The specific endurance (in forcing, coordination and skillfulness) in the applied utilitary swimming

The parameter was tested by the following specific tests:

3. a. Pulling the rope during the swimming. The student swims equipped with the shirt and the trousers and the lifebuoy. His lifebuoy is tied with a rope. The other end of the rope is passed over a double windlass („palanc") and tied to a „crane" lifting a weight of two kilos. The student pulls swimming the weight using that special „palanc" (an adapted helcometer) and tries to maintain it at a constant height. They record the time the subject can maintain the weight at a heigt between 30 and 50 cm. pulling it by swimming.[3]



[3] **Note:** cessful in any kind of water, havingthe helcometer fixed on the bank, as well as in the small swimming pool aboard ships, for example, as we did aboard the school ship "Neptun".

The appreciation scale is the following one:

NOTES	Recorded time	The level of appreciation
10	≥ 121"	FB
9	111"-120"	B (91"-120")
8	101"-110"	
7	91"-100"	
6	81"-90"	M (61"-90")
5	71"-80"	
4	61"-70"	
3	51"-60"	S (41"-60")
2	41"-50"	
1	≤ 40"	NS

3. b. The transportation during the swimming, of the lifebuoy, an equipment set and of the AK , along 50 meters.[4]

The thorough description of the test is the following: the subject comes in front of the swimming pool start the AK and the tarpaulin in his hands and has a circle lifebuoy nearby.

The moment they give the start signal, they start the chronometer, the subject get rapidly undressed packs his tarpaulin, the boots, socks, the cap, the belt, the bayonet, the bag with three loaders. He keeps on only his shirt and the trousers. He jumps in the water having the whole pack folded over the circle lifebuoy and pushes it while swimming along the 50 meters distance.

The scale and the appreciation times are the following:

NOTES	Recorded time	The level of appreciation
10	≤ 2'10"	FB
9	2'11-2'15	B (2'11"-2'25")
8	2'16-2'20	
7	2'21-2'25	
6	2'26-2'30	M (2'26"-2'40")
5	2'31-2'35	
4	2'36-2'40	
3	2'41-2'45	S (2'41"-2'50")
2	2'46-2'50	
1	≥ 2'51"	NS

4. The speed of the movement, the specific skill and the general coordination in the terms of the real conditions aboard ships.

The parameter was tested by an ***applied ittinerary of a rapid race aboard ship***, which included the following specific compounds: The student, the lifebuoy on, starts from the deck at the pilot's ladder, runs along the commander's deck to the back of the ship for 10 meters takes a lifebuoy from its place gets down some 3 meters on the inferior deck and runs to the prow to a previously established place, 15 meters nearby the pilot's ladder (totally: 10 m to the rear of the ship + 3m getting don on a ladder + 10 m + 15 m run the lifebuoy on to the prow + 38 meters). He puts back the lifebuoy in the hook, jumps out in the water (from 3-4 meters) keeping his lifebuoy tight on, swims to the pilot ladder (15 m.) climb it up (5 m.) vertically

aboard o the command deck, the very place he started.[5]

They record the time the naval student covers the itinerary.

Here they are the times of appreciation:

NOTES	Recorded time	The level of appreciation
10	≤ 64”	FB[6]
9	65” - 67”	B (65”-73”)
8	68” - 70”	
7	71” - 73”	
6	74” - 76”	M (74”-82”)
5	77” - 79”	
4	80” - 82”	
3	83” - 84”	S (83”-87”)
2	85” - 87”	
1	≥ 88”	NS

IV. CONCLUSIONS

The exceptional physical effort and the specific involved in the navigation includes a very serious training of the naval students, future officers, either in the Military or Civilian Navy. We considered the persons, as officers, will develop a responsible professional activity according to the different conditions the ergonomy of ship they’ll serve, will usually offer their best, in normal and unusual weather conditions. That means the balance the couple man-sea, will function all the time, no matter the weather.

V. METHODICAL RECOMMENDATIONS

Considering some of the tests targeting the ***physical and specific psycho-motional training*** have a high difficulty level and they request at a special level the effective capacity of the subjects in this field, a good ***physical training*** of the subjects as well as a ***motional capacity*** and a ***specific skill*** is needed to get over these tes.

We’ll also have to permanently take into account ***the experimental ethics*** in order the own over-evaluation of some subjects, the wish, the need to be seen on the first place, better than the others, not to provoke accidents, during the training and the tests as well.

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[5] This test is applied at the end only, after the students can gather the multiple specific motional capacity and, after a thoroughly training on each compound of the named test.

[6] **FB** = very good; **B** = good; **M** = medium acceptable; **S** = almost satisfying; **NS** = not-satisfying.

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THE PSYCHOLOGICAL PROFILE OF THE HIGH – PERFORMANCE MILITARY PILOT

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ABSTRACT: *Becoming a military pilot presents a high appeal for future graduates who want to join the military. In the past few years, due to technological development and increasing requirements, the psychological factor plays a significant role in the complex human – machine (aircraft) environment and flight safety. In this context, the purpose of this paper is to highlight the specific traits of a high-performance military pilot. This was achieved by using the experts' method (Delphi method). Thus, a number of pilots (flight instructors on different types of aircrafts) were asked to enumerate the specific traits of a high-performance military pilot.*

Key words: *military pilot, performance, the experts' method.*

1. INTRODUCTION

Assessment of professional performance is an important link for an organization, whether civil, military, private or public. This (performance assessment) consists in "*... assessing the degree to which human resources fulfill their responsibilities in relation to established objectives. The evaluated person is an individuality who reaches a certain level of competence in a specific situational context*" [1, p. 257]

Most often there is relatively low importance given to performance evaluation in different organizations, it turned in a formality to be fulfilled and, moreover, does not reflect the actual performance. In other cases, performance appraisal is given of by the views or preferences (subjective) of the supervisors. In the actual evaluation of performance it is more important to establish clear objectives for the organization, group and individual, and after that the performance criteria and standards can be set [2].

Based on these aspects we intend to approach in this paper the issue of professional performance in military pilots. The subject is not new. Overtime it was the aim of many studies and researches. In this context, our paper is part of an ample study regarding the relationship dynamics between emotional intelligence and decision-making performance in military pilots, circumscribed to the specificity of this professional category.

At this stage of our analysis we have proposed to establish the performance criteria for the military pilot. For this we used the *Delphi method* (the experts' method) adapted to our needs, given the small number of military flight instructors. In this regard, we asked a representative group of experts (chief pilots / flight instructors) to list a number of traits (in order of importance to them) considered absolutely necessary to a high-performance military pilot. After the qualitative data analysis of the results we have collected a number of primary traits (here the notion of primary trait refers to the relationship between the perception of the subjects and the semantic meaning of different words used by them) that characterizes a military pilot, expressed in the form of assertions or adjectives. Later, these early results have been analyzed from the semantic - qualitative viewpoint.

2. ANALYSIS OF PILOT FLYING PERFORMANCE

Performance issues in aviation psychology have been the subject of psychologist Valeriu Ceausu's work (1972, 1978, and 1983). Under his guidance, in the aviation psychology laboratory the foundations were laid for the PSYCOMP system developed in the early '90s [Popa & Popescu, 1994]. Noteworthy is the participation in the space program for the selection and training of the candidates who could become cosmonauts. Within the scientific research program of the first space flight the psychological experiment called "Information" was performed [3].

In his works (1972, 1978 and 1983), Ceausu speaks of the so-called segment of *previous performance - aspiration - subsequent performance* (P1 - A - P2), segment which is the basic unit of human activity. Performance level, from a certain point, contributes to the constitution and determining the level of aspiration. In turn, aspiration influences the performance in the next action [4].

Pilot flying performance was also evaluated using data obtained through Zapan method of interpersonal appreciation at the Air Force Academy [5]. It contained the following evaluation criteria: general theoretical education, specialty training, and performance in flying, sports training, discipline and compliance with the group. In the Psychology Laboratory of the National Institute of Aerospace and Medicine, in 2000-2001, these performance criteria have been placed in relation to decision-making behavior under uncertain situations, using the computerized test Optimum Stop.

Also, in aviation there is often a tendency to associate professional performance (in flight) with psychological performance, meaning results to the psychological tests in the laboratory. In this context, age as mental capacity variable has been recognized and studied extensively in aviation psychology. In analyzing the relationship between age and flight accidents there is the issue of changing mental capacities associated with advancing age. According to the results of an experiment conducted by Ceausu (1972), the maximum effectiveness of the decision in aeronautical personnel (called "the motor expression" of activity) is reached between 22-30 years and maladaptive manifestations occur in the fourth decade of age, respectively between 33-34 years (especially for the jet fighter pilots, where the motor component is subject to maximum requirements). In a study of Popa (1997), the changes in mental performance depending on the age of aeronautical personnel were studied. Thus, there were a number of considerable changes in information processing capacity in a diminishing direction, starting with the second half of the decade of age between 35-39 years and a significant accentuation over 45 years.

The relationship age - human performance in the aeronautical environment was analyzed in the years 1993-2002 with the computerized psychological test system PSYCOMP [6]. The investigated variables were a number of cognitive features (abstract-logical reasoning, verbal intelligence, mathematical calculus, spatial representation, attention, operation in multitasking mode) and personality traits with the help of the ALAPS questionnaire - Armstrong Laboratory Aviation Personality Survey [Retzlaff, 1996]. Analysis of the results of cognitive tests shows a trend below the average of the sample investigated both in terms of Intelligence Quotient (especially after age 45-49 years) and the basic arithmetic operations level and in the operation with multiple tasks.

In regard to personality, "*progressive trends are seen with growing age on scales like emotional lability, anxiety, preference for alcohol, depression, and declining trends in scales such as trust, risk, sociability*". Also, it can be seen "*with growing age, an increasing tendency of emotional reactivity characteristics (depression, anxiety, emotional instability), of the negative attitude and dogmatism, while diminishing tolerance for risk, sociability and self-confidence*" [7, pp. 51-55].

In terms of identifying the criteria for professional performance, this is one of the five phases of the predictive validity of psychological selection in the aeronautical

environment [8]. The criteria most commonly used are those based on performance in the training process, but there are multiple longitudinal criteria. It can be said here that the identification and measurement of performance criteria in the aeronautical environment presents major difficulties, given by:

• remoteness in time from selection;

• the pilots performance influenced by variables such as *amount of flight hours* (in this context, our view is that the number of flight hours is insufficient to maintain a high level of performance) or *professional experience*;

• *"assessment opposition"* manifested primarily by experienced pilots, which leads to difficult acceptance and effective implementation of performance measurement procedures [9].

3. RESEARCH METHODOLOGY

The research objective is to identify performance criteria for the military pilot.

The research group used in the investigation is composed of 30 chief pilots/ flight instructors (male) from a military air force base. The group was composed of three groups, of the following types of aircraft: C130 Hercules (10 pilots), AN 26 (10 pilots) and IAR-330 M (10 pilots).

Method

In the research were used:

- *Delphi method* - a method for stimulating group creativity (developed by Helmer), "*builds on the views of a group of experts in the proposed theme"* [10, p. 200]. Used to identify *performance criteria* for a military pilot, the method has been adapted by us considering the small number of military flight instructors. The topic was presented using a questionnaire and then completed independently by each participant / respondent [11]. Thus, from the definition of performance, a group of chief pilots / flight instructors was asked to list a number of features - in order of importance to them - in grades from 1-10 (1 = lowest importance, 10 = highest significance), which they believe that a high-performance pilot must possess.
- *Documents analysis* (job description, job appraisal sheet, regulations / provisions).
- *Structured interview* centered on the theme addressed.

4. ANALYSIS AND DATA PROCESSING

After the qualitative processing of the results a total of 30 characteristics / traits emerged that we have classified into five areas / categories as follows:

- **cognitive domain**, which included *above-average intelligence, ability to make quick decisions* (understood as quick problem solving), *capacity for analysis and synthesis, capacity to anticipate;*

- the specialized training domain that includes *a good specialist training*, *continuous improvement*, *general knowledge* (understood as a necessary foundation in specialized training);

- the psychological aptitudes domain; in this category were listed *piloting skills, psycho-physical strength, focused attention, distributive attention, memory, sense of observation;*

- the personality traits domain (which includes the long list of traits) respectively *self-control, perseverance, ambition, self confidence / courage, moral conduct, the desire for self improvement, team spirit, risk taking, sociability, communication skill, will, altruism, accountability, diligence, sense of organization, the motivation for the chosen profession;*

- the psycho-pedagogical skills domain; in this category characteristic *"good educator"* was included.

After processing the responses and average calculation for each characteristic individually, the following classification resulted:

Nr. crt.	Specified characteristics	Average
1.	*Good specialist training*	9,41
2.	*Piloting skills*	9,38
3.	*Motivation for the chosen profession*	9,38
4.	*Ability to make quick decisions*	9,35
5.	*Self-control*	9,26
6.	*Distributive attention*	9,20
7.	*Accountability*	9,05
8.	*Continuos self-improvement*	8,97
9.	*Psycho-physical strength*	8,94
10.	*Focused attention*	8,85
11.	*Capacity for analysis and synthesis*	8,76
12.	*Sense of observation*	8,73
13.	*Capacity to anticipate*	8,67
14.	*Team spirit*	8,67
15.	*Self confidence / courage*	8,58
16.	*Diligence*	8,50
17.	*Memory*	8,47
18.	*Desire for self improvement*	8,47
19.	*Communication skill*	8,26
20.	*Will*	8,14
21.	*Risk taking*	8,11
22.	*Perseverence*	8,08
23.	*Above average intelligence*	7,97
24.	*Ambition*	7,97
25.	*Good educator*	7,85
26.	*Moral conduct*	7,70
27.	*Sense of organization*	7,70
28.	*Sociability*	7,17
29.	*Altruisme*	7,14
30.	*General knowledge*	6,91

As it can be seen, the highest mean was obtained for the characteristic "*Good specialist training"* (i.e. 9.41), while at a small difference (i.e. 9.38) *"piloting skills"* and "*motivation for the chosen profession*" were judged to be important. Thus, we consider that to be a high-performance military pilot are important both expertise gained during his career (e.g. to have a good knowledge of the aircraft he's flying, etc.) and the piloting skills (e.g. to know how to handle the aircraft and to execute the flight maneuvers and air navigation elements, etc.). In respect to *"the motivation for the chosen profession*", it was described by respondents through desire, love, dedication and passion for flying.

Also, *"the ability to make quick decisions"* is another important characteristic (denoted 9.35) in high – performance military piloting, described by the ability to judge quickly and make decisions in the shortest time. Referring to this characteristic, it is known that in the flying activity *decision* plays a very important role. This is because the decisions taken during the flight involves a great responsibility and a great amount of dynamic and complex information. Popa (2005) considers that the most important decisions about the flight are *routine decisions* and *creative decisions*. *Routine decisions* are taken by pilots almost all the time (for example, extending the undercarriage, reaching a predetermined height, etc.). In these types of decisions are involved capacity of anticipation and foresight, but the lack of these capacities can block the process of routine decisions, with serious consequences (the destruction of the aircraft or casualties).

In terms of *unique or creative decisions*, these are decisions that the pilot can rarely take or even only once in his career. They can be taken in extreme situations that require urgent action (ejecting at low height in case of engine failure, forced landing due to technical difficulties, etc.). Therefore, in aviation there are special training programs that require pilots to familiarize with new situations and adopt the most effective strategies for solving them [12].

Another important characteristic was "*self-control"* (denoted by 9.26), described by respondents as emotional balance, control of their emotions in extreme situations. Therefore this characteristic may have a predictive value

of high - performance in pilot flying. An example is provided by the results obtained at Cattell's 16 PF Questionnaire by 62 students included in a study by Bartram (1986). There were differences between those who completed and those who have not completed the flight program at factors C, O, I and N. Thus, those who have successfully completed the flight program were more emotionally stable (C), along with other characteristics such as reduced susceptibility to anxiety and depression (O), an accentuated tendency to be aggressive and competitive (I) [13].

Less important for a high - performance military pilot was the "*altruism"* characteristic. We appreciate, at a hypothetical level, that the willingness to *"act selfless for others"* [14], to show generosity, is not an important criteria for a high - performance military pilot. The least important characteristic was considered "*general knowledge",* which means that to achieve a high level of pilot flying performance in military knowledge / information from other areas are less important.

The psychological profile of the flight instructor (included in our research as an *expert* because of flying experience) aims, along with the four areas of analysis mentioned above, the ***psycho-pedagogical domain***. This area relates to the flight instructor's ability to be a *good educator* (characteristic rated at 7.85), in order to transmit to military pilots specialized knowledge, flying technique, the ability to communicate with the pilots they are educating, to motivate and prepare the young pilots to self-teaching and self-education.

In other words, *"the flight instructor must be a good educator who has the knowledge and skills necessary, has to be able to communicate them and shape them in those whom they train and instruct* (s.n.) *has to be a good example of professionalism and ethical conduct to the pilots he trains. He bears full responsibility for the safety of the aircraft and the crew during flight training and evaluation, helping to maintain a level of flight safety*" [15, p. 29]. Of course all of this is an ideal requirement for a good flight instructor.

5. CONCLUSIONS

This paper was conducted as a form of illustration of the possibilities the psychologist by his analytical approach, can make them available to those who are interested. Throughout the paper we have sought to include more aspects emphasizing, in a different light, the *performance* in military aviation and the criteria for identifying it in the military pilot.

To explore and this topic, in our future research we will consider the following steps:

- evaluate through adequate tools / tests the necessary characteristics, identified by us, for a high – performance military pilot;
- identification of possible correlations between the performance criteria for a military pilot and components of emotional intelligence, respectively *self-management, self-awareness, motivation, empathy, social skills* according to the model agreed by us of Robert Wood and Harry Tolley [16].

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TERRROR MANAGEMENT.
TOWARDS MECCA AND A PEACE MESSAGE

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Abstract: *unavoidable subjectiveness of the terrorism issue, associated with Islam was often debated. After September 11 2006, the Benedict XVI Pope's speech from the University of Regensburg seemed to make the connection between Islam and violence, growing up the dissensions between Muslims and Christians, the Vatican initiated in March 2008, the dialogue with representatives of different Islamic faction from 43 countries, gathered around a peace message. Even that we mention the meeting between Pope Benedict XVI and King Abdullah of Saudi Arabia, or we mention the visit in Turkey from December 2006, when the Pope entered inside the Blue Mosque, praying almost one minute towards Mecca, all these are considered as,at least, a theoretical attempt of relations reconciliation between West and the Arabic world.*

Key words: *muslim world, violence, peace message, terror management,*

1. Muslim world

Definitions and lines of demarcation are still controversial. Fully subscribing to the well-known writer's assessment such as Mark Burgess and Eva-Ildiko Delcea (2006), according to whom, to define terrorism is now an exercise so complex and objective so that we can say it's rather an artistic approach than a scientific one, by our research we restrict ourselves only to consider a series of valences, one of them with historical value, in order to accomplish the importance of Islamic civilization and of the common wish of the Muslim world, marked by Islamic Jihad ("the holy war"). Terrorism is essentially a play of theatre played (Dragomir, 2008) for an audience, designed to draw the attention of a numerous audience on a common situation, without direct connection with the violence act, gamble on the shocking audience (terror and horror in the presence unimaginable challenge without any excuse or scruple).

In this context, it can be said that Islam is the one who legitimate the open play game practiced by the terrorism. There is no divine order in Islam in order to force Muslims to commit terrorism acts (Septar, 2006). According to Islam, these acts are dangerous with notorious consequences. Committing of such acts represents a sin and an oppression against human been. The Islamic religion commands everything is healthy and benefic to humanity. Anyone who's researching the two main sources of revealing Islam – the Koran and Mohammed Prophet tradition - will not find any evidence to support the idea according to which it could be divine commandments for Muslims in order to commit violence and terrorism acts.

2. Is the terrorism the mean used by those deprived of force?

Publication of many specialized studies, sets up the terrorism cognition, who can become terrorist and why and on behalf of whom undertake acts are classified as terrorist. For example, some researchers, such as Williams (2004), Chomsky (2003), Hoffman (2001), Ariel (2001) argue that the forms of manifestation of terrorism have evolved from the political side of social coercion through the acquisition of anti-social behaviors. Furthermore, according to Olariu (2008), it was proved, within several specialized studies (Wilkinson, 2006; Lehr, 2006; Scraton, 2002) that contemporary terrorism do not longer represents a mean of proceeding , but has adopted a new method, more dangerous, unpredictable, powerful, organized and professional against the target group to achieve its goal. Other researchers, such as Sookhdeo (2006) and Ahmed (2003), argue that the terrorists reactions are generated by American imperialist politics. And Huntington, (1996) contradicts the secret services " media current", arguing that religious fundamentalism represents the results of an inevitably conflict between different religion civilizations , potential human subjects been recruited for the holy war.

So different from the image described in "Arabian nights" stories, the Arabian world is, for a while, the scene for an incredible violence.(Istrate, 2007). International Agencies News are discusses only about the September 11, Osama bin Laden, the Gulf war, terrorism, people attempts, taking hostages, Talibans, trapping cars, mujahidins, Saddam Hussein, street fights, sun and shiits, wahabi, Al Qaeda, Oil Market. Focusing on giving a meaning to the current feverish world (Fuller, 2003), as well as to the terrorism, war and generalized anti-Americanism, we can not asked ourselves : is the Islam the real source of the problem or it should be associated with other factors , less clear, more important? West and Arabic world, conflict or alliance? Is the terrorism the mean used by those deprived of force? What is the real reason for all these?

3. **Violent events**

Considered as acts of violence committed by a group or an organization for creating a climate of insecurity or for changing the government of a state (Romanian Dictionary, 1996, see also the Dictionnaire de la Langue francaise, 1998) the terrorist phenomenon is more than the individual effort of a kamikaze. And in this case, it could be consider that terrorist acts are even the results of some organizations hiding some states, in fact.(Iova, 2006). The terrorism meaning is also represented by the violent events, precisely targeted and very well organized, which offers an apocalyptical image and is to create a frighten psychosis of terror even in peace time, diversified multiple situations of crisis or in case of war. Following a study initiated in 1983, by the researchers Schmid and Jonginan of the University of Laiden Netherlands, it was concluded that the violence was present in 83.5%, political goals in 65%, while 51% pointed out the way of bring in fear and terror feelings . Nevertheless, it could be appreciate that the terrorism is not , as it often said, "stupid violence", but no mater how against the law would or would seem to be, it is not irrational or without target. At a simple glance, one can say that it agree a certain cause, a political one, has a certain organization and structure, a certain professional specialization of those who participate to similar actions. Terrorism against heart and civilized world (George W. Bush, 2001),at the beginning of this millennium, has a complex character, shaking the present, spreading the evil, and pretending that provide a better future (Marret, 2002).

There's nothing better illustrating that, than the images from Sept. 11, 2001: run away walkers because of the first WTC tower falling; a worker from Emergency services helping a wounded woman, a person falling

down after he jumped out from the inferno from 83 floor. To consider terrorism as a result of Islam, and Islam as a violent religion is more than a mistake. No matter what the west world consider, Islamism remains a religion of peace for Muslims, which does not allow killing of innocent people (Bacchiocchi, 2002), but above all, is a religion of freedom, peace, well-fare and mercy (Rashid, 2003). Moreover, any damnatory act represents a violation of Sharia (the Islamic sacred law), as well as a human logic (Sultan bin Abdulaziz, 2002). Not without significance is that in Arabic language, Islam means "obedience" (within the meaning of God obedience) and is described as a "way of life" or "religion". It derives from the same root word as, for example, the word Salam (which means "peace" used as greeting mean). The word "Muslim" is also related to the word Islam and means person who obeys Allah's will. So, the religion name refers to God obedience. Theoretically, all that is need for some one in order to become Muslim is to sincerely recite the brief version of religion known as "shahadah": "I confess that there's no another God
but God (Allah) and that Mohammed is God's prophet. "Once converted to Islam, renunciation is consider a major offence.

4. "**Why terrorism?" and "why Islam?**

Taking into consideration all these, we consider, as we mentioned before, that is necessary to give up the phrase "Islamic terrorist" instead of "terrorist who abusively invoke Islam". In these terms , and fallowing the statement "God has blessed a group of foremost Muslims, the head fraction of Islam, to destroy America " (Al Jazeera, 7 October 2001), Osama bin Laden is "condemned by his own words" (U.S. Department of State, 2002). Muslim leaders and clerks throughout the world, from the sheick Mohamed al Sayyed Tantawi of Egypt, to Yusuf al Qaradawi sheick of Qatar, and Yusuf Muhammad from Indonesia, condemns terrorist attacks considered them as a debasement and a betrayal of Islam, innocent people killing in order to achieve a goal, never being the purpose of religion (Yusuf Muhammad, the Muslim cleric, Jakarta, Indonesia, 2001). Nevertheless, although everyone condemn sterrorism, there are not many able to understand its cause. Despite the diversity of declared opinion , the answers to the questions "why terrorism?" and "why Islam? are still waited for, the association between the terrorist group's actions as Al - Qaida with Islam, generally similar with IRA (well-known terrorist group from Northern Ireland that used attempts resulting in the death of hundreds of civilians to achieve their political goals) with Catholicism in general.

Unfortunately, often increasingly, in Western democracies, Islam is considered and judged by the acts and deeds of groups. And this is another reason for which is necessary to be very clearly specify that such approaches are not objective, changing the real meaning of Islam. To admit that it should be like this, that this is the reality, than what we could say about the Christian world, taking into consideration the human trafficking, the children molestation or more?

Islam is the religion based on obtaining peace through submission to the God's will . This is a simple linguistic analysis, which shows the nature of that religion., How can to support so many violence acts, such a religion, ? The answer is simple! Such actions are non-Islamic and shouldn't be associated with Islam (Enghin, 2007).

The tradition mentions that the Islam is related to Mohammed Prophet who has lived in Western Arabia at the beginning of the VIIth century

d.Ch. Traditionally, it is known that the geographical environment where Islam was borne is the desert plateau, called Higaz, along the west coast of Arabia, towards Red Sea (Frattasio, 2006). Here, Muhammad received a series of verbal revelations from God through Gabriel Archangel. The desert loneliness of an empty area seems to be, exceptionally, favorable to direct contact feeling with God (Bloch, 1975). The Prophet life story, of Hegira, of the first Muslim community organization, submitted to a precise legislation inspired by Revelation text, and then, after the Muhammad's death, of the first conquest, all together, advice us to meditate to Islam.

Within Islam there are two main branches. One of them is the sunit branch, and the second one is the şiită branch. The Suniţs Muslims are the majority within the Islamic world. The term "sunna" means "the way" or "the example" and refers to the Mohammed prophet example . Thus, all Islamic groups and sects of Islam consider Sunna (meaning Muhammad), together with the Koran, the Islamic holly scriptures as mandatory. Taking in consideration that "sunna" means "the way" , its main purpose is making distinction between sunits Muslims and şhits Muslims, which have another ideology.

Basically, both main branches of Islam differs regarding the Mohammed's succession. Suniţs Muslims believe that Muhammad intended that, by consensus, the Muslim community to choose a successor or a caliph, to rule the theocracy (earthly kingdom under the divine leadership) set up by him. Muslims believe that Muhammad choose his brother in low, Ali as his successor, and that only Ali and Fatima, his wife 's ancestors , have the right to rule the Muslim community (Cornila, 2008). Also, there are differences between the two branches as regards the Koran understanding.

In a historical way, Muslims dates their religion beginning from Muhammad period. From a religious point of view many consider this religion similar with the real monotheism that prophets before Muhammad, such as Abraham (Ibrahim), Moses (Musa) and Jesus (Isa), made it known. Spread by its successors in all areas, Islam is considered by a large majority of Muslims "a standard of living than a religion" (Prunescu, 2004) the fundamental concept being give by uniqueness of Allah (tawahid). This Monotheism is plenary, but not relatively, pluralistic in all its meanings. Muslims claim that Islam contains essentially the same faith similar to all the messengers sent by Allah for the mankind,from Adam, Koran encrypting Allah final revelation .

5. What is the real significance of Jihad?

The Islamic doctrine considers Judaism andChristianity as derives from one of those prophets' doctrines - especially Abraham - and accepts their avraamic origins while the Koran called them "People of the Book." Koran, the Islam holy book is a life guide for ordinary human being. Made by 114 chapters index (Sure) 6,235 poems, 79,439 words and 323,670 letters (Isopescu 1912), the Koran, also considered as "the Word of God" promotes an ethic based on moderation and sensitivity (Gregory, 2005). It doesn't urge for the ascetism, but only for moderation: "Eat and drink, but do not exaggerate "(Sura 7, 29). Islam accepts the world and human life as they are, considering them as a work that can not be criticized and as inderogabile will act of Allah, and not at all alterate and corrupt by the consequences of an original unforgiving sin. The features of this simple religion, accompanied by social individual duties, for long codified, are sufficiently marked to be changed and to keep on changing even in present many aspects of a psychic nature and also sociological manners of its supporters (Sourdel, 1975).

In these circumstances, how can it be demonstrated the indestructible connexion between Islam and Jihad? What is the real significance of Jihad? According to Arab Dictionnaire - Française - Anglais, (Paris, 1972), the term Jihad derives from the verb djahada, which means "to be hard worker", " to make effort" and from the abstract noun 'juhd',

that generally describes "the effort," potency " in order to achieve a goal. "(Ruslan, 2003).
According to the Koran, the name jihad has two basic meanings, in relation with two stages of revelation. Thus, in meccan time surres, jihad means the follower's fight for proving his faith for Allah, to bring new followers through peaceful means (Sura 29, 6).
Jihad. Within Medina's sures ,meaning after the Hegira (622 year), jihad got new meanings as "to fight against someone"," to argue against polytheist "or, "the war against Muslim Arabs" (Surele 60.1; 66.6). War is allowed in Islam, but only when all other pacifist means, such as dialogue, negotiations and truist has failed. "Fight for God cause, against those fighting against you. Do not brake the law, because God does not love the out low people"(Sura 17,190). Nevertheless, within Sura 9, verses 29 to 31, there is an order for Muslims "to fight against the judas and against Christians till they will obey. Those who will surrender to Muslim rulers will pay a huge tribute. The reason is that that God will curse them. Fight against those that do not believe in God and in judgment day, do not consider stoped what God and his messenger stoped, and also do not agree the true religion, even that they are "people of the Book", till they will pay jizya (the tribut) and will voluntarely obey and they will be obey (…) May His curse to be on them. "

5.1. Islamic Jihad

Can we consider that Muslims understand by Jihad the use of all resources and energies to learn how to control their own wishes and bad intentions and to get Allah bless? It should be noticed that Jihad can not be fully understood by occidentals, as more as, unlike Muslims, they do not represent the religious culture of Islam. It becomes even more interesting, that as long as another side of jihad is, actually, to have an educational role (jihad al-tarbyia), which involve spreading the Islam knowledge, social fight against inequity, corruption, decadence and the endeavor for social improving (Tihan, 2008). Thus, for example, during the 60's,tunisian chairman Burghiba called jihad the citizens effort to work for the country prosperity and absolved them from fasting in Ramadan time in order to avoid the goods product depreciation, in a manner as warriors were absolved from fasting post during conquest wars.
Is remarkable that one of the terrorist organizations has the name of holy war, "Islamic jihad" ", borne around 1970 and with origins in Muslim Fellowship, founded in 1928. The organization, every time contested by Israel because of its radicalism, takes the islamic religion through the terrorist training activities in various training camps that held throughout the continent. Its members have acted within terrorist attacks along with other organizations such as Hezbollah or Hamas. Its main targets were relieved by Egyptian government subversion and by the islamic state setting up, as well as the fight against American and israelian interests: President of Egypt Anwar Sadat was assassinated in 1981 by the Islamic Jihad because he signed the document stipulating the peace with Israel; there was an assassination attempt against the Egyptian interior minister, Hassan al-Alfi in 1993 and against Prime Minister Atef Sedki in the same year, November ; în 1995 they claimed the attack from Egypt Embassy in Islamabad. Several members of the organization, according to Cornila (2008) also committed the bloodiest and most famous terrorist attack from history: 11 September 2001, when terrorists hijacked four aircrafts, two of them hitting World Trade Center in New York , One Pentagon and the fourth-falling down in Pennsylvania (2,978 deaths). Other claimed tracks: august 1998 -

explosions at U.S. embassies from Nairobi and Dar el-Salam (301 dead); November 2002 - the explosion on a hotel from Mombasa (15 dead); October 2002 – they have supported the explosion from a club in Bali (200 dead), 12 May 2003 - bomb attacks in Riad (30 deaths), 16 May 2003 - they have supported bomb attacks in Casablanca (933 deaths), 15-20 November 2003 - they participated to bomb attacks against two synagogues, British consulate and against a Turkish bank from Istanbul (61 deaths), 2004 - at least 11 attacks (60 deaths). Managed by of Ayman al-Zawahiri, since 1998, the organization takes part from Al-Qaida. Is the "holy war" similar with the attacks against the United States and Israel?

6. Suicide terrorist

Before giving an answer, we may be tempted to say yes! Weakness fully used by terrorist organizations in order to legitimate the initiate actions, are also given by the verses according to whom " the eternal human soul is given those killed in the name of Allah "(Sura 2, 154; 3, 157, 169). Without intention to extend the "martyr" issue we asked ourselves if this became an impulse for holy war (Jihad)? The Koranului doctrine about coming to paradise (Sura 55, 52) of those died in Jihad, inspired Muslims along centuries, stimulating them to fight till death for the holy cause of Allah. Expanding the doctrine to a simple interpretation on Mohamed Atta's will, ne of terrorist from 11 September 2001, one can say that this still inspire

young Muslims to become " suicide bombs"? We hear, not once, more or less motivated, that for those who choose martyr death is the safest and fastest way to achieve a better life, prosperous, comfort and sensual pleasures ,promised by paradise.

Through this kind of death, those sacrificing become together with his family, shaheed, at great honor within Muslim community. The tribute should be finalized, for Allah, first of all. Those who transform death into a love symbol, a truth prove, that one is a martyr (...) He lives. He is here, among us. Forever along with God, but also everywhere, in hearts of all devoted. That one who, on the contrary, choose the disgrace for saving his own life, that one, face to face with history, is just an hideous dead-live"(Rauffer, 1987).

Last day before the attack, the shaheed is very well trained, completely empty mind, he want and he is able to commit suicide, even all by him self. In this phase he writes his will asking the family not to cry for him, because he is dead, but rather gone to another life along with Allah - a good motivation to be proud (Cornila, 2008). Hisham Ismail Abd El Rahman Hamed'will a suicide terrorist which detonated the blasting from his own body in November 1994 in Nezarim (in southern side of Gaza Strip), killing three officers and wounding two Israelits and four Palestinians, provides a real image : "Dear family and friends! I am writing this with tears in my eyes and sadness in my heart. I want to say that I am leaving and ask you for forgiveness because I decided to see Allah today and this meeting is more important than living on this earth ... Bassamat al - farah. " Another suicide terrorist - Salah Abed El Hamid Shaker - who died along with one another shahid at Beit Lid (in the center of Israel) in January 1995, killing 18 Israelis and wounded another 36, wrote in his will: "I will revenge on the sons and monkeys and pigs – unfaithful sionists and humanity's enemy I'll meet my brother Hisham Hamed and my distinguished professor, Hani El Abed and others shahizi and saints in paradise ..."(Scaletchi, 1999). First message, well-known formula, " Bassama al-farah"or,"joy Suras" explains the martyrs ecstasy when they commit the suicide act.

Paradise is described as a place where "They will be layed down on brocat carpets . The devoted one will receive not just blooming gardens, plenty of food and fresh water wells, but also maidens. "Seventy wonderful maidens will be created for the joy of the youngest devoted "(Sura 55, 52-58).

As Christianity and some Jewish sects, Islam preach the dead material resurrection. If the good one will be reward with Paradise delights (Jannah), the other one will be punished in Hell (Jahannam - hell, derived

from …. ge-hinnom or Hinnom Valley, as presented as Gehenna). Considering Islam as a obedience to Allah, we can not or We will ask ourselves what is the origin of the Islamic fundamentalism ?

Following the victory of the 1979 Iranian revolution, the Islamic fundamentalism has benefited from an impressive reviriment within mahomedana area . Inspired by Khomeini's success, the radical panislamic movement is spreading increasingly. Without any intention to insist on this issue, we can not ask ourselves : what the Islamic fundamentalism plans? Above all, needs a theocratic state, within the low enforcement to be subordinated to Islamic law, Sharia, at the beginning created to guiding the muslim daily life. Making abstraction misleading interpretations as frequent, as unreal, of "Jihad" meaning, the set of Koran provisions which outlines "the right way " shari'ah (the incomparable and unequalled law ") generates physical consequences for Islamic societies, especially clear in the political and economical area (Apahideanu, 2007).

7. Islam means about 1.3 billion people

Religious leaders are constantly inoculating the idea of Caliphate rehabilitation . " U.S. National Intelligence Council report predicts the Islam intention to make, till 2020, a universal caliphate, the main challenge of the Islamic fundamentalist movement is given by restoring moral and political virtues of the traditional Islamic society (Barna, 2007). In the context of enlargement Islam, how can it be interpreted the Vatican worry related to the imminent Europe islamisation risk? In an interview for German magazine "Süddeutsche Zeitung" the Pope Benedict XVI, councilor pointed out that "the West is threatened by Islamizing ", mentioning that Europe must not give up its Christian origins. The veracity of the mentioned fear is unanswerably as much as more millions of Muslims live outside the Islamic historical area. Actually, Islam means about 1.3 billion people. It is the most dynamic religion in the world, its followers are all over the continents, including Europe. Probably is the only religion that expands in a time when others are in fully crisis. It is also the newest from the great religions and now s on top.

According to U.S. Department of State's Annual Report on International Religious Freedom (2003), in Europe are registered over 23 million Muslim residents, also confirmed by the by the American diplomat's study, Timothy Savage, specialized in European affairs, according to whom approximately 5% from Europe population is represented by Muslims (23 millions) for the year 2050, estimating an increasing to 20%. In Indonesia there are 120 million in France and the United States

seven million per country, and in China about 50 million.

In this context, the issue of Turkey admission in U.E. became more than a problem. With a population of about 70 million people, mostly Muslims, Turkey might irreversible exacerbate the process of converting Europe . The risk that the Christian population from Western countries to be numerically overcome by the Muslims immigrants, over a few generation, growth, because of the demographic crisis in Europe and also because of the new coming's high rate of the birth (Buchaman, 2005). High rates immigration level from Muslim countries, will generate so – called Eurabia, mosques could be more than the churches. If E.U. did not use a coherent control strategy in order to control immigrants from the Muslim countries, former colonies of European states (Barna, 2007) is not impossible to face

a changing Europe into an Islamic continent till the end of XXIst century (Lewis, 2006). Issues such as apocalyptical prophesies , "legitimate targets", the Al-Tajdid forum , July 7 2005 - the intervention of the emergency, all of them subscribing to " global security paradigm" and complete the present work. A brief research of the Internet, in 1998, emphasizes that approximately half from 30 groups considered foreign terrorist organization(Law on the U.S. antiterrorism proceedings, 1996) operated on web sites, such as: assam.com, almuhrajiroun.com, Qassam.com, Jihadunspun.ne, or Jahad.net Alsaha.com. If in 2000 has been identified 20 jihadist sites, in 2005, there was an increase to around 4,800 (www.smitson.org / newcentury / ppt / Atran_Senate.ppt), most of them with locations in Iran, Canada, the United States, Netherlands, Lebanon, Russia, Hong Kong and Great Britain.
The terror " existentialism philosophy " is defined by a series of terrorist organizations, such as Muslim brothers, Hezbollah, Mujahedine Khalk, Islamic Jihad, Hamas, White Al - Qaida, Al Haramain Islamic Foundation, Al - Masjed al Aqsa, Benevolence International Foundation, Al Furqan, Global Relief Foundation / Taibah International Humanitarian Organization etc., the last one being founded in Belgium, in august 22 1996.

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Following the terrorist attacks from September 11, the organization name has been related by American specialized institutions, with terrorist groups, including Al-Qaida network. Without insist on the issues already discussed within seven chapters, to be discover by readers, we limit only to consider Europe as a real action area lies from Atlantic up to to the Urals. Terrorism is far from its ending , its characteristics are similar with those of the war of future. What is the bat and which interests are involved in this strange game? It's about a conflict between generation? Does it mean West-civilization, and Arabian world - oil ? There are answer to questions that may bring new opportunities in order to accomplish the Islam, and also the Islamic Jihad versus Terrorism.

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THE TERROR PSYCHOPATHOLOGY

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Abstract: *The need to know as many details as possible regarding terrorists' psychological, physical and specialized training that is generated by terrorist groups' intention of brain washing of the new recruits, religious indoctrination and training based on models inspired by The Big Encyclopedia of Jihad, The letter from an al-Qaeda member, How to withstand and to confront special services' investigators requires now, more than ever, a special focus on understanding terrorist groups re configuration and a new approach to antiterrorist fighters' training. Al-Qaeda ("Qaidat al-Jihad"), after merging in June 2001 with al-Jihad (the Egyptian Islamic Jihad), holds training bases spread over the south, South-East Asia and Middle East. Beside these bases, it is a well-known fact that the terrorist group is very active through its European cells called White al-Qaeda or "the terrorists with white skin". This group reunites around 800 Bosnian mujahedins and its purpose is to expand al-Qaeda in Europe with the final aim of accomplishing the "Pan-Islamic Caliphate" worldwide.*

Keywords: *Jewish Virtual Library; Letter from an al-Qaeda member; Mohamed ATT's WILL; Blonde phalanx.*

1. Those devoid of pity

Social Sciences Researchers (Hudson, 1999, McCauley, 2002, Mansdorf, 2003, O'Connor, 2004, Zimbardo, 2004) concluded that terrorisms acts are not related to psychopathological and personality disorders. Terrorism, consequence of the group or organizational pathology gives a meaning for the individuals tempted by these groups. (Mansdorf, 2003). Analyzing the Americans militaries abuses against the Irak prisoners from ABU GHRAIB (Irak) American military prison, a military psychiatrist says that it is about the military acts done in a dangerous environment and without any supervision. (Taguba, 2004, in, Poponete, 2005).

According to the „novinite.com" site citing the Bulgarian magazine, „24 Ceasa", AL- QAIDA enrolls Bulgarian students for religious Jordan Universities and tries to involve also young people from Romania, Bosnia, Macedonia and Kosovo country (http://www.adevarul.ro). The mosques, cafeterias, bookshops, or prisons are radicalism "incubators", where young Muslims are enrolls (http://www.realitatea.net). A confidential report , analyzed by „Associated Press", shows that *the method started up right after the attempts from September 11, 2001* , when it become difficult for the outside American or European borders Muslims to break the security counterterrorist system. According to up-mentioned report, not just once, the

terrorists consider that *their duties within this territories should be undertake by locale organizations*. *The individuals borne and living there takes the advantage of hardly setting of* (http:// indexmedia.ro). The 19 years old, Swedish citizen, Bosnian descent, Mirsad Bektasevic, also surnamed *Maximus*, is one of them choosing the terrorism . The Bosnian police found in his house a real explosible arsenal , and also a self-murderer belt. The Police declared that the Swedish citizen intended to plot an attempt at one of the European embassy from Sarajevo. This case is just one of the example from the cases named by the American and Bosnian intelligent services named as: "an ample enrolment campaign for the terrorist within Balcanic states" .

"The Washington Times" (2007) said: Al-Qaida has begun an ample enrollment volunteers campaign in order to involve them in the terrorist organization war against the America and its west allies in Iraq, Central Asia and Middle West . Currently, according to the "International Institute for the strategically studies" from Great Britain , the terrorist network Al-Qaida has more than 18.000 ready to fight militaries, the Iraq invasion by coalition ruled by the Americans speeding the volunteers enrolling process for the groups acts. The British Institute estimates that about 2.000 de members and more than half from the Al-Quaida 30 leaders have been killed or capture and, almost 1.000 from organization militaries there are in Iraq. "The basic leadership is still sound and over 18.000 potential terrorists are still free , speeding up the recruitment for Iraq declared IISS, without any references for the mentioned information. The American officials (http://www.adevarul.ro) from security area assert that they have detected over 20 Muslims youth groups in North-East of the United States, in order to organize internal terrorist centre . Any group could be able to commit a terrorist act generating victims. Rebel youngsters are the first to be oriented towards terrorist organizations (Gurr, 1970).

Placed at the periphery of community, being born into a disadvantaged environment, haunted by an inferiority complex and feeling unfulfilled, psychopaths of terror try to take revenge on a society in which they could not fit, on a way of life incompatible with their deviant psychology.

A survey performed on 250 terrorists from Germany revealed that 25% of the enquired people had lost one parent before reaching 14 years, 79% had had arguments with their parents and 33% had described their fathers in a hostile manner (Brad, 2004).

Unacceptability of the established order, secretly considered a form of disguised oppression, represents the most frequent type of profile for the psychopathic terrorist. Strange or psychopathological behaviors (Delcea, 2006), noticeable in a series of terrorists from groups such as AUM (*The Supreme Truth*), a Japanese group or ANO (*Abu Nidal Organisation*), amplify violence, their actions lacking any form of compassion for the victims. It results from the same research that 33% had been formerly convicted by a juvenile court .

2. Institutionalized judgment

Irrespective of the unclear purposes for which terrorists are ready to sacrifice their lives, regardless the unlimited violence they use, as well as the total lack of scruples they prove, these people, the real professionals of terror, do not share anything with the other kind of terrorists *who want to save the world, to make it a better place*, through a crime. Completely opposite to the type of psychopaths – known under the name of *lonely wolves* and described above, normally, terrorists think and act in an institutionalized way, being members of a group, political organization or religious extremist faction .It is interesting to remember that psychic disorder is incompatible with political or religious terrorist "status" (Delcea, 2006). The people who act in groups similar to these are likely to have normal psychical state but they have been, most probably, brought up to hate. Cold, calculated and well trained, these so called professionals of terrorist attacks very often serve specific interests that are not related to theirs. They practice terrorism as a

job, without passion, but persistently. All the aspects presented above are needed in order to understand the *genesis of terror*, taking into account that the structure of the terrorist group as well as the *terrorist's profile* has recorded substantial changes.

Within the group , the leader's responsibilities are to manage all the activities and to constantly bring in narcissism doses (Frattasio, 2006) for those without love and gratitude. Terrorist attacks planned by terrorist organizations are, most of the time, the answer to frustrations built up during the struggle for power or for getting rid of unwanted situations by violent criminal means. Turning their causes into a war is highly important for terrorists, as they look to test faith through military confrontations (Powers, 1971).

By understanding terrorist psychology, specialized structures can take the most appropriate *measures to fight* terrorism. Needless to point out that the interest for *the antiterrorist profile* is equally demonstrated by terrorist groups such as ANO, ETA, ASG *(the Group Abu Sayyaf),* al-Gama'a al-Islamiyya *(The Egyptian Islamic Group IG)*, Asbat al-Ansar *(the League of the Followers)* or PFLP *(The Popular Front for Palestine's Freedom).*

3. Theory: "death for death"

Experimentation of contemporary terrorism was possible in some South American countries where, at the same time with revolutionary factions, a series of terrorist organizations such as *The Freedom Army Forces* from Venezuela, *Cinconceros* from Honduras, *Tupamaros* from Uruguay, *The Anticommunist Alliance* from Argentina appeared.

The activity of these organizations has served as a model for Europe, offering a source of inspiration and support for terrorist groups such as: *Baader – Meinhoff* and *2nd of July Movement* from Germany, *The Red Brigades* from Italy, *The Secret Army* from France, *ETA* from Spain or *IRA* from United Kingdom. As time goes by, terrorism has developed to new stages of violence, the theory of "*death for death*" was launched and the cooperation with terrorist organizations from far away situated areas as, for instance, *The Red Japanese Army* appeared as a new phenomenon. On May 30, 1972, a group of Japanese terrorists arrived at Tel Aviv, with an Air France airliner and opened fire in Lod airport. 27 people died and 80 were injured. In this context, besides the revitalization of *Muslim Brothers Organization,* other groups appeared such as: *Hezbollah*, *Hamas*, *The Palestinian Islamic Jihad,* as well as Osama Bin Laden's *al-Qaeda* (Andreescu, 2002).

Nowadays, no one do not deny three well-known facts; let's point them to remember everybody:

First : over seven years United States has occupied the most sacred land of Islam, the Arabian peninsula, plundering its riches, commanding to its rulers, blustering its neighbor converting its units from Peninsula into a spearhead in order to conquer the Muslim border people. In the past, if some doesn't believe that is about an foreign invasion, now, all the peninsula inhabitants agree with this theory. The best argue is the American offence against the Iraq people ,using the Peninsula as a outpost, even that its rulers are against using their territory for this purpose, but they are weak.

Secondly ,despite the important destructions caused by syon-crusader Alliance to the Iraq people, and despite awful numerous deaths over one million , ... despite all these , the Americans try again to commit terrifying massacres, the prolonged blockade after the awful dividing and destroying war

hasn't been enough for the Americans. So they are coming to destroy the rest of this people and to humiliate its Muslims borderers.

Thirdly, if the Americans' purposes within these wars have been religious and economical, other purpose is to redound to the small Jewish state and to call away from the Jerusalem's invasion and from killing Muslims there. The best proof in this way is their ambition to destroy Iraq, the strongest Arabian state , and their efforts to divide all the states from the area, Iraq, Saudis Arabia , Egypt and Sudan, in order to make them weak states , and using their weakness and dissensions between them to ensure the Israel continuity and the crusades occupation steadiness within the Peninsula. All this crimes and sins committed by the Americans represents a war declaration against lord Allah, his messenger, prophet Mohamed, and against the Muslims. Also the ullemas from the whole Islam history agree that Jihad is every Muslim's duty if the enemy is destroying Muslims countries . Indeed, Bin-Qadamah imam in "Al-Mughni", al-Kisa'I imam in "Al-Bada'i", al-Qurtubi in his interpretation and al-Islam sheik in his book said: "In order to defeat the enemy, the war is in defense of peace and faith and as ullemans said is a duty. Nothing is more sacred than the faith except the sending away enemy that attacked faith and life". For these reasons and obeying to God we give the fallowing FATWA (February 23 1998) towards all Muslims :the decree of killing Americans and their civil and militaries alleys – is mandatory for every Muslims capable to accomplish in every country I order to release al-Aqsa musk and the Holly City [Mecca] and for the defeating and disabling no more threatening any Muslims. Carrying out the demand of the Great Allah , "fight against all unfaithful and fight all together", and "fight till it won't be any more wrangle or oppression and till justice and faith in Allah will gain". The Great Allah also said, You should fight for Allah and for the weak and ridden, aggrieved - women and children crying "Allah, save us from this city where we are ridden. Rise up the one who helped us!" Helped by Allah, we call all the faithful Muslims which want to be rewarded by Allah, to kill the Americans, plunder their money wherever and anytime they find them out. Also is calling for the Muslims ullemas , rulers , youth and soldiers to fight against the Satan American armies and against the alleys of Devil's worshippers and to shatter themes an example. The Great Allah says: "Oh you believer, obey to Lord and to his messenger when He calls you for achieving the goal offering life. For your notice, Allah is joined in with every soul and all of us will obey him." Allah also says : "Oh you believer, what happened to you, you are ask to fallow God, you're so strongly against! You'd rather have this life instead the hereafter one? Your heart's easiness will be less than the hereafter one. And if you do not tend , He will awfully punish you and will call somebody else instead you; but you won't be able to hurt Him. Cause Allah is all-powerful." Also says the all-powerful God: "Do not weak self will and do not despond. You should be strong if your faith is real".

4. Prognosis

By researching the evolution of the terrorist phenomenon, it can be anticipated that *terrorism will persist* most surely in future, *growing quantitatively and qualitatively, especially as there have already been some states which seek terrorists support* to achieve their aims as fallows:

1. *Totally achieving the political goals:* in spite of general opinion, *terrorism is an efficient mean for meeting a political demand*. If the terrorist organization is affiliated to a political group (terrorist group), and the purposes are uphold by the majority of civil population involved within the conflict, the victory is just a matter of time. The most well known cases are the following: state of Israel establishment, for the HANAGAH and IRGUN organizations; *the South Lebanon emancipation from the Israelite occupation*, for the siit organization Hezbolah; *disestablishment of Apartheidpolitic in South of Africa* , for "UmKhonto we Sizwe".

2. *Collateral economical impacts:* the fight effort can temporary influence the region

or country economy. In certain cases the results could be for a long term, especially , in areas depending on tourism industry, such as :*the second Intifadaand the Hamas self-murder attempts w*hich strongly affected the Israel tourism industry ; the *attempts commited by Jemaah Islamiah* in Bali, an isle with a majority Hindu population , from Indonesia, for whom the tourism is the major industry.

3. *Partly achieving the political goals:* the Spanish troops backing from Irak before time by the changing the course of elections in Spain , fallowing the March 11 2004 Madrid attempts claimed by Al - Qaida; "Good Friday Accords" – IRA; getting supplementary rights for the Quebec French Canadians – FLQ are just a few reasons justifying the terrorist acts.

4. *Begining a war:* the terrorist act can be use by the political state bodies as an alibi in order the begin fights. The most well known examples are : *Sarajevo attempt*, used as an pretext for the First World War; *the September 11 2001 attempts* used as an argument for the Irak incursion.

***

All these are possible due to the fact that: *modern air transport* ensures an unprecedented mobility at a global level(www.sri.ro); *radio, the TV, digital communications via satellite, the Internet* allow almost instant access to vital information for terrorists, ensuring, at the same time, a global audience; *modern weapon systems, new generation of explosives, of global positioning systems, remote control systems* will become more and more accessible and easy to find on the weapons black markets, *modern society* offering new vulnerabilities, new *targets* to terrorists.

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PANEL 4. *Communication, education, history, languages, political science*

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A SHORT HISTORY OF LAW ENFORCEMENT IN ENGLISH WORDS: FROM *POSSE COMITATUS* TO *FLYING SQUAD*

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Abstract: English survived, was enriched and expanded to become the most spoken language in the world. As such, it contains a lexical map of the concepts and culture it represents, stored and activated to the present days. Law enforcement has been but a relevant example, featuring fundamental hierarchies of usage for almost a thousand years, in terms of dialect and register. From the 12th century *posse comitatus* and *sherrifs* to the 19th century *Bow Street Runners*, and to the 21st century technical language, English law enforcement vocabulary reflects both etymologically and socially the specialized field it describes.

Keywords: *English for Law Enforcement, sociolinguistics, historical background*

1. Introduction

This paper presents Law Enforcement English as a specialized language [1], evolving in close connection with social and historical developments. As a newly-acknowledged linguistic field, Law Enforcement English stems from various sources, from institutional written documents to criminal slang.

The police vocabulary is a linguistic reflection of the institution it describes; this view is supported by a travel in time, to the circumstances of its emergence and change and to their relevance for linguistics. Obsolete terms that have left the language, newly coined terms mirroring technological developments, and the relevant terms that have witnessed semantic shifts are presented against a socio-historical background.

2. The language of police

Until recently, the institution of police has not been recognized as a source of specialized vocabulary – and language in general - and as such has been little represented linguistically in dictionaries and other resources. It is with the international recognition of dictionaries [2], language course-books [3], discourse investigation [4], and special interest group events that Law Enforcement English has finally made its way among other specialized language fields: Medical English, Legal English, Military English, etc. Although it shares some common ground with the last two above, due to their socially-bound roots, LEE manages to bear all the hallmarks of a fully-fledged language in itself.

Although the discourse level is admittedly more often found representative for police talk than lexemes, the latter bear more evidence of the emergence and development in time of the specialized vocabulary in question. It is acknowledged that specific police language can be found in various types of discourses: written documents of the institution, police communication techniques, witness-victim statements, media accounts, and criminal slang. In terms of specificity, some border general English (witness talk, media accounts), others reach a high degree of technicality and inaccessibility (police jargon,

criminal slang).

The emergence of police as a free standing institution, as a social phenomenon, partly assimilated to and influenced by other systems, calls for a proper display of a more or less clear-cut specialized vocabulary. The well-established institutional framework, traditions, concepts, reforms assign a precise meaning to certain terms in the police vocabulary, or the police sociolect, gathered in specialized lexicons according to professional, social and cultural criteria. [5].

This study will look in particular at the challenges that dealing with such words can pose for a historical dictionary, where complex conceptual changes must be accommodated within a diachronic account of individual word histories. Examples will be taken mainly from entries which have been revised for the third edition of the Oxford English Dictionary [6], cross-referenced with entries from specialized dictionaries, such as the Oxford Dictionary of Law Enforcement, the Oxford Wordfinder, the Longman Lexicon of Contemporary English, Roget's Thesaurus.

3. The history of British Police in words

Police or law enforcement (despite the differences, the terms *law enforcement* and *police* are used interchangeably in this study) in Great Britain refers mostly to the police of England and Wales, as 'the bureaucratic and hierarchical bodies employed by the state to maintain order and to prevent and detect crime'[7]. The police have been portrayed as the rational solution to the problems of rising crime and increasing disorder, which means that they were created and steadily developed and improved to protect the law-abiding citizen from the criminal and disorderly element which prays upon society.

The legislation draws attention to the wide variety of tasks undertaken by the police in England and Wales, and how their role has gradually converged with the original meaning of the word 'police'. The Greek *politeia* meant all matters affecting the survival and well-being of the state (*polis*). The word and the idea were developed by the Romans (the Latin *politia* can be translated as 'the state'). By the early eighteenth century in continental Europe la police and *Die Polizey* were being used in the sense of the internal administration, welfare, protection, and surveillance of a territory. The word *police* gained popularity in England towards the end of the eighteenth century. While the main duty of the new police when they were first established in London in 1829 was declared to be the prevention of crime, as the nineteenth century wore on, English policemen found themselves carrying out a variety of tasks fitted with the older definitions: they *regulated traffic, ensured that pavements were unimpeded, kept a watchful eye for unsafe buildings and burning chimneys, administered first aid at accidents, drove ambulances, looked for missing persons*. Some of these tasks have been yielded to specialist agencies, but the fact remains that police not only deals with law and order, but also with the smooth running of different aspects of society.

A broad chronological sweep of the history of the police to the present, with focus on the 19th and 20th centuries, will explore its linguistic dimension, covering the social contexts for coining or borrowing new words, and the rationale behind the shift of meanings.

3.1. The beginnings of policing

Until the mid-1800s, law enforcement in England was a local responsibility of citizens. From 1066 (invasion and conquering of England by William Duke of Normandy) to the 1300s, police services were provided through the *frankpledge* system, the local *watch* and the *hue and cry*. Under this system, citizens were appointed with the responsibility of *maintaining order* and *controlling crime*. Men were formed into groups of ten, called a *tything*. Ten tythings were grouped into a hundred and were supervised by a *constable*. Groups of ten hundreds created a *shire*, controlled by *reeves*. *Sheriffs* were appointed in counties as the first law officers to *arrest suspects*; they could also call out *posse comitatus*, consisting of all adult males, against *vagabonds and malefactors*.

During the 1500s, England increased its participation in world trade and through the

1700s more citizens moved into the cities and crime began to rise. Although England had one of the harshest criminal justice systems of its time, including *death sentences* for *minor crimes*, crime and *disorder* continued to rise. Many began to hire their own private police, and the king began a system of *night watch* for the large cities.

The police in the UK have always been associated with *constables*. A Norman term, *constable* stood for a variety of functionaries of whom the most significant were the high constables of the hundreds and the *petty constables of the manors, tythings or vills*. The petty, later commonly known as the *parish constable,* acquired royal authority and was responsible for maintaining the *King's peace* in his district. The constable registered a decline in Elizabethan times from a man of authority to a figure of fun, illustrated by Shackespeare's *Dogberry*, the headborough in 'Much Ado About Nothing', and *Elbow*, the simple constable from 'Measure and Measure'. However, constables demonstrated courage in *making arrests*; their duties also consisted in *maintaining the king's peace*, overseeing the poor and the vagrants, surveying the highway, or *warding* churches, *enforcing the law* on taxation and military recruitment.

Watchmen were local agents of law enforcement recruited from urban dwellers to patrol the cities in a 'marching watch' arresting night-walkers who behaved suspiciously. *Justices of the peace* were royal officials, often lords of the manor, the social superiors of the constable. If nothing worked to pacify crowds, trained bands, or *county militias* were called in to keep order.

The problems of *administering justice* and *pursuing offenders* in the growing cities led to the appearance of the *trading justice* and the *thief-taker*, as professionals who eased the burden on the constables. Although some of them were corrupt, the *Bow Street Runners* were considered dependable and far-sighted. The 1770s city police organized effectively against criminal gangs, were given a *uniform* and a regular pay, had to comply with minimum standards, and were divided into day and night *patrols*. *Mounted* and *foot constables* could still claim statutory rewards for bringing certain offenders to justice, which allowed a certain degree of independence.

3.2. Policing in the nineteenth century

Sir Robert Peel is credited for establishing the first modern police force in England under *the Metropolitan Police Act*, a bill passed in Parliament in 1829. This act created a single authority responsible for *policing* within the city limits of London. The force began with one thousand officers divided into six divisions, headquartered at *Scotland Yard*. These officers (known as *Bobbies* for their founder) started *patrolling* their *beats* in *uniforms*, and introduced new elements into policing that became the basis for modern police, such as the *prevention of crime* as the their first duty.

The new professional high constables, organized in a military-like hierarchy and based in *constabularies*, were assisted by part-time constables in the rural areas and *serjeants-at-mace* and *beadles* in industrial areas, and their efficiency was considered superior to the old-style 'country dogberry'. The old town police was now supervised, put into a uniform, and called by the new name of *policemen*. Their duties included now *imposing fines* and *executing warrants*.

It was with the County and Borough Police Act of 1853 that the formation of police forces became obligatory on local government; they were certified by Inspectors of Constabulary and were directed by the *Home Office* in the performance of their duties; the *Home*

Secretary would require annual reports from *chief constables* on the state of crime in their *jurisdiction*. This led to an increase in arrests for *petty offences* and *misdemeanours*: *loitering, street gambling, prostitution, vagrancy, public drunkenness, rioting. Carrying weapons* however led to certain situations of 'undue exercise of power' and police brutality.

Disorder and *rioting* however increased. Moral panics, such as that generated by the fear of *garroting* in the 1850s and 1860s, and by Jack the Ripper in 1888 was supported by the crime statistics, sometimes caused by a new way of categorizing offences or unsolved cases magnified out of proportion by the press, which led to criticism of the police. As a response, a higher control over the force was imposed to diminish *assaults, watch-snatching, highway robberies, burglaries and pilfering from shops*. Detective policemen began to appear in popular literature, notably with *Inspector Bucket* in Dickens' Bleach House, and the courageous master of disguise *Jack Hawkshaw* in Tom Taylor's The Ticket-of-Leave Man. The police constable became the 'domestic missionary', charged with bringing civilization and decorum, by *seizing goods* exposed illegally, *apprehending disturbers* of the peace, *quelling domestic disputes*, *patrolling* at night, armed with *cutlasses*, or checking on traveling hawkers, gypsies and tramps.

3.3 Policing in the twentieth century

The strains of the First World War affected police development in several ways. Ten new wartime duties added to the police: *mobilization, billeting, requisitioning horses and vehicles, protection of vulnerable points, espionage, control of aliens, detention of enemies' merchant ships, watching wireless stations, protection of defence works, intelligence*.

Active feminists and increasing pressure for some kind of women policing led to the organization of the first *women police patrols* in 1915. Some of them were incorporated into police forces as women police in 1918. At both force and national level there were branch boards elected separately from and for the ranks of *inspector, sergeant and constable*.

Peacetime emergencies listed serious *industrial disorder*, *hunger marches* and *strikes*, which were kept under control with daily *intelligence reports* to the Home Office, Scotland Yard and the Metropolitan Police *Special Branch MI5*. *Police brutality, corruption* and *arbitrary use of powers* were a legacy of wartime, but the Metropolitan Police took great care to avoid leaks to the press and maintain the image of the English *Bobby* as unique, loyal, impartial and non-political.

Throughout the first half of the twentieth century, technological developments marked policing as well as society. The railway and the motor car raised concerns that criminals became mobile. The police began to use *motor vehicles* themselves from the first decade of the century, along with patrols on *bicycle*. *Telegraphic communication* had been used by the Metropolitan Police since 1850s, but at the turn of the new century it was replaced with the telephone and *telephone boxes* in the street, which enabled constables on the beat to *receive information* and *summon assistance*.

The potential for scientific aid in criminal detection was explored by a few enthusiastic chief constables, and most notable before the First World War by Sir Edward Henry who developed a system for the classification of *fingerprints*. Also *computers* and data-processing equipment, the *radar* and the pocket transistor radios, called the bat-phones were introduced into the force.

'The steady march of centralisation' [7] had asked for uniformity, bypassing local police committees, amalgamation of smaller forces, national criminal investigation departments and police *training* and *promotion* systems, represented by the *Police College*. Centralizing *police records* in a *national computer system* provided quick and easy access to information.

The 1960s were the years of change: the growth of consumer society, the increase in private motor vehicles, the extension of roads and the emerging self-consciousness of Afro-Caribbean and Asian immigrants led to significant developments in police organization. The Police Act of 1964

incorporated these changes, including new duties, such as: *mace-bearers, court ushers, market inspectors, mortuary attendants, licencing and inspecting hackney carriages*, etc.

A trade argot developed, often varying from force to force, which became a part of the work culture and helped to cement the police community. Thus, to a member of the Metropolitan Police an ordinary member of the public became a *chummy*, a prostitute was a *tom*, and her trade *tomming*, a pickpocket was a *dip*, a summons a *blister*, an arrest a *knock*, the truncheon was *Charley Wood*, the police station *the nick*, a cadet a *gadget*, the motorcycle officers were *black rats*, the area covered by the station or an individual constable the *manor*, the elite Special Patrol Group (SPG) became *Snatch, Punch and Grab*, and the CID were also known as *Creeping Insect Department*, termed coined by the uniformed branch due to their long-standing rivalry with the CID.

Gradually, the police began to surround themselves with a professional mystique, seeing themselves as the experts in identifying criminals and keeping an eye on old offenders. Expected to *appear in court* and *give evidence,* the officer was equipped with pompous, stereotypical language: "He never walks or runs, he always *proceeds*; he never asks, he always *requests*; he never finds people quarrelling, they are always 'having an altercation'; for a stable to be behind a house near a church is too simple; it has to be 'situated at the rear of a house in the vicinity of a church'; he never watches, he 'always 'keeps observation', or 'keeps observation in conjunction with another officer'." [7]

A unique non-military, unarmed, non-political and non-aggressive British police built on openness to the public and schemes such as *neighbourhod watch* met the 21st century, one police service in England and Wales based on the Metropolitan Police model, controlled both locally and governmentally.

Specialized preventive and detective groups exist within many law enforcement organizations either for dealing with particular types of crime, such as *traffic law enforcement* and *crash investigation*, *homicide*, or *fraud*; or for situations requiring specialized skills, such as *underwater search*, *aviation, explosive device disposal* ("bomb squad"), and *computer crime*. Such specialist squads - *Flying Squad*, *Diplomatic Protection Group, Royalty Protection Branch*, are routinely *armed.* In *The Sweeney,* a 1970s British television police drama, the Flying Squad is portrayed tackling armed robbery and violent crime in London. The programme's title derives from *Sweeney Todd*, which is Cockney rhyming slang for 'Flying Squad'.

4. Findings

English policing in its present form has existed for about 150 years. Throughout the past two centuries, police duties have covered a variety of increasingly complex and specialized tasks, the statute of the police officer has been alternatively controversial, standardized, or professional; police work and ideology has been portrayed in laws and reforms as well as detective stories and slang. These developing facets of law enforcement in England are reflected by its complex specialized vocabulary, comprising obsolete words, new technical entries and shifts in meaning, as summarized in the table below.

	1200 1500	1700	1800	1900 →
policing	frankpledge thying constable sheriff posse comitatus	petty constable parish constable mounted constable county militia thief-taker Bow Street Runner justice of the peace	Metropolitan Police Scotland Yard Bobbies serjeants-at-mace beadles policemen Home Office	women police inspector sergeant market inspectors Flying Squad
duties	arrest suspects hue and cry maintain order control crime	night watch make arrests ward churches taxation pursue offenders patrol maintain king's peace	uniform patrol prevent crime impose fines execute warrants seize goods quell disputes	mobilization billeting espionage intelligence fingerprinting appear in court give evidence regulate traffic
crimes and criminals	vagabonds malefactors	disorder suspicious night walkers	loitering prostitution vagrancy rioting assault highway robbery pilfering	industrial disorder corruption computer crime homicide fraud

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HOW TO AVOID GENDER DIFFERENCES IN BUSINESS ENGLISH CORRESPONDENCE

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Abstract: *Gender differences appear in all societies and they are reflected in language, giving birth to sex cultural stereoptypes. The male-centred culture was studied by feminist critics (and not only), who drew the attention to the authority and leadership imbalance. The language of business (as well as that of politics and diplomacy) tries to settle this imbalance by offering a gender fair response to the issue.*

Keywords: *gender differences, gender fair language, women's language, sexual stereotypes, propriety,business communication*

INTRODUCTION

Men and women occupy separate cultural spheres as well as separate biological ones. Cultural differences between the sexes occur in all known societies and are made manifest in language, the shaper of human reality.

It was not until the 1960s that feminist critics brought to light the hidden assumptions of male-centered culture in which "female" is defined by negative reference to "male" as the human norm. For most of human history - read by feminists as "his story" - women internalized civilization's reigning patriarchal biases and accepted the cultural constructs defining masculinity and femininity.

Stereotypical maleness and femaleness are built into the patriarchal culture and expressed in the language of both art and life. Feminist theorists pointed out that language categorizes and structures one's concept of oneself, others, and society, and amassed evidence indicating the male bias is encoded in our linguistic conventions. For example, the nouns "man" or "mankind" are used to define all human beings, and the pronouns "he" and "his" often refer to ostensibly gender-neutral nouns such as God, inventor, author, poet - and the advertiser as well. The gender identification created and maintained in language was based on the male as a normative model of the self and the female as a deviant "other," first identified in Simone de Beauvoir's landmark book, The Second Sex. Since that time, feminist critics have brought to light the almost unthinkable acceptance of male norms and female opposites hidden beneath the surface.

By the 1960s, feminist researchers had begun to uncover the extent to which male dominance is so rooted in our terminology that it is accepted as "normal" language. Feminist scholars were the first to organize a school of criticism to recognize the presence of women (albeit their official invisibility), the kinship among them, and the differences between this sub rosa group and that of the male mainstream. Feminist criticism always examines cultural factors because to understand a woman's point of view (as a character in a novel or in an advertisement), a critic must take into account the social, legal, and economic status of women in society.

Three characteristics of women's language

Beginning with Lakoff feminist critics have set out to specify the impact of place on "woman's language," that distinctively feminine style of speaking and writing. They have focused on sentence structure, diction (word choice), organizational flow, and characteristic images to ascertain how women select and combine words in everyday life. This usage is related to the covert messages that culture sends about women's place. Women's speech reflects cultural imperatives calling for niceness, politeness, ladylike expression, and concern for the feelings of others. Women externalize society's message to be "nice" in their speech, just as men externalize society's permission to be "rough": male talk can be powerful, hard, and intellectual as a result of man's place from childhood on - the ball field, the army, the factory. But women are expected to speak more softly. Three characteristics that mark women's language as special are its propriety, hesitancy, and verbal excess.

Propriety

Propriety in word choice (diction) and grammar reinforces the dual sexual standard. First and foremost, women are expected to talk "like ladies." This entails avoiding obscene words, curses, and angry expletives. Sexual or scatological terms are taboo for women, while men who curse are considered "one of the guys."

In addition to sanitized diction, women are also expected to use hyper-correct grammar and any polite forms of address the language possesses. The expectation of perfect correctness harks back to women's role as the keeper of the cultural flame: while men went off to work and war to protect society, women stayed home to preserve its cherished values for transmission to future generations. Women have traditionally been regarded as guardians of the language, primarily as mothers teaching their children informally, but also in more formal occupational roles as elementary school teachers and librarians. Women were thus conventionally cast as conservators of language deemed proper in reference to dictional choice and grammatical structure.

Hesitancy

Women's language also avoids the taint of impropriety by displaying hesitancy or tentativeness. This hesitancy is expressed in two ways: a tendency to make assertions using tag-question form and a reliance on "hedge" or filler words. Women are likely to state things tentatively either by appending a question to a declarative sentence or by turning a statement into a question. For example, a simple declarative sentence reads: "It's a nice day." This is made tentative by a tacked-on question: "It's a nice day, isn't it?" or by the interrogative, "Isn't it a nice day?"

A second way to express uncertainty is to circumlocute, and women tend to use "filler" and "hedge" words that undercut ideas so that they may be stated, but not strongly enough to provoke disagreement. Empty adjectives, long stripped of substantive meaning, such as "divine, charming, cute" are all-purpose descriptors attached to nearly any

noun. Additionally, meaningless filler expressions such as "well," "you know," "sort of," or "like" punctuate sentences.

Verbal Excess

Related to women's use of tentative expressions and filler words is the last characteristic: a tendency to verbal excess. One kind of excess is sheer verbosity - constructions that use more words than necessary to express a thought. This, of course, inevitably accompanies reliance on filler phrases and is a means of softening direct assertions by circumlocution, or beating around the bush. Another kind of excess is hyperbole or overstatement. Language is hyperbolic when frequent underlining or italicizing of words and expressions occurs, when unremarkable comments end with exclamation points, and when emphatic words are sprinkled throughout.

The issue of cultural conditioning leads to the need for more careful examination of whether (or how) the language of marketing, advertising, business etc. perpetuates/changes sexrole stereotypes. Despite objectively similar roles that can be taken by men or women nowadays, stereotypes about sex-linked appropriate behaviors - including language persist and are embodied in advertisements, business letters and other documents. Even though women have entered the work force and educational institutions in record numbers in the past decades, old habits built into the traditional cultural heritage die hard. The construct of appropriate role behaviors may be changing more slowly than the actual sociocultural changes in role performance.

Gender-Fair Language to Be Used in Business Correspondence

The language used in business correspondence provides an important model for students and the larger community. Word choices often reflect unconscious assumptions about gender roles. As professionals, we all need to examine our language to reduce or eliminate choices that silence, stereotype, or constrain others. The following examples provide inclusionary alternatives to specific exclusionary wording. Many are matters of vocabulary; others are matters of usage. What follows details choices and recommendations[1] that address the following issues of gender-fair language use:

Eliminate the generic use of 'he' by:

- using plural nouns
- deleting 'he', 'his', and 'him' altogether
- substituting articles ('the', 'a', 'an') for 'his'; and 'who' for 'he'
- substituting 'one', 'we', or 'you'
- minimizing use of indefinite pronouns (e.g., 'everybody', 'someone')
- using the passive voice [use sparingly]
- substituting nouns for pronouns [use sparingly]

Eliminate sexism when addressing persons formally by:

- using 'Ms' instead of 'Miss' or 'Mrs.', even when a woman's marital status is known
- using a married woman's first name instead of her husband's (e.g., "Ms. Annabelle Lee" not "Mrs. Herman Lee")

- using the corresponding title for females ('Ms.', 'Dr.', 'Prof.') whenever a title is appropriate for males
- using 'Dear Colleague' or 'Editor' or 'Professor', etc. in letters to unknown persons (instead of 'Dear Sir', 'Gentlemen')

Eliminate sexual stereotyping of roles by:

- using the same term (which avoids the generic 'man') for both females and males (e.g., 'department chair' or 'chairperson'), or by using the corresponding verb (e.g., 'to chair')
- not calling attention to irrelevancies (e.g., 'lady lawyer', 'male nurse')

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TEACHING NEGOTIATION SKILLS

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Abstract: *The present paper outlines the importance of teaching negotiating skills in the Business English seminars at the Academy of Economic Studies in Bucharest. Its main focus is the development of the professional and language skills, taking into account the similarities between the MBA programmes and Business English training. The context, the setting and the situation are very important when using the language. In developing negotiating skills one should bear in mind the cross-cultural communication competence which helps us become better negotiators and communicators. The method employed in teaching is the communicative approach using interactive techniques, collaborative tasks, role plays and simulations.*

Keywords: *cross-cultural communicative competence, professional skills/language skills, cultural awareness, negotiating skills/stages, language functions/exponents.*

1. INTRODUCTION

As markets become more and more global there is a constant demand for managers and business people with language skills and cultural sensitivity. The changes in the EU brought about by the presence of Central and Eastern European economies have contributed to the increased interest for Business English in Europe and elsewhere.

Within this framework a need has been felt to redefine the goals of Business English courses and teaching methods.

1. THE BUSINESS ENGLISH TEACHER

As Business English lays emphasis on performance rather than on competence, on fluency rather than on accuracy, so the Business English teacher trains learners to become "operationally effective".

Business English courses focus on such areas as meetings, presentations, negotiations, - areas which are also addressed in management skills training (where behavioural strategies and techniques play an important role).

Some English language teachers feel that they should not be concerned with matters beyond teaching the language, while other teachers are keen to move into new fields and develop themselves professionally; and there is still another category of teachers who are so much absorbed by the professional content that they forget about teaching the language.

Therefore, there should be a proper balance in teaching professional skills via the medium of English language.

3. THE METHODS

The methods employed in management skills training such as role play simulations, or the case study method (which are also common for Business English training) have the following characteristics:

These methods:

- are task oriented and purposeful, the goal being to find the best solution and support it in order to persuade others of its merits;
- are motivating, due to the relationship to the real-world problem solving and interpersonal strategies;
- are also challenging for both pre-experienced and in-service students;
- emphasise co-operation, the students build on each other's ideas;
- are constructively competitive.

All in all we can see that emphasis is on the process rather than on the product, since there is no 'one' correct answer.

3.1 BUSINESS ENGLISH/MBA PROGRAMMES

There have been certain assumptions stating that the purposes of Business English and MBA programmes are essentially similar and therefore the same methodology and syllabi are appropriate.[1].

The purpose of BE is to develop communicative competence for business settings, where communicative competence refers to Canale and Swain's [2] classification of language skills into areas of grammatical, sociolinguistic, discourse and strategic competence. Among all these, advanced students interested in business are usually most in need of sociolinguistic and discourse competence.

An appropriate definition for Business English would be **communicative competence for the business settings**. While the difference between BE and professional education for business lies in the following: the main goal of BE is not to teach students how to think like business managers, but rather how to **communicate** like business managers in English.

The Business English teacher should not approach a course from the point of view of setting out the stages of a meeting, negotiation, etc., and developing the participants' skills at negotiating, etc., by getting them become manipulators of these stages. Nevertheless, the Business English teacher does necessarily have to know what these stages are, otherwise there will be no focus on language.

4. LANGUAGE CONTEXT AND MATERIALS

The language areas are so context-rich that whatever the language item, there is always a reason for performing it: it is always clear **who** is doing **what** and **for what** purpose. Thus, the language tasks have reliability, face validity and practicality.

The materials used in a Business English course present a familiar area, a virtual world of work, where the participants will want to practise the interactions they imagine take place in that world. In such an environment, the teacher's role would be that of process manager, language and culture consultant, facilitator of learning.

In sum, the Business English course benefits from the practice-centred methods for professional education while focusing on the specific purposes of the language course.

5. FOCUS REDEFINED

The discussion of purpose and pedagogy for Business English is an example of the older debate between a focus on language or content.

As Mohan [3] points out: "In subject matter learning we overlook the role of language as a medium of learning. In language learning we overlook the fact that content is being communicated."

Business English learning for students, as any second language acquisition, is an integral part of their **enculturation** process, in this case, acquiring communicative competence in business settings.

What is cross-cultural communication competence?

Teaching a foreign language without its underlying culture is, even if it were possible, totally useless. On the other hand, too much stress on the importance of culture can have totally undesirable effects: there is always the danger of blocking communication if we become too specific in our attempts to give students too much cultural information.

It is not only information that our students need, but the development of specific strategies that lead to competence in surviving and getting by in an increasingly multicultural world as ours has recently become. Such strategies help students to survive better, with fewer misunderstandings and breakdowns in cross-cultural communication, and also to better understand aspects of the other culture and, at the same time, become aware of their own cultural values and practices.

In teaching Business English the teachers should keep in mind the **main goals** of cultural instruction (adapted after *Barry Tomalin* and *Susan Stempleski*) [4]:

1. to help students develop an understanding of the fact that all people exhibit culturally conditioned behaviours.
2. to help students develop an understanding that social variables such as age, sex, social class, and place of residence influence the ways in which people speak and behave.
3. to help students become more aware of conventional behaviour in common situations in the target culture.
4. to help students increase their awareness of the cultural connotations of words and phrases in the target language.

5. to help students develop the ability to evaluate and refine generalizations about the target culture.
6. to help students develop the necessary skills to locate and organize information about the target culture.
7. to stimulate students' intellectual curiosity about the target culture, and to encourage empathy towards its people.
8. to develop the students' **cross-cultural communication competence** (in fulfilling the requirements under 1 – 7).

In sum, the teacher must help the students develop the knowledge and skills that form the basis of cross-cultural competence. Language use, language awareness and cultural awareness form the basis of this knowledge and are used in order to help a learner cope cognitively and affectively within his/her new experiences. The spoken language has a special role in this as it reflects the dynamics provided and maintained by interaction and allows learners to actively engage in promoting different cultural perspectives which are reflected in the selection of appropriate material. Teachers should allow their students to take charge of their own learning and to become more autonomous learners. An autonomous language learner will be more capable of learning both inside and outside the classroom. In this way, the learners' capacities for understanding, valuing and dealing with new cultural phenomena are increased.

6. NEGOTIATING IN ENGLISH

People negotiate in generally similar ways in all the cultures of the world. A negotiation can be defined in simple terms as an interactive communication process that may take place whenever we want something from someone else, or another person wants something from us. (Shell, G. Richard: Bargaining for advantage.). All negotiations proceed through a form of cooperative communication (relationship building). Then, negotiations commonly follow a recognizable path: preparation, information exchange, explicit bargaining and commitment. If we are to describe the path in more detail we get the following stages [5]: 1. Relationship building; 2.Agreeing procedure; 3. Exchanging information; 4. Questioning; 5. Expressing options; 6. Bidding; 7. Bargaining; 8. Settling and concluding.

Students who learn to negotiate in English, plan to negotiate internationally, and therefore, across cultures. So, any training focusing on both professional and language skills must take into account the cross cultural element. In this respect, relationship building, establishing trust and respect for the other party is an essential factor in business dealings.

Another aspect to be taken into account is the non-verbal aspect of communication: an example here is silence, which means different things to different nations (the British or Americans can take silence as disagreement or lack of interest, while the Japanese and the Nordic cultures consider it an opportunity to think and reflect). Other examples include eye contact, conversational overlap, touching, attitude to time, distance etc. (see Hofstede) [6]. The teachers should make the students aware of the cross-cultural communication differences in negotiations.

The negotiating skills described in this workshop are clothed in language functions and

exponents to be used for different stages of the negotiation process. In this way the students receive the language training they need to negotiate in English, and also they improve the business skills to negotiate effectively in a real business context. An example in question is represented by a gapped table containing information about the negotiation stages and language functions, while the teacher elicits from the students the corresponding language exponents:

Table 1

Negotiation stage	**Language function**	**Language exponent**
1. RELATIONSHIP BUILDING	*greeting, introducing, welcoming, phatic communication, offering hospitality, small talk*	
2. AGREEING PROCEDURE	*suggesting, sequencing, checking & clarifying, agreeing, presenting alternatives, supporting/giving reasons, disagreeing, requesting changes*	
3. EXCHANGING NFORMATION	*asking for/giving info, questioning, interrupting, checking, explaining, giving opinions, expressing interest, exploring, turn taking, rephrasing*	
4. QUESTIONING, CHECKING & CLARIFYING	*reformulating, asking for clarification, giving information*	
5. GENERATING & EVALUATING OPTIONS	*suggesting, giving reasons & hypothesising, explaining, presenting alternatives, building arguments, accepting, rejecting*	
6. BIDDING	*making proposals, channelling the discussion, giving/supporting reasons, questioning, amplifying your proposal, emphasising*	
7. BARGAINING	*accepting, rejecting,*	

	persuading, justifying, making counter-proposals, conceding, giving conditions, expressing feelings, stalling, hedging, reassuring	
8. SETTLING & CONCLUDING	*summarising, checking, making future plans, celebrating, toasting, postponing action*	

Table 1: Language exponents

In completing the language exponents, the teacher uses audio- video materials, printed handouts, realia, overhead transparencies, everything that comes in handy to demonstrate the real situation. After this type of input there follows a set of realistic negotiations using role-plays and simulations to familiarise the students with the actual business setting.

The teacher points out that good negotiators generally wish to reach an agreement meeting the interests of both sides, the participants are problem-solvers and the goal is a wise outcome reached efficiently and amicably.

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EDUCATIONAL MANAGEMENT – ART OR SCIENCE?

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Abstract:*Educational management involves both art and science in identifying efficient leadership manners to be used for the accomplishment of the targeted objectives. Within the educational environment, the manager needs to harmonize individual interests with the collective interests of the educational institution, mitigate conflicts, and to stimulate initiative spirit and ambition of placing the institution he or she manages at the highest possible levels. The more various the managerial abilities are, the more efficient his or her activity becomes. A permanent self-analysis on the manager's behalf will contribute to the development of the educational management.*

Key words: educational management, individual interests, collective interests, managerial abilities

1. INTRODUCTION

Educational management consists of a complex activity involving various areas of expertise such as: the educational practice, the didactical activities, the teaching staff's training, the economic and financial activity, school-family relationships. Nowadays, issues specific to the educational management have become a priority among the concerns of experienced researchers in the field of pedagogy. Leadership, as a specific process within the educational management, has existed ever since immemorial times. Nevertheless, starting with Comenius, "it gained those attributes and features that allowed for a theoretical crystallization imposed by its integration within a well-contoured pedagogical system, thus opening the road towards the modern school's organization". (Rusu, Voicu, 1993: 37, apud Jinga, 2009: 24) Gradually, the leading of the educational activity has become a distinct subject matter within the education sciences and a series of researches and a consistent number of related papers have had it as their focus. The reform of the educational management generated new approaches to the decentralization and autonomy of education institutions, the training of school managers or the reasonable distribution of both financial and material resources. The managerial activity cannot be excluded from the European and world context, nor can it be successful without an adequate training of the managers. The selection of managers based on rigorous criteria and their implication in activities regarding the continuous learning may guarantee an efficient educational management and an improvement of quality and efficiency of the entire educational environment.

2. CHARACTERISTICS OF EDUCATIONAL MANAGEMENT

The concept of management has a plethora of meanings. It derives from the Latin "manus", which means maneuvering. The one who does the maneuvering is the manager. In our case, the manager was the one in charge with a sportsman, an artist or and actor. Thus, the manager "set the ground for success, particularly the financial one, of the activities performed by his/her client" (Jinga, 2009: 13). According to Peterson and Plowman, management comprises the

"methods by means of which a collective's goals and tasks are determined, explained and achieved" (apud Jinga, 2009: 14). Karl Hegel argues that management is a subject matter leading to the achievement of set objectives by efficiently using human and material resources. Corneliu Russu (1991) notes that management is "the science of scientifically leading social-economic organizations" and carries three meanings:

- Science – organized set of concepts, principles and methods that explain the processes specific to organization management;
- Art – the manager's skill to efficiently deal with various situations;
- State of mind – a certain way to regard, wish for and achieve success.

From the viewpoint of the above three meanings, educational management is regarded as "a complex process of managing the educational act within the educational system" (Niculescu, 1994, apud Jinga, 2009: 18). The core of management is to ensure maximum results with minimum material and intellectual expenses (Petrescu, 1991). Sorin Cristea (1998) thinks that educational management encompasses various strategies used to accomplish teaching activities.

Therefore, educational management seen as a combination of science and art shapes competent and developed personalities, able to adapt to the numerous and rapid changes occurring in every walk of life. The problem here is to decide how much of educational management is science and how much is art. If we view educational management as a science, then we establish that it has an object of study, methods and strategies to achieve its goals, theories, norms and principles, as well as management assessment procedures. The first stage requires intuition and management practice. The following stage embeds the general management concepts and legislation (Ivancevich et al., 1989, apud Jinga, 2009: 15). The stage of scientific management involves calculus, statistics and mathematical methods. Regardless of the number of its development stages, educational management comprises:

- an educational ideal;
- general objectives;
- teaching strategies;
- assessment methods;
- human resources;
- financial resources;
- pedagogical research (Niculescu, 1994).

In terms of teaching objectives and strategies, educational management may be placed at various hierarchical levels, as follows:

- central level – strategic management: it orients, guides and evaluates the entire educational system;
- unit level – operational management: it puts in practice the strategy developed at higher echelons.

Educational management at unit levels approaches the teaching process in all its aspects, logistics, interpersonal relationships, and cooperation with other institutions. The institutional framework is ensured by general regulations such as: the Education Law, the Teaching Staff's Statute, government decisions, norms issued by the Ministry of Education, Research and Innovation, as well as special stipulations – school regulations, University Chart etc. A UNESCO document (Russu, 1991) assessing the state of education in the year 2000 mentions that the manager must display a set of skills, knowledge and attitudes in order to address the specific requirements of his/her duties. We now talk about management optimization efforts, the manager's professional techniques and his/her involvement in lifelong learning to ensure the effectiveness of educational management, which in turn leads to the improvement of the entire educational system. Also, success greatly depends on the manager's personal traits.

In the following paragraphs, we will approach educational management as an art. Thus, it focuses on the manager's personality,

which must be role model to the subordinates. By his/her persuasion role, the manager must harmonize the individual and the collective interests. Besides professionalism, the manager must display empathy, communication skills, the desire to support and develop the employees in terms of their professional and social potential. The recognition of a job well done and support provided when a teacher encounters difficulties in their work enhance confidence and trust. Apart from professional, artistic and organizational skills, the manager must also act as a leader and psycho-pedagogical professional. An effective leader will not expect change to be imposed, but will stir change as a tool for progress. At the level of educational management, art and science go hand in hand, so that the manager adapts to social requirements for the purpose of achieving educational objectives.

3. EDUCATIONAL MANAGEMENT COMPETENCES

In carrying out his/her duties, the school manager (*aka* principal) performs roles such as:

- state representative – applies rules and regulations pertaining to his/her own school's policies;
- representative of educational community;
- president of the Teaching Board and Administration Board;
- person in charge of developing educational objectives and goals;
- credit responsible person;
- decision-maker;
- organizer of educational facilities;
- mediator within educational community;
- evaluator of teaching activity and staff;
- member of local community;
- citizen.

In order to perform these roles, the school manager must have competences such as decision-making skills and professional skills. Whereas decision-making skills are regulated by means of legal documents, professional skills are examined in handbooks and specialized literature. Also, the school manager must display the following competences: psycho-pedagogical, legal, economic-financial, managerial, cultural, social-moral.

Management skills imply the ability to set goals and objectives, organize and plan activities, take responsibilities, communicate, negotiate, interact, empathize, make firm decisions, solve conflicts, solve problems, keep an open mind and adapt to changes. In order to select school managers' eager to achieve performance, one must know the profile of an effective school manager, as well as to facilitate professional growth by training, education and gaining experience. The initial development of school managers is achieved by postgraduate courses in the field of educational management. In the year 2000, by the government ordinance no. 92/29 June, a national system was set up to develop school managers, but its functioning was affected by the elections held in late December. Consequently, the school managers' initial development can be done in the Departments of teaching staff's training by studying subject matters such as "Elements of educational management" and "The management of educational system and

process". School managers' professional development requires the establishment of an accredited center with a flexible structure, with experts in the fields of management, psycho-pedagogy, communication sciences, economics and culture. The range of educational programs must be diversified in the sense of a module-based approach with a variable duration (from 2 to 6 months). The school manager's job description is regulated by legal documents (Jinga, 2009) in accordance with every educational level:

- primary and secondary education – specific rules and norms and job description;
- graduate and postgraduate education – University Chart and job description;
- for school inspectorates – rules issued by the ministry and job description;
- management team of the Ministry of Education, Research and Innovation- government decisions and job description.

In order to accurately establish the relevant duties, the following stages must be considered:

- analysis of legal documents;
- group duties according to compartments within each institution;
- distribute duties according to area of responsibility, decision level, interpersonal relations, activity complexity and frequency. On a regular basis and for purposes of management optimization, the accordance between positions and job descriptions will be examined by means of legal documents and questionnaires. Jean Gerbier suggests a duty diagram to determine job specifications and related duties within an institution.

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Duties	Principal	Deputy principal	Chief accountant	Head of faculty	Admi to
Schooling plan design					
Schooling plan implementation					
Organization of schooling facilities					
Development of income-expense budget					
Execution of income-expenses budget					
Drawing up timetable					
Methodological-scientific activity					

Table 1. Diagram of duties to establish job specifications (Jean Gerbier, apud Jinga, 2009)

For exemplification purposes, below we present the main duties of a high school principal:

- organization: clarification of each department's and employee's duties, establishment of commissions in charge with timetable, attendance, dress code, teaching activity, quality assessment and assurance, goal-setting according to established objectives, coordination of activities. At the commencement of the academic year, he/she carries out the pupils' census, distributes the teaching staff, organizes the medical checkup, initiates activities of school guidance, and distributes pupils on classes. Throughout the academic year, he/she puts in practice the provisions of the School Regulations, and at the end of

the year organizes the final revision sessions, assessments, high school leaving examination, holiday schedule of events, cleaning activities.

- control: monitoring teaching staff's adherence to schedules, activities, dress code and conduct rules. He/she monitors students' training, behavior outside the school perimeter, fills in and keeps school records and labor documents, observes syllabi, curricula, handbooks, teaching process calendar and other relevant documents. This reflects the complexity of educational management and the fact that it requires attention, effort and responsibility.

What distinguishes educational management from other types of management is the fact that "it affects the children's and youngsters' personality and character development. In industries, for instance, losses or mistakes may be compensated for and then reused, in education failures can have negative effects at individual and social levels: incompetence, illiteracy, inadequacy and delinquency" (Iucu, 1999: 12). Therefore, we consider that approaching educational management from a modern perspective meets the needs for optimization and efficiency. In this respect, the school manager may delegate some of his/her responsibilities to deputies or counselors able to do that. Effectives does not depend exclusively on the manager, but also on his/her coworkers. Thus, a manager is effective if he/she:

- is able to manage time, human resources, material resources and financial resources;
- motivates staff by valuing their individual skills and interests;
- performs relevant and constructive staff appraisals on a regular basis;
- knows how to delegate responsibilities;
- keeps an open mind to modern methods and techniques to smoothly run the organization;
- overcomes communication blockages, organizational conflict and "scapegoating";
- is committed to the organization and its objectives, which must match the subordinates' objectives at the same time.

4. METHODOLOGY AND RESULTS INTERPRETATION

In order to assess a school manager's efficiency and they extent to which art and science converge at the level of management skills, we have applied the survey related to the managers' perception of their own position. It was undertaken by high school principals and was evaluated by combining the survey data with the self assessment questionnaire concerning individual management skills (Jinga, 2009). Thus, the managers were able to assess the extent to which the feel that their position provides them with promotion and personal accomplishment opportunities. The analysis parameters of responses were the following:

R – accomplishment
Rp – responsibility
Rn – recognition
Av – promotion
Im – interest in task
Ap – personal fulfillment

The listed parameters describe work motivation. The final score reflects the impact of each factor upon the overall job satisfaction.

R	Rp	Rn	Av	Im	Ap	Total
3.1	3.0	2.9	3.2	3.6	3.5	51.8

Table 2. Analysis parameters of managers' opinion survey

The final score is between 45 and 55 points, which describes a certain level of dissatisfaction. A total of 55 points or above would have described a level of full job satisfaction.

As far as the second tool is concerned, the final score if between 41 and 60, which means a lack of attention paid to the subordinates' psyco-social needs. This may lead to confusion and may be put down to the managers' lack of time. Too many problems to solve in too little time make managers ignore their subordinates' concerns. The managers' actions must be carefully considered and well organized in order to favor their coworkers, which will increase the quality of their professional performance.

5. CONCLUSIONS

Educational management is a system of actions taken in a conscious, organized and systematic manner meant to develop the students' personalities and characters according to their own purposes and values. Thus, educational management aims at ensuring education quality in terms of the obtained results compared to the envisaged results. Also, a professional diagram for school principals can be drawn up based on algorithms, competences, knowledge and skills in accordance with a good manager's profile:

- physically and mentally fit;
- able to cope with stress and intellectual effort;
- energetic and consistent;
- determined;
- confident;
- accountable;
- altruistic;
- loyal;
- competent;
- intelligent and knowledgeable;
- open-minded;
- empathic;
- able to communicate efficiently;
- able to network for the benefit of his/her organization.

Nowadays, a manager is much more than a manager. His/her responsibilities pertain to the art and science to organize, guide, catalyze, optimize and influence his/her organization. The methods one may use in this respect are:

- information and decision-making by means of personal observation, self-study, monitoring, attending report and debate sessions, meetings etc.;
- involving the teaching staff in managerial activities: explanation, discussion, persuasion, critical analysis, personal example, suggestion, urging, praising, support, disagreement etc.;
- stimulation and encouragement of initiative and creativity: brainstorming, debate, analogy etc.;
- operative tools: clear objectives.

By applying these methods and techniques in order to guide activities, interact, communicate and persuade others, art and science converge. Also, one should mention the importance of how a manager manages his/her time, how he/she addresses the environmental challenges, solves conflicts and problems. In terms of interpersonal relations, one should handle communication tools, find the right words and body language, display confidence and openness. In our opinion, this art is mastered by the practice and experience which every manager should gain. One cannot draw a clear-cut line between art and science, but their combination results in efficient and effective outcomes and contribute to the overall improvement of the quality of Romanian education.

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GEORGE THE THIRD, SELIM THE THIRD AND ENGLISH ORIENTAL POLICY AFTER THE ESTABLISHMENT OF ROMANIAN CONSULATE (1803)

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Abstract: *The papers in my hands contain a letter drawn up and signed by George The Third, at Royal Palace St. James, the Thirteenth Day of September 1789.*

The letter gives information about the improvement of English trade in the Ottoman domains and talks about the Protection that Selim The Third grants to English subjects doing trade on the Ottoman domains.

Keywords: *St. James Palace, George The Third, Selim The Third, English merchants, English trade, Ottoman domains.*

1. THE FOUNDATION OF LEVANT COMPANY AND ENGLISH EMBASSY AT CONSTANTINOPLE

England had no direct contact either diplomatic or commercial with the Byzantine Empire, and even the fall of Constantinople in 1453 passed without notice in contemporary English chronicles.

During the fifteenth century English merchants pushed their ventures towards the Mediterranean.

By 1511 diverse English ships were carrying English cloth to Crete, Cyprus and Syria in exchange for silks, oils, spices, carpets and mohair yarn. From this period onwards proofs of the existence of growing commercial links with the Levant are not lacking. The products of the orient had been conveyed along the great routes of the middle ages which all converged upon the shores of the Levant, either via the Caspian Sea to the Black Sea, via Persia and Aleppo to the Syrian coast, or via the Red Sea to Alexandria. All the three routes had finally joined at Venice. From this great clearing house oriental commodities were distributed all over Europe.[1].

In the middle of the century Venetian trade with the Levant was diminished by the state of the eastern Mediterranean, as the loss of some territories in the Aegean. The Ottoman sea-power reached its zenith in that period, and the trade routes leading to Constantinople, Smyrna, Aleppo and Alexandria swarmed with fleets of corsairs which paid little respect to treaties. The discovery and development of the route to the east round the Cape of Good Hope by Portuguese ruined the trade of Venice in the Mediterranean, as it was proved that oriental goods could be brought to Europe cheaper, and more safely.

Even so the English traders were obliged to look elsewhere for the supplies of eastern goods, for the moment there was no desire for them to travel to the Levant to buy the oriental commodities when they could purchase the same goods from the wealthy merchants of the Netherlands. But when the Ottomans leaded by the Sultan Suleiman got the gates of Vienna and filled all Europe with alarm, it was impossible for England to ignore the Ottomans.

At the end of the century two of the great merchants of that time, Edward Osborne and Richard Staper took the first steps towards the foundation of the Levant Company. In the meantime it was essential to have an ambassador and consuls to govern the merchants who settled there, to secure protection from the Ottoman authorities.[2]

2. ENGLAND AND THE EASTERN QUESTION

At the end of the 18th Century the relationship of Catherine II and Joseph II became an agreement between the two sovereigns and they were solemn promised to support each other in the Balkans and in the Black Sea.

The Porte regarded with great concern the relationship and Russia's supremacy in the Black Sea. Moreover, Russians agents extended their intrigues among the Greeks, Slavs and Romanians. As the Sultan Abdul Hamid was required to gave up his sovereignty over Georgia, to surrender Bessarabia to Russia, to permit Russian governors in Moldova and Wallachia, to accept the seizure of the Crimea in time of peace, he demanded the restoration of Crimea and that was followed up the demand by a declaration of war against Russia (August, 1787).[2]

The Porte's move was attributed to the encouragement of Pitt the elder and it brought the Triple Alliance, in 1788, between England, Prussia and the United Provinces. In this Alliance, England was not concerned about Russia's advent into Europe, as England saw in Russia a possible counterpoise to the dangerous France.

The younger Pitt was the first English statesman who appreciated the real concern of England in the affairs of the Balkans and Black Sea.[3]

The younger Pitt formed the Triple Alliance to save Belgiun from France, to preserve the peace of Europe, but not to further the ambitions of Prusia.

Some events disposed the belligerents to peace, as in April, 1789, Abdul Hamid I died, and was succeeded by Selim III. The death of the Emperor Joseph and the accession of his brother, Leopold gave a new turn to Austrian policy. And above all, it was the revolutionary moment in France, rousing strong interest the attention of every monarch and every government in Europe.

This was the moment when Pitt assumed a firmer position towards Catherine II, and in November 1790, he demanded that Tsarina Catherine should surrender Oczakov, and in March 1791 the Cabinet agreed to dispatch an ultimatum to Russia in that position. But the debated in both the House of lords and in the Commons, underlined the fact that public opinion was not prepared for a reversal of the traditional policy which had governed the relationship between England and Russia. Tsarina Catherine II had her own way about Oczakov, without any attack from the English fleet.[4]

In August, 1791, Austria concluded peace with the Porte and Serbia was handed back to Turkey, and there was restored the *status quo ante* war. On

January, 1792, at Jassy, a treaty was signed by Russia and the Ottoman Empire. The treaty of Küçük Kaynarca, the Convention Explicative of 1779, and the Commercial Treaty of 1783 were confirmed; Porte recovered Moldavia, but the stipulation contained in the preceding treaties were fulfilled, the Russian border was advanced to the Dniester (Oczakov being thus transferred), and the Porte agreed to recognize the annexation of the Crimea.[5]

3. DIPLOMATIC AND COMMERCIAL CORRESPONDENCE BETWEEN GEORGE THE THIRD AND SELIM THE THIRD

In 1789, autumn King George the Third in His letter addressed to Sultan Selim the Third, stipulated in it about the protection for English merchants doing trade in the Ottoman territories.

The letter was written at St.James Palace, on the 13th of September, 1789 and it was signed by His Royal Highness George the Third.)*"George The Third by the Grace of God King of the United Kingdom of Great Britain and Ireland Defender of the Faith, Duke of Brunswich and Lulenburgh, and Treasurer and Prince Elector of the Holy Roman Empire"* (see attch.)[6]

I found the letter when I was doing research with the *T.C. Başbakanlık Devlet Arşivleri Genel Müdürlüğü; Osmanlı Arşivi Daire Başkanlığı*, Istanbul, Turkiye, The Prime Minister's Office Ottoman Archive, Istanbul, Turkey) HR. MTV. 747/3.

The letter begins with a salutation formula written in full respect and goodwill addressed to Sultan Selim the Third by George the Third "…*King of the United Kingdom of Great Britain and Ireland Defender of the Faith, Duke of Brunswich and Lulenburgh, and Treasurer and Prince Elector of the Holy Roman Empire"*[6]

The letter continues the same message addressed to Sultan Selim the Third „*Most High and Mighty Prince Being desirous to maintain, without Interruption, that Friendship which has subsisted Our respective Royal Predecessons and to strengthen and improve it upon all Occasions"* [7].

The document mentiones the willingness to maintain the relationships between the two Royalties and introduces John Spencer Smith Esquire, the new Ambassador, Charged Affairs and Secretary of Legation at Constantinople "*We have determined to appoint Our Trusty and Wellbeloved John Spencer Smith Esquire who has resided since the return of Our Trusty and Well-loved Robert Liston Esquire, late Our Ambassador, Charged Affairs and Secretary of Legation at Your High Porte to assume the additional Character of Our Minister Plenipotentrary, and We fully trust for the Frienship which reigns between Us, that You will kindly and graciously admit him in that Quality and that You will give him entire credit in all Things which He shall at any Time represent to You in Our Name and that Your Highness will afford him Your Favour and Countenaince...*"[8]

The continues with the same kindness and wiliness addressed to Sultan Selim the Third, and it stipulates the liberty, rights and privileges agreed for English merchants and for English subjects traveling and trading in the Ottoman domains „*....whenever he shall find it necessary to make application to You, or Your Principal Minister in behalf of Our Subjects, to obtain Relief and Regards of any Grievances or Difficulties they may labour under, and present to Your Royal Hands any other Matters and Things which may lend to the Confinning*

and advancing the strict Friendship and good Correspondence between Us and Our futher request is that Your Royal Majesty will conffine the ancient Freedoms, Liberties and Privileges which by virtue of the Capitulations made with the sublime Porte have been hetherto enjoyed by Our Merchants and Subjects, trading to and with Your Dominions..."[9]

The letter introduces the capitulations agreed between England and the High Porte„*....that the said Capitulations may, by virtue of Your Royal Orders and Authority the same be necessary, be so fully and clearly expalined, as to prevent any complaints on Me understanding on that Head, and to remove all doubts and difficulties concerning the due Execution of them*,"[10].

The closure of the letter shows the fact that the relationships between the two parts are very important for the *S*t.James Palace, and it underlines the desire of His Royal Highness regarding the protection offered by the Porte for English subjects"*....We desire likewise that You will on all occasions grant such marks of Your Royal favour and Protection to Our said Subjects as many be needful and convenient for their carring on and improving more and more Trade, from whence will arise mutual Benefits and Advantages to Our respective Countries and Dominions: and in return to these friendly Offices, We assure Your Imperial Majesty, that We will not be in anything[deteriorate document] in anything, that may tend to the advancement of the Prosperity and We have of Your Empire And so We wish Your Royal Majesty Healthy, Peace and Felicity, Given at Our Royal Palace St.James, this Thirteenth Day of September 1789"*

4. CONCLUSIONS

Sir John Spencer Smith was appointed the Ambassador, at Constantinople, Charged Affairs and Secretary of Legation at Levant Company.

In 1789, autumn, Sir John Spencer Smith wrote a memorandum addressed to the Porte and requested permission for English vessels to navigate into the Black Sea. The Porte allowed English merchants to do trade in the Ottoman territories, and they got a *ruhsat,* a document that allowed English merchants do trade in Ottoman and Russian ports of the Black Sea.

In 1802, England got the permission for its Merchants to trade in the Danubian ports, and for its vessels got *İzn-i sefine*, a document that allowed English vessels to enter the Black Sea.

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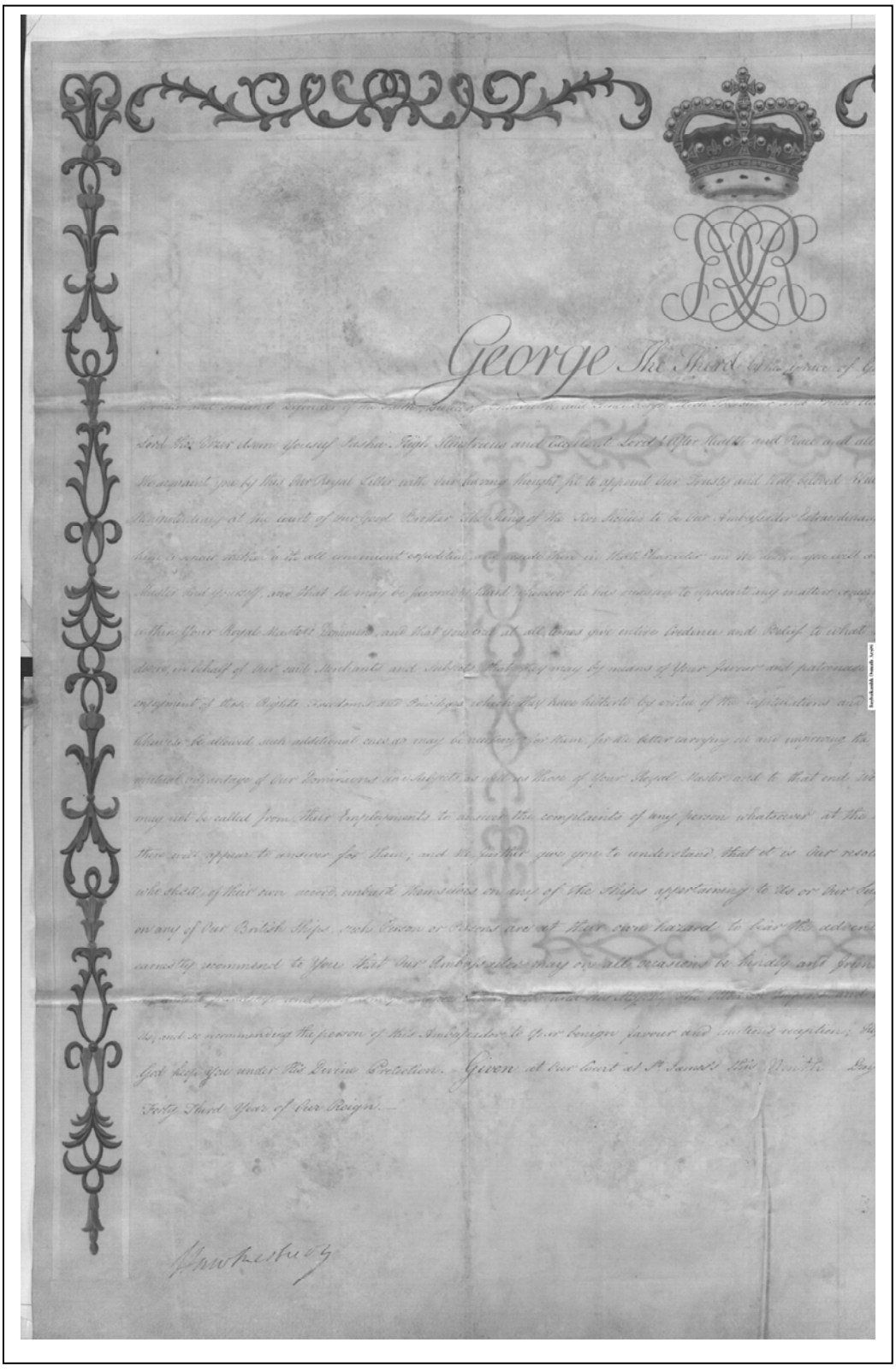
George The Third

The Third by the Grace of God King of the United Kingdom of Great
[illegible] Treasurer and Prince Elector of the Holy Roman Empire &c. To the High Illustrious and Excellent
[Lo]rd! After Health and Peace and all Salutes with Respect Friendship and good correspondence being premised
[...]nt Our Trusty and Well beloved William Drummond Esquire late Our Envoy Extraordinary and Minister
[...] to be Our Ambassador Extraordinary and Plenipotentiary at the High Porte, We have accordingly commanded
[...] Character, and We desire you will at all times procure and grant him a kind and easy access to Your Imperial
[...]asions to represent any matter concerning Our Service, or the good of Our Merchants and Subjects trading
[...]ive Credence and Belief to what he shall deliver and impart to You in Our Name, and We further
[...] of Your favour and patronage to which We earnestly recommend them, not only be continued in the
[...] virtue of the Capitulations and Agreements made with the Porte, been possessed of, but that they may
[...]etter carrying on and improving the Trade and Commerce which have flourished for so long a time to the
[...]oyal Master, and to that end We desire that Our Merchants residing at Smyrna, Aleppo and elsewhere
[...] any person whatsoever at the High Porte, in case Our said Ambassador or any of the Merchants
[u]nderstand, that it is Our resolution never to answer for the persons and estates of such Turks
[...] appertaining to Us or Our Subjects, but that whosoever shall entrust his goods or person
[...] hazard to bear the adventure of those accidents to which the Sea is liable, and We
[o]ccasions be kindly and friendly received and treated at the Sublime Porte, agreeably to
[illegible] happily established [illegible]
[fa]vour and courteous reception; High, Illustrious and Excellent Lord, The One Great and Omnipotent
[...] St. James's this Ninth Day of February, One Thousand Eight Hundred and Three, in the

Your affectionate Friend

George R.

"HENRI COANDA"
AIR FORCE ACADEMY
ROMANIA

GERMANY

"GENERAL M.R. STEFANIK"
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AFASES 2011
Brasov, 26-28 May 2011

NEW DOCUMENTS REGARDING THE SPREAD OUT OF THE ENGLISH TRADE INTO THE OTTOMAN DOMAINS: THE MEMORANDUM OF THE BOARD OF TRADE, LONDON, 1828

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Abstract

The papers in my hands contain a memorandum drawn up by the Board of Trade, London, 1828. The memorandum describes the discontinuous trade practiced in 1825 by the Levant Company and the decisions drawn up by the representatives of decision makers of English government to enlarge English commerce and to open new markets inside the Ottoman domains.

Keywords: *Foreign Office, Levant Company, memorandum, Treaty of Küçük Kaynarca, Ottoman maritime trade, English trade, Ottoman domains*

1. GENERAL VIEW REGARDING THE ATTITUDE OF FOREIGN OFFICE IN LEVENT IN LATE 18 CENTURY

In 1793 the out break of war with France produced a prolonged fall of the Levant Company trade. That was the beginning of acts of warfare that made the passage through the Mediterranean a dangerous space for merchant ships and brought to the withdrawal of the English fleet from the Mediterranean and for two years no protection could be given to English merchants sailing in the Mediterranean Sea.

The English vessels trading to the Levant as a consequent of danger and of high rate of insurance of their cargoes suspended the import of goods that usually were brought from the Levant in English ships or in vessels belonging to a friendly nation.

In 1794 the Levant Company applied to the government for help and from then until 1802, with the exception of 1795, the Company received an annual subsidy to support its expenses.

After Napoleon's expedition in Egypt in 1798 trade in Levant was once more possible, as there was a demand for English goods needed by the Ottomans to equip their armies.

The unexpected attack of France upon an Ottoman province led to a treaty of alliance between England and the Porte in 1799 and that was the first treaty made between England and the Ottoman Empire and made them close partners in a common struggle against France, and it brought the dependence of the Ottoman Empire upon its ally for help in naval defense, supplies and military aid [1].

2. TRADE IN THE BLACK SEA AFTER THE TREATY OF KÜÇÜK-KAYNARCA

The whole situation allowed the English Levant merchants to acquire from the Porte the long-forbidden right to enter and navigate in the Black Sea.

The first break in the strict control of trade of the inland sea came after the Treaty of Küçük-Kaynarca in 1774 when the Ottoman Empire was obliged to allow Russia to navigate and trade in the Black Sea with its own ships [2].

The crisis with Russia over Ochakov in 1791 promoted that the government was awakening to the interest that England had to preserve the integrity of the Ottoman Empire. The maintenance and defense of the Ottoman Empire was essential in keeping the British Empire that was rapidly expanding in India.

The English ambassador at Constantinople got a new significance as the look-out upon the connection which linked the kingdom to her eastern domains.

The Peace of Jassy in 1792, which carried the Russian frontier to the River Dniester gave the opportunity to tsarina Catherine to obtain from the Porte the permission to all foreign merchants trading or settling in any of the ports of her territory on the Black Sea. That was the opportunity for the English Levant merchants to get from the Porte the permission for the English flag to enter the Black Sea.

Until 1799 no progress was made towards that direction when Spencer Smith, who represented the Levant Company at Constantinople, was authorized to obtain the privilege and the permission given by the Porte to England in proof of her friendly assistance to enter and trade into the waters of Black Sea [3].

The promise was postponed until 1802 when England gained the right to pass through the Straits and English merchants could trade in the ports and territory of the Black Sea and deal a direct trade with Russia. The Ottoman government gave permission to non-Muslim merchants to sail the Black Sea and trade in its ports and settlements but it gave a great importance to the export of banned goods such as, olive oil, soap, coffee and ammunition.

Corn, tallow and timber were the chief articles in which the English merchants traded from the Black Sea region.

In 1809 after the war (1806) between Ottoman Empire and Russia, England gave assistance to Ottoman Empire, and there was a written agreement in Kal'a-i Sultaniye according to which England was entitled to support the Ottoman Empire [4].

3. THE CEASE OF THE LEVANT COMPANY'S ACTIVITY

As England's diplomatic interests at Constantinople increased it led to political importance of the English embassy to the Porte. The English ambassador to the Porte, who once was a commercial agent it was transformed into an important person who could intervene in European politics [5].

In May 1825 the foreign secretary, George Canning, communicated that the Company's authority passed to the crown and the Levant Company activity ceased to be.

The Company's activity influenced the introduction of cotton and then it laid the foundations of the Lancashire cotton industry, coffee was introduced onto England and former luxuries commodities became so plentiful that they were transformed into necessities [6].

The cease of the Levant Company's activity opened new markets for Levant merchants on the Black Sea ports and settlements and that led at the end of many consulship's activity at the Mediterranean Sea as it was mentioned in the letter dated Dec.,10th, 1828, London and signed by twenty one leading members of the Levant Company *We, the Undersigned, having had, as leading Members of the late Levant Company, opportunities of judging of the qualifications of Mr.Richard Brant, strongly recommend his as a most prosper and fit person to be appointed to fill any Consulship that may become vacant in any Port of Turkey or Greece, and We feel convinced that, if so employed, Mr.Brant would from the*

experience he has acquired of the Customs and Commercial usages in the Levant, fulfill the duties of his office with credit to himself, and to the entire satisfaction of His Majesty's Government [7].

The increasing power of the state in wealth and executive power showed the way to establish government's control both over the ambassador but also over the other representatives and commercial agents in the Levant.

4. THE MEMORANDUM OF THE BOARD OF TRADE, 1828

Later events showed that the work of Levant Company from the political point of view was complementary and it led to the establishment of a connection with the Ottoman Empire which became indispensable both for geographical and commercial aspect for maintenance of English power in the East. The Ottoman Empire was the key to India and English interest and intervention to support the Porte increased due to English commitments to East as proved by the Memorandum written by The Board of Trade in London and dated 1828 "*…to look into the state of our Commercial Relations generally with Asiatic Turkey. In the present state of their Country and the World not to say how important is to seize every possible occasion to extend the employment of our capital and Shipping*…."[8]

There was mentioned the importance for the Board of Trade to use any mercantile opportunity, to extend the commercial limits and to look for new markets, new channels of distribution,,…..*The Board of Trade is especially called upon anxiously to explore any openings that may present themselves for mercantile Enterprise: to watch for means of enlarging our Commerce, to point out opportunities which might otherwise be unnoticed, by judicious measures the attempts of skill and capital in new channels…*"[9]

The Board of Trade underlined the main geographical area of the Ottoman Empire where English commodities did not entered the markets"….*countries which compose the chief and most valuable portion of Asiatic Turkey – all that region, bounded by the Mediterranean, Black and Caspian Seas, is now literally without the pale of British Commerce*…."[10]

The Memorandum gave information and details about the region, countries, population, religion and there was mention the fact that England had less commercial activity in the area"….*These countries are Caramanian or the Eastern half of Asia Minor – Armenia – Syria – Diarbekiz – and Kurdistan. They countain a population of at least nine million, of which great population is Christian. They offer every facility of advantage to Commerce with England. The Levant Company maintained some hold, a very imperfect and inadequate one. Since the dissolution of the Company even that position has been relinquished: Smyrna and Beyrood are the only points which we retain...*"[11].

As it was underlined in text of the above mentioned Memorandum, England encouraged her merchants to enter new markets and among these regions was the Black Sea.

The events between Greek rebellion in 1821 and the Treaty of Adrianople in 1829 changed the Ottomans political position. According to the treaty of Adrianople, the Black Sea was opened to navigation for the merchant ships of all countries. The non-Muslim merchants got *ruhsat,* an authorization to trade in the Black Sea ports and an *izn-i*

sefine, a permission given to foreign ships to sail and trade in the Black Sea [12]

As a conclusion after Russia gained the right to trade on her own ships, as stipulated by the article 11 of the Treaty of Küçük Kaynarca, the other states England, France and other small European countries[13] were allowed to sail and trade in the Black Sea.

5. CONCLUSIONS

One of the most important consequence of the memorandum was the settlement of the first English consulship representative at Bucharest and that established the first step towards Lord Palmerston's view regarding Britain's policy: the Russian danger and the support for the Porte against Russia.

That was the context in which the Anglo-Ottoman commercial agreement was negotiated in 1838 – a context of political and strategic considerations, and also with economic considerations.

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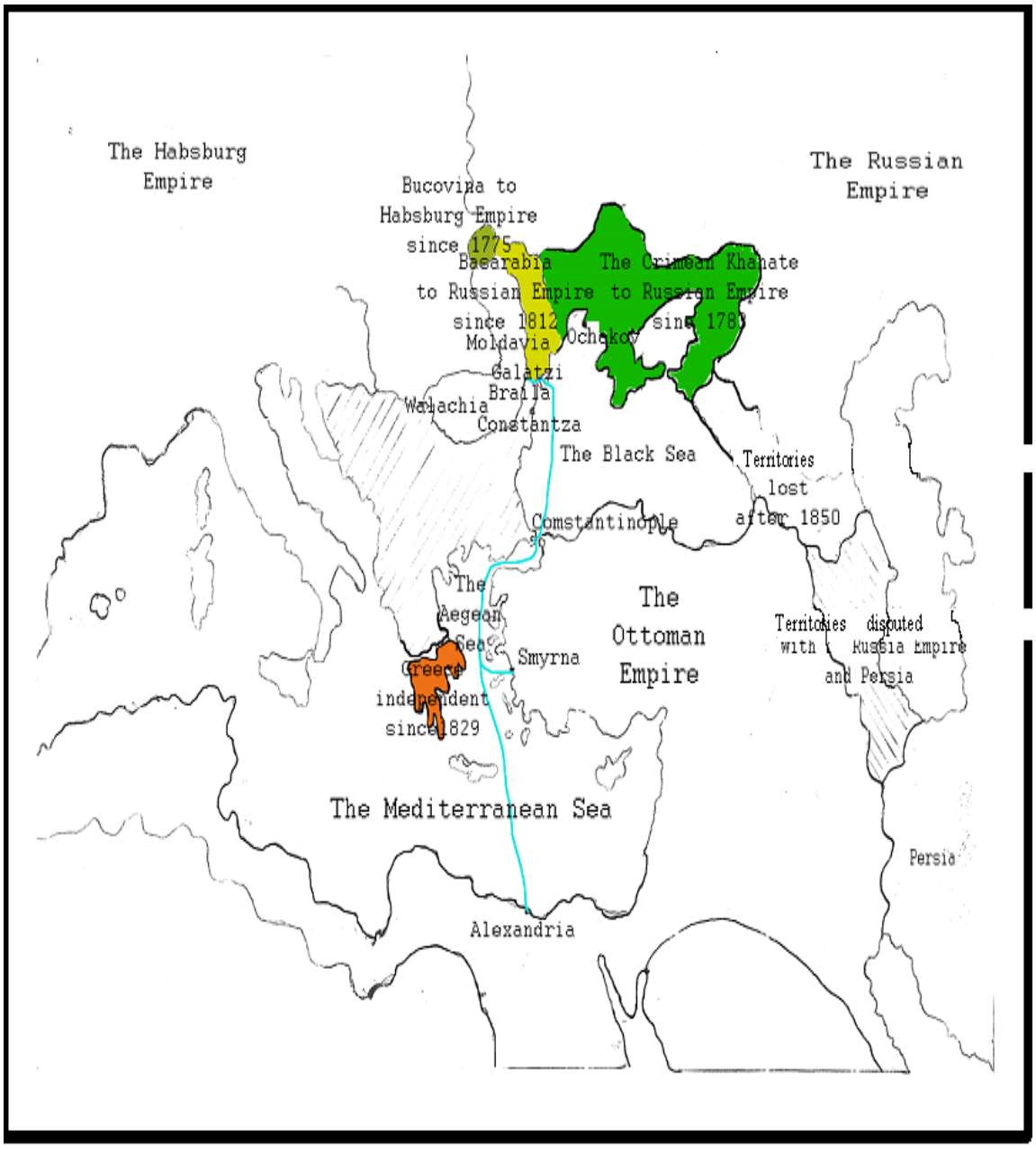
THE BLACK SEA, SOUTH-EASTERN EUROPE AND EASTERN MEDITERRANEAN SEA IN THE MIDDLE OF 19 THE CENTURY



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EUROPEAN AND NATIONAL BORDERS: TRANSFER OR PENETRATION OF VALUES

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Remember the past? Remember globalization? Can you forget for a second both of them and reconsider everything around you? Can we merely define globalization as free exchange of values without distance? What are the political implications of producing a certain type of memory or values? The usage of certain values leads to the creation of a certain type of governance. If every bit of history is contemporary and one looks to the past in order to explain the present and get a glimpse into a possible future, then memory is being influenced by the present in its attempt to account for the past.[1] *I aim to analyze the way in which the economic hardships and cultural exclusion have shaped the memory of communism and in which way the current European integration and cultural globalization are shaping the memory and value system nowadays. One danger is that being confined to the political space, memory thus runs the risk of being "relativized to ideology". It does not matter if we place ourselves on the present axis or the past axis. Memory and values risk of becoming ideology and ideology can just fade away, real values do not disappear.*

Keywords: values, memory, European, Union, change, network, innovation, danger

[1] Benedetto Croce's assertion was that history could only be contemporary because, regardless of how chronologically distant a series of events might be, their history is relevant insofar as their significance reverberates into the current state of affairs (Vittorio Vidotto, *Ghid pentru studiul istoriei contemporane* [A guide for the study of contemporary history], Bucure ti: Editura BIC ALL, 2007, p. 4).

Twenty-one years have passed since the demise of the old regime. It belongs to memory, but for how long? Although people that have lived in that period still remember, they remember only facts and memories. This article is meant to focus mainly on the memory of values and the way they can work for the regime in power, or not. This paper is meant to address issues pertaining to the type of society and personal relations that developed in the last twenty-one years. In the face of the social unanimity generated by the ubiquity of the Party activists, there were little forms of collective or individual citizen manifestation under the Party-state regime which existed before the revolution. The majority of network were accidental. Instead, currently, one can identify stable and universal practices – both formal and informal – of political and civil participation to the functioning of the state in our present day. By means of such practices, many citizens offer an extra "bit" of legitimacy to a political and social order that had become their expectation of normalcy and the subsequent criterion of ordering their own personal lives. The Communist regime exercised a type of domination that presupposed a social practice of exchanging values and resources between those who held the power, as owners of the means of production, repression and propaganda, and those who were simply the passive and constrained recipients of this power. In today's society the citizen is expected to take active part in the governing system. He is offered the possibility to exist and last by personal and collective adherence. The goal of the Communist state was to dissolve in society: the means by which it went about achieving it was the complete penetration of society. Today there is more than just one wave of influence. The top-down approach has lost some of its appeal and power. The interaction takes places at more than just one level.

The Romanian people was constantly under siege from a political body completely impervious to its interests and aspirations; the genuine personality of each and every person who lived between 1948 and 1989 was unable to fully express itself[2]. During totalitarian communism, Romanians were forcefully deprived of the possibility to evolve individually or to express their opinions in any way. They lived under constant fear and were continuously assaulted by the ideological fervor of the Party structures. We can see a definite break with that system of thinking of a state. A need for the construction of a new network build upon real values and real principles is very important in the case of former Soviet bloc countries. It was a great surprise to witness the collapse of the soviet countries because their image was one of united values and strength through cooperation. It was a real lesson for the European states in the need for a solid foundation of common values and ethics. The power of a nation like organization lies in the common values and beliefs that not only bring together its people, transforming them into citizens, but help them to network, to establish relations and to give legitimacy to the governing institution through their adhesion. Unless the new European nation will have a strong edifice it will be in constant danger of crumbling. The east-European states find themselves in the process of rebuilding their framework of governance.

During the totalitarian communism, Romanians were forcefully deprived of the possibility to develop their own individuality and lack the possibility of voicing their opinions in any creative or rebellious way. It can be said that life went on constantly under constant fear and the individuals, member of the state, were continuously assaulted by the ideological fervor of the governing structures. In our contemporary times things are different. Each individual is encouraged to actively participate in the live not only of its state, but also of the greater European nation.

It is my understanding that over time the shape of state and organization has been under

[2] See Daniel Barbu, *Republica absentă. Politică si societate in Romania postcomunistă* [The Absent Republic. Politics and Society in Postcommunist Romania], Bucuresti: Editura Nemira, 1999, p. 93-94.

constant pressure from different outside powers. Governments and governing system have invested a lot of time and effort to construct the perfect ways of creating a community and maintaining it through force. Gradually, growth started to influence the way in which a state was governed. Human history knows in our contemporary time another notion that is used to steer society, the European Society. Growth and values have fused together in a plan to unite the European States. Leaders have gradually diffused away from old trends of governing and are bent on changing the scope and means of exercising authority. Most have looked at the European Union as a possible federation of states or a confederation, but as time progresses it becomes clear that we are witnessing a radical break with the past. The current existence of the European Union does not seem to be heading in the direction of a confederation. Although it is made out of sovereign states which agree to take common action in certain important matters, the relationship among the states does not vary considerably. The existence of the European Union will not depend only on a treaty, the traditional way of creating a confederation, but on the adhesion of each of its citizens to the concept of an European nation made out of a network of states. The basis for its existence will be the common will of all of the citizens, as individuals. A great deal of effort and money has been invested in working with the citizen, with the individual and pitching the idea of an European Union so as to be not only accepted but also acknowledged. For the time being there is no legal classification for the European Union, because it represents an unique experiment. Although it bears resemblance to a confederation and some similar aspects regarding a federation, I think that constant research will prove that it will consist of a nation of network states. Interconnecting states are able to share resources and information. Due to technology development which is obvious even in our contemporary times it is a lot easier to connect states and citizens in a single system. States within the European Union share information in all fields of activity and also have complex programs of mobility in human resources. All types of resources are intended for sharing and there is an open market and open access. The process of sharing information does not happen only at the level of state, but also at the level of citizen-state and citizen and Union. After careful analysis I have concluded that we can find the following arguments for the incipient form of a future network of states. First of all the relationships between the states operate at different levels. The changes that take place and the given feed-back does not involve only the state, but reforms and change occurs at the level of corporations, firms, families and regional communities. Secondly the states are connected by more than just one specific type of interdependency: common interest, financial exchange, values, beliefs, prestige, academic values, common problems and a common foreign policy. Another aspect worth mentioning is that the measures taken at the level of the European Union are meant to be useful to its citizens. It is meant for a proper medium to be created for their development through the introduction of ideas and opportunities. The citizens find themselves in the position of exercising influence or act as brokers between different entities within the network. This network system encourages a much broader dispersion of initiative and accountability.

Taking a good look at the measures taken within the European Union it can be said that the change does not envisage only a different way of governing the new system, which starts to look more and more with a network of states, but it implies a change at the level of the citizen, the smallest particle of a state. The European Union envisages a change that will start with the citizen, continue at the level of the family, city, firm and at the end the state. History has taught us that those which held authority in a traditional state preferred to use a centralized way of governing coupled with top-down structures both in the family life and in the firm's existence. Although things have not changed totally at the moment, it is arguably possible to see in the future a switch from predetermined structures that are operating in a top-down manner to a more flexible way of governing and living, based on assigning formal power to citizens. The word of the day is discontinuity. So many dimensions are being challenged and a break is expected with the past and even with what we call "today". Although this is frightening, we are put in front of an age that resembles other periods in history. For example, take the break between the agricultural society and the industrial society. The difference is that this time the changes do not have their origin in just one genesis and that each genesis that is changed has the power of influence and creates a wave of change. This could not have happened without the presence of technology.

The European Union seems to become more and more a network of states. People are used to working with the concepts of state and nation. Although an European nation is desirable, the distinction between state and nation has to be made clear for everybody. History has taught us that unless the difference between a state and a nation is made clear the result can be devastating, resulting either in a failed concepts of governing or in violent turmoil. Contemporaries and people generally tend to make a confusion between a nation and a sovereign state. Historically speaking a nation has referred to a group of people who share a common history, culture, ancestry and territory. I take great pleasure in giving an example of the notion of nation being employed with its right meaning, its intended meaning by Cicero in "Philippics Against Mark Antony in 44 BC. He uses the term nation to refer to all the people that are within the borders of the Roman civitas, roman community, which was united by different values and within the natural borders of the European continent.

"Omnes nationes servitutem ferre possunt: nostra civitas non potest." ("All races are able to bear enslavement, but our community cannot.")[3]

The state has a different definition in the social sciences. The emphasize is on force and on centralized government. The state represents a compulsory political power which has been institutionalized and has the monopoly to the use of power within its borders. Another interesting fact about the European Union. Ethnicity has been over the course of time an active and most powerful concept. It is very hard to argue otherwise. Europe's geographical space and cultural landscape is being changed according to a different way of looking at a nation. As it was mentioned above, when we are talking about a state, we are talking about a totally different concept in comparison with the concept of nation. Ethnicity has played a powerful basis on the creation of most states. The dominance of one ethnic group has demonstrated that the geographical territory belongs to a state. The European Union only seldom works with the concept of ethnicity. It turns out that the concept is mainly used in discussions about the need for a better understanding of ethnicity but not in dialogues about the creation of a viable and working European system of states. Ethnicity does not play a vital role in the formation of the European nation. Although it most surely will remain a highly important factor of debate and

[3] M. Tullius Cicero, Orationes: Pro Milone, Pro Marcello, Pro Ligario, Pro rege Deiotaro, Philippicae I-XIV (ed. Albert Clark, Oxford 1918.) Online at Tufts.edu

concern for the European policy it will not be able to define the European identity and will not be part of the basis of this organization. The formation of this organism need to have a solid base that can not be changed or moved by demography or other unforeseen factors. The focus of the European Union is on forming an European citizen, not on determining their origin.

Taking a good look at the measures taken by the European Union it can be seen that it prefers the organization of a interconnected network. It becomes plausible to think that a system of states based upon a network system has a totally new perspective than a hierarchy system of organization. Such a system stimulates the learning process of some values that bring together and unite all of the states. The learning process develops through action and innovation. The network, in this case the European network can be the perfect way of connecting the states and a quick means of disseminating the necessary changes and also any innovation that might benefit the entire system. In the past any union of states has had at the basis the principle of hierarchy. Information was send through difficult channels that were a burden. Through a network of states each state is given and provides accurate information regarding its market, its citizens and its national interests. The European Union holds the key to this network. Its leading organisms have to develop the necessary infrastructure for the changes that take place to be disseminated towards its citizens. The new organizational paradigms need a proper infrastructure.

The results of the survey conducted on students from their first and second year of faculty entitled me to believe that there is a balance between the conserved values of the past, traditional values, and the new values, which represent change. Most of the time we are talking about values that are inherit to a population, values that have survived despite the means of democratization or organization and about old values but rebranded to fit the new situation. Tradition and novelty are complementary. The changes in a country that belongs or aspires to EU accession are of two types. On one hand we have emergent changes. These changes are formed naturally becomes of the contact with the European culture. That is why people in Romania have started to change some part of their behavior so as to be more European. These changes are spontaneous, under the influence of macro-social, political or economical changes. These changes are permanent and occur at the level of the individual. The process starts from the stage of the individual and it passes to the immediacy of the individual's social circle and then to the community. As a result political and economical decision factors may become later aware of this change trend and react to it in order to obtain popularity and support from the population. In general terms it can be mentioned that in the end the political and economical apparatus will have to adapt to this change in the life of the individual. The change occurs because the political decision factor will want to win the support of those individuals and the economical decision factor will want to transform that community into a market. The only rule that applies to these changes is chaos, because it is very hard to predict the final result and when the process will end.

We also have the planned changes. These changes are systematic and they are induced.

These measures are applied having in mind a particular result, a result which will be measured according to certain values. The purpose of these changes is to reconstruct the system being specially design to create a new framework, a new contour for the entire country. At the end of this process, the measures will affect the entire system, all the individuals, and the individuals will have to adapt to this context and make it their own. These changes are to a very small degree flexible and are orderly and under constant verification. The target must be achieved. The completion of the process has a deadline which must be reached in time.

The network-nation type of organization is a totally new way of envisaging a community of states. The strength of a network lies in the convergence point of all the states that are involved. This convergence point can be represented by a value system that will legitimate the authority of the nation, on one hand, and can act as a stimulus for action and innovation. Astley, W.G. pointed out that the relations that exists today got so complex that a reality with a network in any field of activity is slowly becoming a stringent need. Nation building and community building in Europe will continue to represent a great effort, both economical but also political from both governments and citizens. A balance will have to be achieved between functional integration, brotherhood among citizens from different states, ethical principles, values and nationalist resentments.

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MILTON'S SATAN: HERO OR ANTI-HERO?

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Abstract: *Satan is the most controversial and appealing figure of Paradise Lost. No convincing single source for Milton's Satan has been found, not even the Bible, which contains very little evidence referring to Satan. Satan is, according to some theories, a vital part of a Manichaean universe, the "infinum malum" necessitated by a "summum bonum" which is God. Milton's attempts to concentrate evil in Satan, however, were not very successful. There have even been claims that Satan is superior in character to Milton's God. The critics are divided on the question whether Satan is a hero or an anti-hero: the anti-Satanist movement emphasises Satan's selfishness or folly while Satanists highly praise his courage and determination. The present paper aims at demonstrating that Milton's Satan is a multifaceted presence, often contradictory, both a hero and a villain, a character revolted against tyranny and a tyrant, a preacher of freedom and a prisoner of his own egocentrism.*

Keywords: *epic, hero, anti-hero, ambivalence*

The source of inspiration for Milton's puzzling character remains unknown. The Bible contains very little evidence referring to Satan. According to Biblical records, he is the author of all evil, the master of disguise and man's worse enemy. Satan is, according to some theories, a vital part of a Manichaean universe, the "infinum malum" necessitated by a "summum bonum" which is God. To combat this theory came the doctrine of the early Church which sustained that evil had no real being but was merely "privatio boni", a privation of good. Milton, on the other hand, presents evil as real and isolated in a single being, and therefore punishable.

Milton's attempts to concentrate evil in Satan were not very successful. The critical reactions have seldom been able to regard Satan as the depiction of pure evil. There have even been claims that Satan is superior in character to Milton's God. Unfortunately, sometimes the critical approaches tend to take their argument to extremes in their endeavour to strengthen their cause. For instance, the anti-Satanist movement emphasises Satan's selfishness or folly while Satanists highly praise his courage. Either of these perspectives risks to ignore the elements which do not fit into their theories, much to the detriment of the work's itself. The dispute remains unsettled, and it should remain so or else we would be destroying much of the poem's value and significance. A more appropriate solution would be to recognize the "character's ambivalence"[1], a precondition

[1] John Carey, "Milton's Satan". *The Cambridge Companion to Milton* (Cambridge: Cambridge University Press, 1989): 132.

of the poem's success and a major factor in the attention it has aroused. This controversial aspect of the poem has the advantage of validating individual reinterpretation and renders the modernity and appeal of the work.

The character of Satan cannot be understood only one way, he has a plurality of meanings and therefore to limit him to only one specific definition would ruin its singularity. A multifaceted presence, often contradicting himself, Satan is both hero and villain, revolted against tyranny and tyrant, preacher of freedom and prisoner of his own egocentrism. Milton seems to be deliberately portraying several different and sometimes incompatible Satans.

As John Carey observes, the term most suitable to express this ambivalence of character is "depth". Depth in a fictional character, Carey argues "depends on a degree of ignorance being sustained in the reader," the illusion, he continues "must be created that the character has levels hidden from us the observers.[2] None of the other characters of Paradise Lost exhibits such non-transparent nature. Adam, Eve and God, all lead simpler existence, at least at the level of words they speak. Unlike them, Satan seems to adopt dissimulation as an "art de vivre".

It has been argued that *Paradise Lost*'s Satan deserves the tragic hero status. He has not only the stature of a tragic hero, but also his attributes. In the Greek tradition, the tragic hero was supposed to stir up admiration, fear and pity and had to display a tragic weakness or flaw in his character which was to lead to his downfall. Satan may be said to inspire these emotions. Moreover, critics have often compared him with great tragic figures such as Prometheus, Faustus and Macbeth. He is admirable in his indomitable pride and his unyielding ambition, just as he inspires fear and pity for his forecast doom and his determination to fight against something he apprehends as undefeatable. Paradoxically, his main qualities are also his tragic flaws: envy, pride, ambition, self-glorification give the character his singularity and magnificence but also pass the rigorous sentence on him.

A good Christian, Milton theoretically condemns the devil's master, but, in the same time, he feels attracted, against his will, to this character, proud and revolted like he himself was. In spite of Milton's attempts to make Satan an incarnation of evil, he is still a fascinating figure which gains our admiration and sympathy. As William Hazlitt remarked, he is "the most heroic subject ever chosen in a poem."[3] Indeed this protagonist meant to be the most dissenting of the poem, is by far the most interesting and convincing through his complexity and authenticity. This can be easily understood when Satan's description is compared to God's. God is described monochromatically; He is the omniscient and omnipotent God of Righteousness. To stress this idea, Gen Ohinata says that Satan's appeal grows once with his misery.[4] He appears very human because he is drawn as a complete character and thus, the reader who pities his misfortunes can have familiarity and sympathy with him. Throughout much of the early part of poem, Satan retains his hold on the imagination of the reader, he is a powerful and complex character seeking to assert his identity against invincible odds, refusing to bow in submission to someone he perceives as a tyrant.

Milton's presentation of Satan makes it difficult for the reader not to respond to him with some admiration and sympathy. Hamilton states: "he wins our admiration the more firmly because he is ultimately real, while the inhabitants of Heaven are remote and strange."[5] He is the most real and tangible of the spiritual hosts. He is easy to identify and sympathise with because the weaknesses he exhibits – although on a much larger scale – are predominantly human. Satan is the first of the created beings and the most disdainful; his ambition is the greatest: he

[2] Carey: 133.

[3] William Hazlit, "On Shakespeare and Milton". *Milton Criticism. Selections from Four Centuries* (London: Routledge & Keagan Paul Ltd, 1965): 107.

[4] Gen Ohinata, *Hesitation and Retrogression in Paradise Lost* (Hishinomiya: Kwansey Gakuin University Press, 1981): 50.

[5] Rostrevor G. Hamilton, *Hero or Fool: A study of Milton's Satan* (London: George Allen & Unwin Ltd, 1944): 39.

aspires to conquer the empire of Heaven and take up the throne of the universe. The greatness of the character resides in the fact that although lying in a fiery gulf surrounded by "darkness visible", tortured by fire, Satan rises above his predicament and adapts to the circumstances. Hell becomes the abode of his palace Pandemonium and the residence of all evil. Not only does he survive the greatest battle in the history of the universe, he also finds the strength to rally himself and establish a new empire in Hell from which to conquer a new world.

In all the councils, surrounded by legions of rebel angels, he distinguishes himself as the sovereign leader. As a true leader he argues persuasively that there is still hope for battle and installs in his followers the determination to regain their former state. He bestows into their beaten spirits some of his own ferocious courage.

Nothing can match the heroic determination, power, courage and energy manifested throughout Satan's early speeches. The convincing eloquence with which the debate is carried on stresses Satan's self-glorification. He is, as ever, the predominant voice of the assembly, allowing, it is true, the voicing of individual opinions, but seeing to it that his views and his will prevail.

Conscious of the fact that he was in danger of portraying Satan as too much of a heroic figure, Milton made efforts to belittle him through the use of less favourable imagery, and by highlighting his flaws. Satan's courage diminishes, and his character deteriorates greatly through the epic as he gradually becomes an egotist who is only looking for personal glory. Coleridge recognises in him the "alcohol of egotism"[6], a self-absorbed, self-obsessed creature. His attractiveness is only initial, his original charisma, courage and confidence diminishing with Book IV when he reveals much about his torment and despair. The reader thus becomes aware of his weaknesses and his ability to fall.

Milton shows skilful tact in his treatment of Satan, the personage degenerates and gradually loses our sympathy. What seems clear is that the poet is continually trying to control the reader's response to Satan in order to make sure that he doesn't respond to the magnificence of the poetry in a manner inappropriate to the willed intention in the doctrine. He introduces revelatory commentaries during Satan's speeches as if the poet were afraid that his fiction will not subject itself to the orthodox meaning he wants to assign to the story.

Satan's consciousness is also problematic. Like no other character of *Paradise Lost* there is a discrepancy between his inner state and the outward profession of appearance. At times he becomes torn with conflicting passions. The inner debates and self-criticism reveal him as a creature of dynamic tensions. Therefore, at some points in the story, it is difficult to label Satan as essentially evil. His malignity is to a great extent attenuated since he speaks the truth and curses himself as God cursed him: "Me miserable! which way shall I flie
Infinite wrauth, and infinite despare? Which way I flie is Hell; my self am Hell;" (IV, 71-5). The natural reaction is to show compassion to this being trapped within his own inevitability. He is the titanic character who in spite of his resolution and fortitude is not able to rise above his doomed condition. No matter how hard he tries he cannot escape himself.

[6] Samuel Taylor Coleridge, "Milton". *Milton Criticism. Selections from Four Centuries* (London: Routledge & Keagan Paul Ltd, 1965): 95.

Satan also has a tendency towards love and beauty; he is not irrevocably hardened or incapable of gentle emotion. William Hazlitt observes that Satan "is not the principle of malignity, or of the abstract love of evil, but of the abstract love of power, of pride, of self-will personified, to which last principle all other: good and evil, and even his own are subordinate."[7] Satan has a capacity for a different role from the one the fiction assigns him.

As he surveys the new world and approaches the couple in Paradise, he says he feels an inclination to love them, thus surprising the reader with a revelation of desire for love in a figure which was believed to be wholly committed to wickedness. According to Hamilton, Satan in imagination defers from Satan in idea: "In the abstract we may conceive him, whether actual or symbolic, as wholly evil, the negation of all good, but, when we try to imagine, it will not be surprising if all kinds of elements – foolish, virtuous, heroic, human – begin to enter in."[8] The ambivalent character of Satan is emphasized by these unexpected and contradictory features he seems to manifest. Whenever we may think we've begun to understand him, we are stopped by his own inconsistencies.

Thus, in spite of his momentary tenderness, he recollects his hatred and falls more and more a prey to envy and hatred. Why Satan should not learn from his fall remains an issue of ambivalence.

John Carey makes a very pertinent affirmation when he argues that Satan is "the victim of a breakdown of fictional logic inherent in the terms of the myth Milton is transcribing."[9] This would explain the contradictory aspects of Milton's Satan, like the fact that he undertakes a journey to Earth although he knows his mission is bound to make things worse for him. He is cast in a poem with an omniscient and omnipotent God, and this means that every move he makes against this God must be self-defeating. His fictional function is precisely to make hostile moves he is the fiend, the enemy.

The question regarding the relationship between Satan and Milton's intentions, whether he consciously or unconsciously sided with the devil, whether Satan is the hero of the poem or not is clearly an unanswerable one since we cannot have access to Milton's mind or to his subconscious at the time of writing.

Many theories have been launched. Among them, the psychoanalytical approach which adopts Freud's analysis of the psyche and applies it to Satan's disputable nature. According to this theory, Satan is the expression of the id ostracized by the superego (God) and exercising his influence upon the ego (Adam and Eve). In *Civilisation and its Discontents* Freud speaks of the great influence of the superego and the ethical demands it imposes on the individual in modern culture.[10] The superego demands of the individual to restrain his aggressiveness and his hunger for self-satisfaction. This would explain why Satan cannot cope with his inner struggle and why he cannot submit to the regulations of God.

Following this idea, the battle between Satan and God may be viewed as a psychological one. The sovereignty of the Spirit is highly praised by Milton throughout the poem. Satan himself speaks about the "unconquerable will" (I, 104), that is, his psychological power.

Satan perpetuates his heroic fantasy, allowing himself to be the hero of his own tale just as he is the anti-hero of the Miltonic epic. He refuses to acknowledge his failure as a leader of the rebellion and still sees himself as a glorious war hero. Like all heroes, he brings his boon, the corruption of mankind, in triumph back to his community, the rebel hosts, but it turns out that instead of bringing order it produces chaos. All the angels are turned into serpents and their applause turns to scornful hisses.

[7] Hazlitt: 118.
[8] Hamilton: 8.
[9] Carey: 136.
[10] Sigmund Freud, *Civilisation and its Discontents*, translated by Joan Riviere (London: edited by James Strachery, 1979): 80-1.

Merritt Hughes believes that Satan is created as "an example of the self deception and the deception of others which are incident to the surrender of reason to passion."[11] He wants to maintain his glorious image of heroic conqueror and in doing this not only does he lie to the others but he also deceives himself.

The romantic criticism perceived Satan as the quintessential hero. Shelley for example considered that Milton was engaged in a heroic conflict with the principle of evil on its earthly manifestation of tyranny and injustice.[12] In contrast, for Shelley the principle of evil is incarnated in tradition and comes dangerously near to being identical with law itself, against government itself and not necessarily against government which is tyrannical and corrupt.

It is in Satan that Shelley finds the true embodiment of Milton's personality and of his moral ideal. For him and many other critics Satan has remained the real, if not the technical hero. There is one very important objection to all purely Satanic explanations and that is that the earlier books have been admired at the expense of the whole poem. The grandeur of Satan is, however, confined to the first part of the poem. The romantic appreciation, in exalting and generalizing the grandeur of Satan has distracted attention from important aspects of the poem, and has altered the professed moral of the poem.

A more temperate perspective belongs to Tillyard who makes a clear cut distinction between the conscious and unconscious meanings in *Paradise Lost*. In his opinion Milton certainly intended Satan to be "a terrible warning embodiment of the unrestrained passions, inspiring horror and detestation rather than sympathy."[13] He is meant to incarnate those bad passions that entered man at the Fall, expression of man's unappeasable dissatisfaction with what he has.

Other critics believe that Satan expresses something in which Milton believed strongly: heroic energy. Satan is the one figure in *Paradise Lost* whose strength is shown through conflict and endurance. It is through him that Milton's own heroic energy is most powerfully shown. But he cannot be the hero of the poem because his energies are evil. He is the most powerful figure of *Paradise Lost*, more fascinating than the Son himself. The odds are against him but he still struggles, he is energy and passion incarnated. Christ, on the other hand, is energy as well as reason; He is the creator while Satan is the destroyer. Milton means to express as much energy in his description of the world's creation as in Satan's exploits, but Christ seems to be connected with reason above all.

Milton does not accept the standard interpretation of the heroic figure, he reinvents it. He creates a character who is at once someone we tend to appreciate as heroic, and someone we want to see defeated. Challenging the heroic stereotypes, Milton considers that the most heroic qualities are humility and submission to God. Adam in choosing to be with his wife may be said, from a traditional heroic point of view, to be acting as heroic as Satan ever had. But he didn't escape punishment; he was instead reminded that his duty to God came first. Likewise, if Satan was to be the Miltonic hero, he would have followed God irrespective of all other heroic inclinations; instead he is

[11]Merritt Hughes, *Ten Perspectives on Milton* (New Haven: New Haven Press, 1965): 177.
[12] Percy Bysshe Shelley, "A Defence of Poetry." *Milton Criticism. Selections from Four Centuries* (London: Routledge & Keagan Paul Ltd, 1965): 358.
[13]E. M.W. Tillyard, "*Paradise Lost*: Conscious and Unconscious Meanings." *Milton Criticism. Selections from Four Centuries* (London: Routledge & Keagan Paul Ltd, 1965): 193.

acting constantly in opposition to the divine will. This is when the difference between Satan and Man emerges more clearly. Adam and Eve decide to take a submissive place in God's plan and remain hopeful and humble. Diametrically opposed, Satan could never be capable of repentance and supplication and embraces "desperate revenge" (II, 107) as his life's purpose.

In conclusion, Milton's definition of heroism is not physical bravery or military adventure, and therefore Satan is not the hero, but rather an expression of the theological heroic ideal by opposition. He is however one of the heroes, and a very significant and appealing one. He is the antagonist who drives the plot with his machinations, the great adversary who we are to loath for his rebellious nature and a character with a great vital force of his own even if it lies in the direction of evil. There is a terrific drive and adventurous daring in Satan that fascinate the reader, and if he is finally overthrown, this is because he is not only God's enemy but also the enemy of Man's happiness. As he pursues his vile purpose, he degenerates from the proud rebel of the first books to the liar, cruel and spiteful seducer of the following books. His superior endowments decline until, at last, he becomes the lowly serpent, he fades away and Adam emerges as the hero during the later course of the poem.

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LIMITATIONS TO LAUNCHING DEVELOPMENT PROJECT OF INTERCULTURAL COMMUNICATION COMPETENCE IN THE MILITARY ENVIRONMENT

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Abstract: *Through this article we intended to highlight the stage in which projects on developing the intercultural communication competence were launched and implemented that is, to identify the possibility of applying them within the military environment. Generally speaking, projects have been implemented within the European environment, on topics related to training persons willing to work abroad and also "training" teachers` intercultural communication competence. The military environment has been "avoided" by launching some international projects, although researchers have identified the need to form at least some skills/abilities concerning intercultural communication. In the present article an important emphasis is on directions and limitations regarding the possibility of launching such projects having as starting point the Romanian military educational environment.*

Keywords: projects, *communication competence, Romanian military personnel*

1. INTRODUCTION

A prolific direction of developing an interpersonal communication competence and, especially, an intercultural one, concerns the launch of projects that involve military educational institutions of Romania and of partner countries of the North-Atlantic Alliance or of the European environment. For a judicious projection of such a tool of developing the intercultural communication competence, we have pictured projects on this topic regarding the general educational environment, then, we've focused on the military environment, in order to identify, in the end, the directions and limitations on the possibility of promoting the formative design of Romanian military personnel in accordance with the intercultural requirements derived from their working performance in the theatres of operations.

2. PROJECTS ON GENERAL EDUCATIONAL ENVIRONMENT

Starting from the models of forming/developing the intercultural communication competence, some developing projects of this competence have been implemented. One of these is the IICEE project (Interpersonal and Intercultural Competence for Enlarged Europe), accomplished within the framework of Erasmus/Socrates program that aimed at and applied a module for training persons willing to work into a boundless world. This module has been structured on three learning units:

- „*interpersonal and intercultural communication abilities, of presentation and team working;*
- *problem-solving creative strategies;*
- *trans-cultural project management and team working facilitation*" (Sola, Wilkinson, 2008:59).

Accomplished with the financial support of the European Committee, coordinated by Great Britain and with partners from Germany, Spain, France, Finland, Italy, Netherlands, Hungary, Lithuania, Poland, Slovenia and Slovakia, the IICEE project aimed at developing the communication competence by the accomplishment of an interrelation between the cognitive, affective and conative subcomponents, of this competence, courses being „*experimental, conceptual, practical, prospective and imaginative*" (Schneider and Barsoux, *apud* Sola, Wilkinson, 2008:60). The IICEE module intends to allow managers (the present or future ones) to continue their objectives within diverse cultural environments and to assure them the necessary abilities to act into a multicultural context. In order to develop the intercultural communication competence, this module aims at, among other things, assuring the needed level of knowledge and at forming the abilities necessary for intercultural communication competence[1]. For example, in Great Britain, at Thames Valley University, the project included the ICBE module (Intercultural Communication for Business Environment) organized for 15 weeks, that presupposed spreading from the European level to the global one.

Other projects in the field of forming/developing the intercultural communication competence targeted the communication efficiency within a variety of cultural frameworks, of the development of multicultural consciousness or social mobility into a world where multicultural professional staff became an everyday reality. The European Council supported many projects that intended to develop the intercultural communication competence and/or the critical cultural consciousness for native or non-native speakers (Penz, 2009:55-58).

One of these projects, ICCinTE (Intercultural communication training in teacher education) coordinated by Ildikó Lázár, aimed at introducing the „training" intercultural communication competence into the teachers` training schedule. The project ended with the achievement of a guide about forming and evaluating the intercultural communication competence (Lázár *et al.,* 2007). The reference model used within the forming project is that of Byram`s, a set of forming and evaluating methods being proposed, such as:

- intercultural knowledge (*savoirs*) from the humanist perspective, in terms of culture and civilization, from anthropological perspective, in terms of diversity knowledge and from sociological perspective, in terms of knowledge of socio-cultural background;
- the intercultural *know-how* (*savoir-faire*), that is, forming/evaluating with the purpose of interaction, adequacy, integration, interpretation and negotiation within distinct cultural backgrounds;
- intercultural identity (*savoir-être*), that is forming/evaluating critical cultural consciousness, considering other identities, beliefs and values in relation to own identities, beliefs and values (Lázár *et al.,* 2007:27).

Evaluation, predominantly formative, targets not only the enhancement of knowledge level but also catching performative abilities in the given contexts, along with displaying the reference elements from the new world perspective.

[1] The purposes of the course are: „*1. to equip learners with the necessary knowledge, capabilities and skills, drawn for a range of academic disciplines and vocational backgrouds, to work and provide leadership in cross-cultural management contexts; 2. to introduce learners to the major principles strategies and tools of „cross-cultural management"; 3. to provide current and future practitioners with an internationally respected cross-cultural expertise and to broaden learners' awareness of the European dimension by consciously focusing on perspectives provided by the new member state; 4. to enhance learners' employability and job performance in the European and global labour market*" (Sola, Wilkinson, 2008:62-63);

LEA Project (Language educator awareness), coordinated by Mercè Bernaus, made on support structure of competences, as they were defined through the European Common Framework of Reference, aimed at teachers` training in order to develop the multilingual and multicultural consciousness. LEA project objective was to develop social cohesion through teaching/learning a foreign language, and for that, within the process of teaching, a set of useful materials has been elaborated to introduce into teaching practices of multilingualism and multiculturalism. The intercultural communication competence (or the multilingual and multicultural competence) can not be acquired by overlapping other competences, but it represents a complete complex, dependent on the accomplishment of four dimensions: the socio-affective dimension, the dimension of linguistic and communicational registers, learning strategies dimension and interaction management dimension (Bernaus *et al.,* 2007:15). The working areas, inseparable at the practical level, but possible to be interpreted distinctly at theoretical level, were the social and the personal ones, that is, the professional one.

ICOPROMO project (Intercultural competence for professional mobility), coordinated by Evelyne Glaser had objectives close to those of IICEE project: it triggered the development of critical cultural consciousness into native and foreign cultures and the development of intercultural communication competence for persons that intend to work into distinct cultural environments or into international companies (Glaser, Byram, 2007). Made after the intercultural mobility model, and presupposing intercultural learning through mobility, the project intended to provide the multicultural teams with the necessary background for team- working with other cultures representatives. The project benefitted of Michaël Byram`s involvement as expert in the field of forming the intercultural communication competence. The project coordinators considered that forming the intercultural communication competence represents a process that never stops during the whole life, each new experience increasing the competence.

GULLIVER project (To get to know each other leads to better mutual understanding), coordinated by Magdalena Bedynska, offered the possibility to organize a forum for intercultural interaction of 23 categories from 22 European countries (Penz, 2009:56-57). The organization of this virtual discussion forum analyzed the possibility to integrate such authentic interaction instruments into the routine of classroom teaching act, with the purpose of forming/developing the intercultural communication competence.

3. PROJECTS REGARDING MILITARY EDUCATIONAL ENVIRONMENT

In the military field, the problem of cultural contact with other cultures representatives was not given special importance. In order to accomplish the peacekeeping mission, the soldier (no matter the source culture), follows a training program in the country and where the mission takes place. But, in some cases, due to the lack of some relevant international experiences and, as there is no adequate training, the own cultural matrix will shape the way of thinking and acting in relation to the others. The necessity of adequate training, and especially, of forming/developing the intercultural communication competence, has been remarked by various researchers, but no training program has been implemented based on one of the models previously mentioned or

a theoretical substratum that came from the adaptation of one or more models to the inland cultural stock. As a rule, military field researchers speak of the necessity of shaping some skills/abilities or see the intercultural communication competence as a juxtaposition or addition of abilities, formed and automatically put into play. „*Many of the skills required for intercultural competence also relate to learning – learning about one's own culture and that of the stranger, learning new communication styles and scripts, learning to suspend judgment and perceive new ways of looking at situations, and learning new patterns of behavior*" (Elron *et al.*, 2003:269). In such a case, a way of developing this competence is the cultural adaptation of the military personnel to the terms of mission development, by social engagement into the cultural background in a comparative manner (when representatives from more cultures meet within a common and normalized framework of mission development, they usually do, in the beginning, comparisons between affiliated cultures, followed by learning out of specific differences related to customs, norms and values of The Other), that is, by involvement into specific aspects of requirements, by exploitation of cultural differences and by trying to find the optimum modality of meeting the mission demands (inclusively by identifying those differences that can lead to lifting of some communicational barriers) (Elron *et al.*, 2003:269).

This manner, of cultural adaptation, is not always adequate, as the mission period of time is limited and the cultural adaptation may provide answers regarding the adequacy of cultural behavior without explicit understanding of the necessity of adopting that particular behavior. The easiest way is that of adequate selection and training the personnel that is to participate in a mission. An adequate selection and training may assure a higher efficiency level concerning the mission accomplishment, given that „*Humans embedded in the complex military systems must possess the knowledge, skills, abilities, aptitudes, and temperament to perform their roles effectively in a reliable and predictable manner, and effective military management requires understanding of how these qualities can be best provided and assessed*" (Blascovitch, Hartel, 2008:7). So, the military system needs professionals who, besides the requirements related to adequate use of technology, to stress resistance, to behavioral flexibility, to the ability of acquisition in the field of using a foreign language, must have a proper level of cultural consciousness. Thus, the requirement of forming/developing the intercultural competence is imperative as long as the mission accomplishment depends on the understanding of a certain intercultural context. On the other hand, once leadership is based on communication, efficient communication means to understand the others. From this perspective, the communication competence must be formed. Additionally, considering Wen`s model, for an adequate response in the theatres of operations, the servicemen need the forming/developing of intercultural communication competence.

Even if projects developed regarding forming/developing the intercultural communication competence for the military personnel that joins peace keeping missions do not exist, the committee for opportunities in basic research in social and behavioral sciences for the American army draws attention on two major aspects related to forming the intercultural communication competence for military personnel:

- firstly, they recommend research and development of projects in this reference field: „*The Committee recommends six areas of research on the basis of their relevance, potential impact, and timeless for military needs: intercultural competence, including second-language learning; teams in complex environments; technology-based training; nonverbal behavior; emotion; and behavioral neuropsychology*" (Blascovitch, Hartel, 2008:2);
- Secondly, the way forward for developing the intercultural communication competence is recommended: „*The ability to navigate and adapt to different cultures is known as intercultural competence or cultural intelligence. The latter term includes cognitive (knowledge of language, customs, beliefs),*

psychical (body language, gestures), and emotional (confidence, adaptability, openness) components. Thus, a key issue for the military is to select, train, and develop individual who possess these qualities and to be able to function in multiple cultures" (Blascovitch, Hartel, 2008:15)

Although the necessity of forming/developing the intercultural communication competence has been reported, The U.S. doctrine does not contain elements concerning the way in which cultural consciousness may be activated. More, despite the interest to form the cultural consciousness at political and diplomatic levels, the culture role (language, religion, values etc.) is also neglected when it comes to training, to learning a foreign language, but especially, when it comes to training for international missions: „*Cultural awareness is not currently included as part of foreign language training, and the cultural training provided to soldiers prior to deployment trends to be overly simplistic, typically focusing on lists of do's and don'ts without providing a context for cultural understanding. Current US joint doctrine does not stress consideration of any type of cultural awareness and competence factors during the deliberate planning process. Intelligence gathering also neglects culture*" (Wunderle, 2008:1). But, if the problem of the lack of adequate training is raised in what the U.S. army is concerned, then it can be easily recorded in the case of other armies. Researchers in the field of military sciences of other western armies have also remarked the necessity of a proper lesson, of an adequate training, in line with international mission requirements. Regarding the German army, Maren Tomforde draws the attention on developing intercultural abilities: „*Besides their military skills soldiers, especially officers, also need political, diplomatic as well as intercultural abilities in order to meet the various demands the missions*" (Tomforde, 2009:40). The Dutch army trains cadets to form their intercultural communication abilities, and the training is done as a result of accumulated intercultural experience, in a certain order and with emphasis on some aspects considered important: „*(...) cadets also receive, prior to their academic education, training in Intercultural communication and Negotiation. During this training, cadets' cultural competences (such as openness, respectfulness and cultural empathy) are first assessed, and hopefully subsequently enhanced by, amongst other things role-play exercises*" (Olsthoom, 2009:155). Canadian researchers in military sciences field operate with the term „cultural intelligence" (*cultural intelligence*, CQ), similar to that of intercultural communication competence. CQ becomes a compulsory requirement for adapting to contemporary operational environment, being necessary to be integrated „*into education, training, planning, and operations*". Starting from general Robert H. Scales`s assertion, dr. Emily Spece (2010:115) underlies the need to develop a high level of cultural intelligence (Spence, 2010:119-120)[2].

[2] „*(...) officers and soldiers need to learn how best to use information and hand to afford the most desired results when dealing in intercultural situations. Essentially, they need to know how to demonstrate high CQ. In order to demonstrate high CQ, individuals must be capable of critical thinking, understanding basic human behaviour and the human rationality, appreciatingthe basics of cultural groupings, as well as understanding and appreciating the role that perspective plays in people's configuration of the world, their place in it, and their view of your place in it. Learning these four foundational skill sets will enable soldiers to apply specific regional/cultural information about a particular group of people in order to further their cause and achieve their aim.*";

The phrase „cultural intelligence", used mainly in the specialized literature of North America, hasn't been defined with the same methodological rigor as the intercultural communication competence. Emily Spence (2009:125-126) remarks that there are distinct terminologies used for advantageous exploitation of cultural knowledge[3], by „cultural intelligence" meaning the intercultural communication competence. On the other hand, William D. Wunderle (2008:53) subordinates cultural understanding and intelligence to cultural consciousness, whose maximum stage is represented by cultural competence[4].

Irrespective of the used terminology, the issue of developing the intercultural communication competence applies only theoretically, the mission cultural training being done by providing a set of prescriptions (of „yes" and „no") that do not give also the possibility to properly understand the cultural fund.

The same issue of an insufficient mission training from the cultural point of view was remarked in the case o the Romanian Army. Călin Hentea (2006:33) shows that „*This peace-keeper connection to the culture and reality of a theatre of operations is kept in most cases at a superficial level that is not enough to realize a more profound intercultural dialogue. One of the causes of this situation is principle of military staff rotation once in six months, period considered as being optimal from their psychic affordability, but insufficient from the its mission effectiveness point of view*"[5].

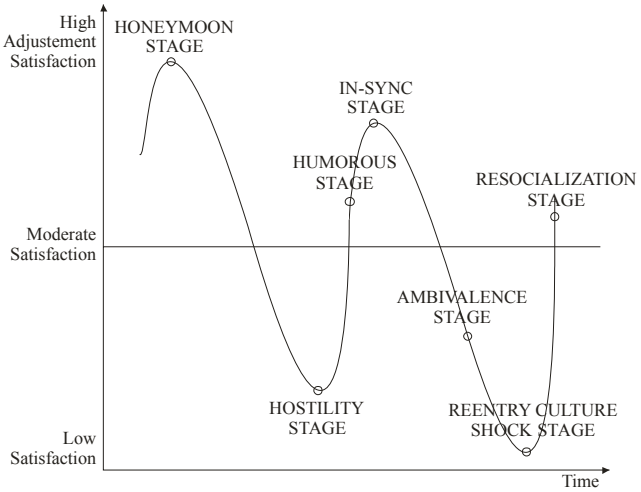
To underline how the low level of cultural consciousness can affect the success of a mission, William Wunderle (2008:54) appeals to an adaptation of Gullahorn & Gullahorn`s intercultural adjustment model (*apud* Spitzberg, Changnon, 2009:23)[6]. Cultural understanding may be realized not only as a result of an adequate training, but also as a needed adequacy to the intercultural environment (theatre of operations). In the first case, this final stage is a certain result, whereas, in the case of adaptation, depending on the profile of the military in mission, either the desired stage is reached, or there may be a failure in the mission accomplishment.

[3] „*Ces termes includent, notamment, la connaisance culturelle, l'astuce culturelle, la littératie culturelle, l'appréciation culturelle, la compétence culturelle et la compétencve interculturelle; il y a aussi de nombreux acronymes proposés pour désigner l'intelligence culturele, par exemple IC, CULTINT, CQ, etc.(...) le terme IC ne limite pas le concept à un strict calcul mathématique d'une compétence statique, De plus, quelle que soit la manière de désigner le concept, en bout de ligne, l'objectif est de déterminer ce qui permet aux gens de fonctionner efficacement dans le contextes culturels.*";

[4] „*Cultural competence is the highest level of cultural awareness, representing the fusion of cultural understanding with cultural intelligence to allow for focused insight into planning and decision-making for current and future military operations. Cultural competence can be achieved only with adequate cultural intelligence – intelligence gathering that actively seeks information on the adversary's culture and the influences of this culture on decision making*";

[5] Călin Hentea, „Aspecte ale comunicării interculturale în teatre de operații şi zone de criză", în Ioan Deac (coord.), *Securitatea şi apărarea spațiului sud-est european, în contextul transformărilor de la începutul mileniului* III, Sesiunea anuală de comunicări ştiințifice cu participare internațională „Strategii XXI/2006", 13-14 aprilie 2006, secțiunea *Comunicare publică,* Editura Universității Naționale de Apărare „Carol I", 2006, p.33;

[6] *U-Curve Model of Intercultural Adjustement*:



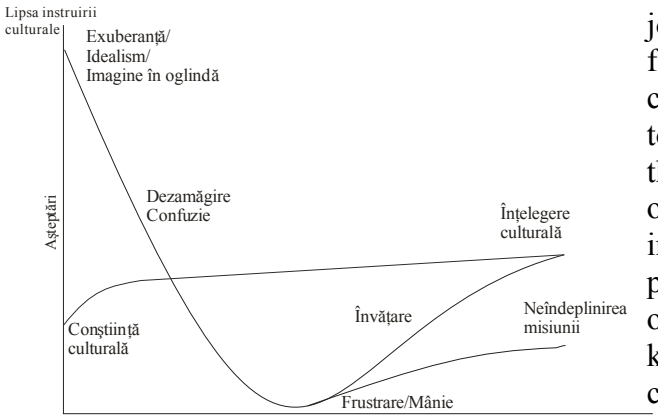


Fig. 1 Cultural awareness and expectation management

4. DEVELOPING PROJECTS OF INTERPERSONAL/INTERCULTURAL COMMUNICATION COMPETENCE OF ROMANIAN MILITARY PERSONNEL. DIRECTIONS AND LIMITATIONS.

Thus, a method of forming/developing the intercultural communication competence is that of real intercultural dialogue within the process of forming, and it can have a place not only in a pre-established diplomatic framework, but also through the launch of some international projects about the intercultural dimension of the military training for peace-keeping missions. Even if this method is only a pioneering idea in the field, not only in Romania, but also in states with a rich tradition in applying intercultural projective instruments, such a project would be only a step to confine with only theoretically, but also one that easily allows implementation. To do this, military higher education institutions of Romania (the academies of the categories of armed forces, and, especially, The National Defense University), may take the initiative to sign partnerships with similar institutions to realize joined training programs in order to form/develop the intercultural communication competence by adequate curricula projection to the new international mission requirements, that benefit of „good practice" guides and other similar tools in interpersonal/ intercultural communication field. Such a program may target the development not only of cognitive competences, concerning knowledge deepening (and inter-knowledge) cultural and linguistic, of understanding the evolution of cultural and linguistic system from interrelation cultural perspective, of developing the ability to understand the intercultural phenomenon, of some instrumental-operational competences, about the ability to utter correctly, orally and in written form, to the ability to correlate and express the acquired knowledge, to the ability to correctly analyze the linguistic structures, but also of some relational competences, that aim at communication efficiency and its adaptation to distinct contexts and the introduction of relational competences among the military professional competences. Last, but not least, joint study programs may establish different methods of developing the intercultural/ interpersonal communication competence by bringing into discussion distinct international experiences, starting with projected indicators, that are easy to quantify (Van der Zee, van Oudenhoven, 2000:291-309), as cultural empathy, openness to new, social initiative, emotional stability or flexibility.

For a well-balanced planning of such a project of forming/developing the intercultural communication competence within the military higher educational system not only an initial adequate planning is necessary (the plan and the project proposal, the pre-project stage), but also the continuous review and improvement of it. Thus, it's necessary to

consider the update or even the project plan development that is, updating the planning tools. From this perspective, a rather rigid system according to the ability to adapt to the new requirements, such as the military system, will allow for much more strict limitations regarding development. The educational system and the military one, illustrative of two different ways of thinking, one of openness, the other of closeness, meet in the military system of education, that submits to some rigors seen as intrusions into the civil institutionalized educational environment. Even if, in Romania (Legea educației naționale, 2011), the national higher educational system is based on academic autonomy principle (art.110, letter a.), even if this academic autonomy and liberty are guaranteed by law (art.115, al.(1)), even if „*the university autonomy gives the right to university community to establish its own mission, its institutional strategy, structure, activities, its own organization and operation, its material and human resources management, with the strict observance of the legislation in force*" (art.115, al.(2)), even if „*the military higher education institutions, of information, of public order and national security benefit of university autonomy principle*" (art.171, al.(2)), higher education institutions of Romania are subject to some bureaucratic structures of force categories staff (education, culture and sport departments) or from the General Staff, that have as main activities to design and approve the educational programs and to supervise their accomplishment (Training and Doctrine Department of the General Staff, based on *Regulations applied to the military education management No. M6/1998),* to select eligible candidates for officers and NCOs' training course following the indirect selection procedure (regional centers of selection and orientation, according to *Decision no.132/29 December 2009*[7]) or their admission (military institutions of education: the application schools belonging to all categories of the armed forces/ training centers, military schools for warrant and non-commissioned officers, based on a curriculum and bibliography established by the *staff of the armed forces categories/ arm command/ structures incorporating educational institutions where courses take place"* and approved by the Human Resources Management Directorate, according to the same Decision), and designing educational plans for training officers selected from the civilian environment and which do not allow for academic autonomy manifestation.

4.CONCLUSIONS

In this respect, the planning and implementation of transnational projects of forming/ developing the communication competence at the initiative of military higher educational institutions of Romania may be stopped, especially those regarding the continuous affiliation to the new requirements, the revision and its improvement. An example of university autonomy limitation concerns the European program of mobility „Military Erasmus", that presupposes cooperation, at the education and research levels, organization of joint MA with bilateral university recognition, creating and applying some mobility programs, that can be accomplished only as a result of an action from outside the institution, more precise, from Human Resources Management Directorate.

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BODY PARTS IN IDIOMS

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Abstract: *Today's English has a general tendency towards a more idiomatic usage. Even educated usage has become more tolerant, so the use of idiomatic expressions increased in frequency. Idioms are, in a very broad sense, metaphorical rather than literal: they are effectively metaphors that have become 'fixed' in language. In some cases, it is fairly easy to see how the idiomatic meaning relates to the literal meaning, in other cases, the literal meaning may make no sense at all.*

The present paper is a study on English idioms which contain words denoting parts of the body. Parallel idioms from Romanian are given in order to exemplify similarities or differences, as well as particularities of some English idioms due to cultural individuality.

Keywords: *idiom, similarity, vocabulary*

If you attempt a comparative study of idioms in different languages, there are several possibilities of grouping them, even within a certain topic, like that of parts of the body.

Quite a few sayings, phrases and idioms have the same or similar form in several different languages, since they can be traced back to a common source:

a) Greek or Roman mythology; the Bible; widely known tales, fables or anecdotes;
b) beliefs and superstitions;
c) experiences of everyday life, practical common sense or the unwritten rules of elementary decency, which must have been pretty much the same everywhere).

In other cases the same idea, action or attitude is expressed in quite a different way in various languages, especially in those which do not have a common origin, a shared cultural background or at least territorial contact.

The third group would be of those idioms which are so typical of a certain language (in our case, English) that they can be considered unique and matchless.

The present paper deals with idioms that are identical or similar in English and Romanian.

Achilles' heel = the only vulnerable spot in a person or thing that is otherwise strong; a serious or fatal weakness/ fault
R: călcâiul lui Achile
After one's own heart = to like someone because of similar interests
R: a fi pe inima cuiva/ pe placul cuiva
An eye for an eye (and a tooth for a tooth) = retaliation/ retribution in kind, a punishment that is as cruel as the crime
R: ochi pentru ochi, dinte pentru dinte
An eye opener = a surprise; a startling or enlightening experience
R: a deschide ochii asupra a ceva nou/ a vedea cu al□i ochi o situa□ie
Armed to the teeth = heavily armed

R: înarmat până-n din□i
Behind one's back = when one is not present
R: pe la spatele cuiva, în lipsa/necuno□tin□a cuiva
Blue blood = having the qualities of being of noble birth
R: a avea sânge albastru
Can't put one's finger on = can't locate immediately, can't find the answer
R: a nu putea pune degetul pe…
Can't see beyond the end of one's nose = limited vision concerning decisions of the future
R: a nu vedea mai departe de propriul nas, a avea ochelari de cal
Crocodile tears = false tears, pretended grief
R: lacrimi de crocodil
Face to face/ eyeball-to-eyeball = confronting each other
R: fa□ă în fa□ă/ochi în ochi
Foul mouth = a user of profanity
R: gură-spurcată
Hand in hand = in close association
R: mână în mână
Hands are tied = restrained from acting
R: a avea mâinile legate
Heart-to-heart = intimate speaking freely and seriously about a private subject
R: de la inimă la inimă, de la suflet la suflet
I could have bitten my tongue off = sorry you said something
R: mai bine-mi mu□cam limba
In one ear and out the other = does not heed or pay attention
R: intră pe o ureche □i iese pe cealaltă
It's in your hands = it is your responsibility
R: este in mâinile tale
On the tip of one's tongue = at the point of telling or recalling
R: a-i sta pe vârful limbii
One foot in the grave = old and decrepit
R: cu un picior în groapă
Over one's dead body = against one's strong opposition
R: (numai) peste cadavrul cuiva
Right-hand man = chief assistant
R: (a fi) mâna dreaptă a cuiva
To (not) lift a finger = not to help in the slightest degree
R: a nu ridica niciun deget pentru…
To be all ears = to listen attentively
R: a fi numai urechi
To be loose–tongued = to talk too much
R: a fi slobod la gură, a fi gură spartă
To be up to one's ears = immersed in, caught in
R: a fi implicat până peste urechi/cap
To break someone's heart = cause great sorrow, disappoint someone
R: a frânge inima cuiva
To breathe down someone's neck = to follow someone closely in pursuit, the action of a superior who is looking for something wrong or watching someone very closely
R: a-i sulfa cuiva în ceafă
To bury one's head in the sand = to refuse to accept facts
R: a-□i băga/ascunde capul în nisip
To catch one's breath = to rest to regain normal breathing
R: a-□i recăpăta suflul/suflarea
To cry on someone's shoulder = to go to someone to talk to about a problem
R: a plânge pe umărul cuiva
to foam/ froth at the mouth = to be very angry
R: a face spume la gură
To force one's hand = make one reveal his plans
R: a for□a mâna cuiva
To get one's hands on = obtain
R: a pune mâna pe…
To get out of hand = become uncontrollable
R: a scăpa din mână
To get through one's head = to understand or believe
R: a băga la cap
To give one's right arm = make a big sacrifice; give something of great value
R: a-□i da mâna dreaptă pentru…
To give someone a hand = help, assistance
R: a da o mână de ajutor
To go to one's head = cause dizziness
R: a i se sui la cap
To have a big mouth = to talk too much
R: a avea gura mare, a avea o gură cât o □ură
To have a sharp tongue = harsh or sarcastic in speech
R: a avea limba ascu□ită
To have an eagle eye = to have an excellent eyesight
R: a avea ochi de vultur

To have one's back to the wall = in a trap with no way to escape
R: a pune pe cineva cu spatele la zid
To have the heart = to have the courage
R: a avea inimă, a te lăsa inima să….
To jump down someone's throat = suddenly become very angry
R: a sări la gâtul cuiva, a sări în capul cuiva
To keep an eye on = watch closely
R: a fi cu ochii pe….
To keep at arm's length = keep at a distance or away from someone
R a □ine la distan□ă
To keep one's eyes peeled = to watch carefully
R: a fi cu ochii cât cepele
to lead somebody by the nose = to persuade somebody to do what one wants; control somebody completely; mislead somebody easily
R: a duce/purta de nas pe cineva
To leave a bad taste in one's mouth = the distinctive quality of an experience especially with reference to the emotion that it consists of or arouses
R: a lăsa un gust amar (în gură)
To lose one's head = to become excited, lose one's normal self-control
R: a-□i pierde capul
To lose one's mind = to become insane
R: a-□i pierde min□ile, a o lua razna
To make eyes at = to flirt, to look longingly at
R: a face ochi dulci, a trimite ocheade
To pull a long face = become sullen, dejected, express facially one's disapproval or annoyance
R: a face o fa□ă lungă
To put one's shoulder to the wheel = to cooperate, to help
R: a pune umărul la…
To put words into someone's mouth = assume a meaning not intended
R: a pune vorbe în gura cuiva
To put your finger on it = to be specific, to explain
R: a pune degetul pe rană
To save your skin/hide = to protect yourself
R: a-□i proteja/salva propria piele
To set foot in = to enter
R: a pune piciorul în…
To shake hands = to clasp hands in greetings
R: a da mâna
to show one's teeth = to show or reveal one's true character or real intentions
R: a-şi arăta colţii = to show one's fangs
R: a-şi da arama pe faţă = to reveal its/ one's copper
To slip through one's fingers = to get away
R: a-i scăpa printe degete
To split hairs = to argue over minor matters
R: a despica firul în patru
To stand on one's own feet = to be independent
R: a fi pe picioarele sale
To step on peoples' toes = to offend or antagonize others
R: a călca pe cineva pe bătături
To take the law into one's own hands = to punish someone without court action
R: a lua legea în propriile mâini
To take the words out of someone's mouth = to say something that someone else was about to say
R: a lua cuiva vorbele din gură
To turn one's back on = to ignore
R: a întoarce spatele cuiva
To turn one's stomach = to cause one to become nauseous
R: a întoarce stomacul pe dos
To turn the other cheek = to permit the repetition of some indignity, blow or attack
R: a întoarce □i celălalt obraz
To wash one's hands = to disclaim any responsibility for
R: a se spăla pe mâini de…(o anumită problemă)

Unable to believe one's ears = difficult to believe what one hears
R: nu–□i poate crede urechilor
Under one's nose = easily seen or noticed
R: chiar sub nasul cuiva
With open arms = with warm welcome
R: cu bra□ele deschise

Idioms are one of the most difficult parts of the vocabulary of any language because they have unpredictable meanings or collocations and grammar. One of the main difficulties for learners is deciding in which situation it is correct to use an idiom, i.e. the level of style (neutral, informal, slang, taboo, etc. idioms). Learners of English may also have difficulty deciding whether an idiom is natural or appropriate in a certain situation. It is extremely unwise to translate idioms into or from one's native language. One may be lucky that the two languages have the same form and vocabulary, but in most cases the result will be utterly bewildering to the English native speaker – and possibly highly amusing. (Seidl 1988)

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WOMEN' S STATUS IN A FREE WORLD: A MODERN PERSPECTIVE

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Abstract: *Religion and law tell us that we are all alike and equal, but society tends to prove us the contrary. The most important and argued difference is that between men and women. The evolution of the role of women within a community took place throughout centuries and it has not completely finished yet. Women have found themselves interpreting many parts on the 'stage' of life, from key characters to ones of very little importance, but always present in the spotlight. From goddesses to slaves, from the symbol of sin to the image of holiness, women have had a difficult path in understanding their purpose, their limits, and most importantly, their freedom. Today's society reveals a modern perspective of this issue, one that in earlier times would have been strongly disapproved. Women are no longer 'the better half' of someone or something, they are their own selves, they represent their own ideas and beliefs, they can be leaders, mothers, wives, heads of companies, in one word they are free. We live in a world full of opportunities, a world that some of us are proud to call a free society. It was a time when only one woman succeeded in being a queen. Now, there is nothing holding us back from becoming 'queens' in our own lives.*

Keywords: *change, society, women, patriarchal society, modern world, women's right, equality.*

1. INTRODUCTION

Change is a natural condition and the world must be accustomed to it. It is not an option. The world in which we live today looks in this particular way, only due to the factor mentioned above. Industrial revolutions, the boom of the economy, of the social studies, the many discoveries in medicine, all have strongly influenced the development of society.

Because society is a pure human construction, it is without question that change affected people and especially women. Even though religion and law create the impression that we are equal, we all have the same rights and liberties, reality is quite different from this idea. Women's role inside a society and, even more, inside a community, a smaller group, like a family, has suffered huge transformations. This study tries to highlight some of the most important changes, that have led to a certain perspective on the condition of women in relation with that of men.

2. WHAT IS THE WOMEN'S STATUS?

2.1 A Historical Evolution

The modern society has brought on visible aspects, which are different from the way in which this entire issue is viewed. However, this is not valid for every corner of the world

and also women have not managed to achieve true equality. History shows us that the status of women has occupied a secondary position to that of men, which is quite interesting, considering the fact that in prehistoric times the woman was the leader of the family.

Once a stable living appeared, forming small communities, the roles seemed to change, and man, due to his physical abilities, took over the control of the settlement. Women's importance diminished considerably. Because power was now measured through physical strength, women did not have decisional power. Therefore, it was not long until a true patriarchal community was born.

Slowly, many of the rules, which we still follow today, date from that period of time. Man was the leader of his family but also only a man could rule a community, women did not have any power, only duties.

What is worth mentioning is that in some communities women could embody goddesses, like in Ancient Rome, Ancient Egypt and even in some African tribes. Still, this did not improve the status of 'mortal' women. They were considered inferior to men. In Ancient Rome, for example, politics was a closed world for women, a man's world.

As the monotheistic religions appeared, women had even more to lose, because what came next was a clear domination of the female race. The Middle Ages saw women as nothing else than objects, that were at the full disposal of men. They were not educated, as it was felt that they did not deserve to be, they did not have the right to their own judgment.

'If the child be a girl she should be put to sew and not to read, for it is not good that a woman should know how to read, unless you wish her to become a nun' (Paolo Da Cretaldo,ca.1320).

The influence of women in that period of time was often underrated and even though some might have had extraordinary powers, their fate was sealed, in the hands of man. Violence was often used to teach women their place, when the husband required anything from his wife, the woman had to fulfill, otherwise a painful experience would be waiting for her.

Furthermore, the famous '*witch hunt'* primarily regarded women as they were considered the Devil's instruments.

The Renaissance did not bring much changes in the way in which they were perceived. Women belonging to upper classes did not face so many problems as regular people, peasants; however, when it came to the issue of marriage, noble women had to accept an arranged marriage, a business.

The Victorian Age brought important changes and many consider this periods the starting point in the emancipation of women and the true birth of feminism. It was an age characterized by important industrial revolutions, cultural and social revolutions, as well as political ones. Queen Victoria, Mother of Europe as she was called later on, held the power within the English monarchy and not her husband, who was quite odd. There are some theorists, who believe that this is actually the starting point of the emancipation of women, but at an ideological level, because inside the society not much had changed. Women were still required to take care of their families, to obey the commands of their husbands, they had no power over their life, as they were still considered incapable of taking the right decisions. A legitimate question would be: How is it then possible to consider this the starting point of feminism?

Firstly, the idea that a woman was head of a State in the presence of a man is of a great importance. It is a first landmark in history. Secondly, the lower class women began to support themselves and their families sometimes. Women started working in factories, in hospitals as nurses, in law. Women began to understand their powers and were not afraid to take on different responsibilities.

The 20th century was the turning point in the way in which women were perceived. Even though in the 19th century, women received some form of education, assured by the church, the true transformations came in the 20th century, when women understood the necessity of political involvement in their struggle for equality

The first sign that women were going in the right direction was the fact that they began

to work in the same fields of activity as men. In 1910, the first policewoman was appointed in America and by 1919 in Britain. Also, due to the *Sex Disqualification Act,* in 1919, women started being lawyers, doctors, even some who were married, having their own careers. They managed even entering the army, forming the women branch, participating in wars.

By 1970, women were paid the same wages as men, women were protected by different laws prohibiting discrimination against women in education, employment and training.

Today, a great number of women are paid even more than men, working in all areas. The myth that women cannot do the same things as men has been proven to be false in today's society.

2.2. Women and Religion

Religion has been a complicated subject all throughout history, being used to justify even the worst crime that mankind committed. In relation with women, religion has created a certain context that men have used intensely to put women in a position of inferiority.

In the Middle Ages, as we have previously stated, women were seen as the Devil's main instruments due to their impressionable, weak nature. The Bible story of Adam and Eve, Eve being responsible for the Fall, explains the female nature. Women were considered to have a sinful nature as well. The most important roles within a religion, the priest, the bishop and the Pope were held and some are still held by a man, never by a woman. It is worth to mention that in some places of the actual building of the church, women are not even permitted to enter (e.g. the altar).

After observing the behavior towards women, motivated by religion, one might think that women are doomed, having no way to escape their terrible fate. But this is not true. All religions of the world do the same thing and that is protecting women. In the Muslim culture, women are protected up to a certain point, they must be well taken care of by their fathers, by their husbands and by their children. The same thing is sustained by Buddhism. Christianity is not the exception, the Virgin Mary is a powerful example in this sense, and also many female saints who are celebrated at least once a year.

Religion is not against women, it never was, but it was interpreted as such by men who desired the power for themselves. The fascinating story of the female Pope, whose existence has been hidden for so many years, Pope Joan, comes to prove once again that women are not the instrument of the evil and that in God's eyes, women and men are truly equal.

Today, the rules have certainly changed, women being able to become priests, thus fulfilling important spiritual roles.

2.3. Women and Politics

Politics has proven to be a very captivating area that holds a great number of opportunities. Because we live in a society, we are bound to regulate it from time to time, as it changes as much as the humans that form it. Therefore, if the feminist current wanted to 'speak up', then this would certainly be the path to success.

Today's world is under the influence of policies, of political regulators. In the past, the association between the idea of authority and the image of a woman would have been unthinkable, this was until Queen Elizabeth I, who managed to prove that women belong in this world as much as men. What is worth mentioning is the fact that not only was she the queen, but also she refused the idea of a husband, being prepared to take on the huge

responsibility of reigning over the kingdom on her own. Queen Mary, Queen Victoria, Queen Elizabeth II were the symbol of power in a world where authority was in the hands of men.

The scene of politics is grand and there is room for everyone on it. The problem is remaining on that stage, for it is so difficult to gain a permanent place. Women are driven by fair, clear purposes, which is why they succeed in staying in the spot light. They do get lost in this game of power, perhaps because they are not accustomed to this exercise, to this function that opens so many doors. Also, women are considered to be the 'ornaments' of a world and it is a fact that image represents 80% in politics. Taking all these into consideration, women could benefit in an open-minded community from all the conditions necessary to succeed. However, how many communities of this kind are there? Unfortunately, not so many.

Still, not all women are fit to be sovereigns. Some remain in the shadow and rule from there. Jackie Kennedy was this type of leader. She managed to fulfill that perfect portrait of the ideal presidential family. Without her, Kennedy might have found it difficult to become president. Joan of Arc was another leader. She influenced as much as she could the king, managing in changing decisions establishing a true dialogue with sovereign.

2.4. Women between Slaves and Leaders

There is not only one society, there are many types, each of them having their own culture and habits. Therefore, the idea of the female symbol is a subject that raises a lot of discussions. In some parts of the world, women are not even close to leaders, not in their own family; they are still perceived as objects. They have no rights, no freedom, no power of choice and what is even more serious they have lost their identity. Women are the product of men. Their entire existence revolves around their fathers, their husbands, their children.

The best known example in this sense is represented by the Muslim communities. Women are put in their place with the use of violence. Their prohibition to decide even the smallest thing is legendary. The justification for these actions is once again religion and this is why any change in this matter seems to be almost impossible to realize.

Indian communities are similar in some way to the Islamic situations. There, women have not gained the power to choose their husbands. Wanting a career is almost a tragedy for a religious family.

The feminist movement has a lot to change in those dark corners of the world for the result to be noticeable and permanent.

3. CONCLUSIONS

Women have fought a great deal so that the present times would treat the new female generation differently. And in some parts of the world the effects were visible, but in others there is still a long way to go in order to reach that desired equality.

The changes are obvious, they are also a necessity in this process of evolution. The world cannot stand still, because humans change, their needs change and so do the opportunities.

Still, a question remains: Is this truly what we want? Do we really want real equality between men and women?

According to Donatella Versace, a woman can make it in a world ruled by men only if she relies on her femininity [4].

Differences exist between the two parts so when they meet the whole is completed.

Women can do anything men can do, as men can do everything that women do, but there should be something that could differentiate us. Women must hold on to their femininity.

The importance of an equal society is a must and it should be our goal but with certain limits.

Women have represented all the possible roles throughout history: from mothers to wives, slaves or goddesses. One thing is certain: a woman is the heart of a family, of a society. Important pieces of literature had as muse one particular woman or the idea of the eternal feminine; wars were held in the name of a woman. There is no domain, which does not have at least one female representative.

There are women pilots, women doctors, women politicians, women journalists and so on. The participation of women in wars was a huge event, quite similar, according to some sociologists, to the participation of women in the election process. It is worth to mention that nowadays in the army women have found it possible to rise to certain important positions, becoming more than just soldiers.

The perspective from which women are perceived is still in a changing process and it will not be long from now on that they will be seen truly in all parts of the world in a different way, in some even higher positions than men. In the Muslim societies, it is very likely that the difference in view, concerning the role of men and women, will not change much, but if the harsh ways of punishment disappear, then the important part of the evolution process will be fulfilled.

Women belong to the same level as men, they are intellectually equipped and some are even physically endowed, just like men and women have proven to be capable of any social duty that community would require. If this happening is a regrettable one, time will definitely tell, but it is without doubt a necessary one.

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ON *UTOPIA* – BETWEEN PHILOSOPHY AND COMMUNISM

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Abstract: *The idea of a perfect State has been a matter of controversy since the beginning of times, being the source of many political opinions and ideologies. Freedom, religion, political order and, most importantly, the State itself are some of the issues which have been approached. Thomas More's 'Utopia' discusses intensely all these topics, setting as a starting point the works of Plato and Aristotle. In fact, the contribution of Plato's belief is of great importance. The present paper analyzes More's views concerning the perfect society, but it also aims at comparing this particular point of view with the modern world. Many critics believe that communism is a direct, modern replica of the ideas presented in this book. Thus, the analysis lays emphasis upon two perspectives of the concept called 'utopia': namely, the philosophical view and the communist regime. The perfect society might not exist, it might very well be a myth and people must find a way to co-exist in peace. In fact, this approach might be the closest one people can get to a utopia, especially in the modern world this request being quite difficultly to accomplish.*

Keywords: *utopia, philosophy, communism, perfect society.*

1. INTRODUCTION

Throughout history different political systems were imagined and some even put into practice. One of the most discussed systems is the one imagined by Thomas More, which resembles a great deal with the communist regime imagined and organized by Marx. The intention of this paper is to identify those elements that could link the two political ideas, but also those that differentiate the two, because in the end the utopian society is named so as a mark of its inexistence.

Society is a human construction, which is bound to fail from time to time. The changing character of the human nature is what defines us, thus for a society to work and fulfill the shifting and many needs that men may have, it must be also characterized by the power to be always 'under construction': that is, the way in which we organize the State where we live must not have a finite, clear form. It must be always open to change and to be able to keep up with its inhabitants.

2. *UTOPIA* AND COMMUNISM

2.1. What is *Utopia*?

Thomas More, an English lawyer and statesman, created in 1515 his most controversial and important work entitled *Utopia*. It is a novel, which reflects upon the

findings of a traveler, Raphael Hythloday, in terms of political organizing. He reaches an island, which is ruled in a way that is unknown to him, but not in a negative sense. The entire book is filled with word games having a philosophic meaning, starting with the name of the main character, which is connected with the Archangel Raphael, who represents the truth and the surname means 'the one who speaks without sense'. The word *Utopia* is a puzzle between its Greek meaning no place (*ou-topos*) and good place (*eu-topos*)

Even the name of the author has a certain significance meaning 'fool'. *Amaurot* is the name of the city which is so envied for its ruling system; it is considered a revelation in terms of politics, but actually the meaning of the word, once again a clever game, is 'dark', much as the name of an important river that passes through there Anyder ('*without water*'). After observing all these marks we can easily assume that more important issues are to be noticed. Actually, one very important question arises in the minds of many theorists. What did Thomas More want us to discover when he decided using all these names with the false purpose of proving the opposite. How should we interpret this action? Many say that the answer is quite simple. From the very beginning, the idea of reaching a utopian society seems to be an impossible mission, because this does not exist. Things tend to be something very different from what they truly are, thus managing in fooling even the most illuminated minds, creating a system, which, at a certain point, will fail.

In *Utopia*, however, besides the fact that all these points are reached, there are also important elements linked to power and its representative as well as to the ruling process, which are worth to be mentioned.

The managing of the island seems to be the main theme of the novel and as we have previously mentioned, the way in which it is conceived is quite similar to the communist view on this subject.

Thomas More tries through the book to set apart the social life of the European states of that particular period of time, which was frequently interrupted by the numerous political conflicts, wars, riots, all used in order to establish order. Thus, reality uses chaos to establish order. This is where *Utopia* differs. Thomas More creates an island in which order, law and reason reign. Here, within the framework of this system, man does not know the meaning of the private property. It does not exist. Religion is not one, there are many ways in which citizens explain the existence of a superior power and this is because, unlike the reality of that period of time, on the island a high religious tolerance was practiced. It is true that this particular element can be explained from a historical point of view, but the importance of this issue remains the same. Religion is a key element of society, having a rather subjective nature and being responsible for many conflicts. Therefore, the perspective from which it is understood inside a certain system has a great value in the development of that entire leading process.

The principle from which the work evolves is that the 'whole island is like a single family'. The distribution of food, money and surplus, all are equally divided, all citizens having the same status within the society. Education is another element that seems to be in the author's attention. In schools, children are taught philosophy based on religious principles, ethics: the nature of human happiness, the relation of virtue and pleasure, what is true and what is considered to be false, the absurdity of fasting and so on. The Utopians were prepared to have a good knowledge about the human nature, being able to better understand the differences between them, which might destroy the achieved order.

Concerning the political management and the regime, Thomas More paints the picture of a democracy, having an elected sovereign, where duties are fulfilled by public agents, organized in steps, from the authority point of view, based on the proportional representation principles. The entire system is organized in this way, therefore every domain is carefully looked after, the role of authorities being that of concentrating on the ruling process.

As a difference between reality and Thomas More's world, the perspective on war is the following one: it is perceived as a brutal, violent habit, which is severely condemned. However, a classification of wars is made,

they are either just or unjust, the first category being represented by the liberation wars and the defensive one.

Slaves existed inside the utopian society, they fulfilled the less rewarding tasks. Still, this position was considered to be a punishment, but seen as a moral and social alternative to the punishments received in real England, in that period of time.

2.2. The importance of *Utopia*

The work has been intensively studied throughout time, not only for its political value, but also for its literary importance. It is true that such a book, that attacks the political society, that manages in creating a new regime proposing clear cut rules in matters as religion education, justice and many more cannot pass unnoticed, but Thomas More's *Utopia* started a revolution in literature as well. The way in which the contemporary political regime introspection is motivated, the story that builds around it, these are all new elements that represent a first step in political literature.

Because of this book, because of the author's perspective upon the world, the human nature and the studies that focus on this particular aspect were once again put in the spotlight. *Utopia* is a perfect mixture of elements taken from Plato's philosophy and united with parts of Aristotle's view on the State.

In the minds of many theorists, *Utopia* is the clear statement of the superiority in quality of Thomas More's humanism, in contrast to the one belonging to the époque in which he lived.

2.3. What is Communism?

It is without doubt that the term *communism* is familiar to everyone. It is a political managing regime that has had the same impact as democracy all over the world, in some parts we can even discuss of its supremacy. In order to talk about communism, as an ideology, it is imperative to mention the *Manifesto of the Communist Party*, issued by Karl Marx and Friedrich Engels in 1848, regarded as the founding document of communism.

This document sets the principles for this impressive movement. First of all, the entire community is perceived as a common group that should work for the State to grow, all citizens must participate in this process of economic and social development. Secondly, the notion of private property does no longer exist, it is replaced by a common property, which is used to gain money. The proletarians are the favorite social class, being considered a part of a great machine.

Further on, every citizen has the legal obligation to work and to produce for the State to proper. Also, for this prevision to be established, there were organized the so-called 'industrial armies', designed for agricultural activities.

What comes next and what is actually the most important action in this document is the necessity for an equal society from all points of view. This means that the community must have the same economic and social standards. Besides the fact that each citizen must submit to the same regulations, having a general applicability, the architecture of the cities came to reinforce this idea.

The border line between urban and rural became thinner and thinner because of the mixture between agriculture and the manufacturing industry.

Education is available for all children, being considered that an educated population is an advantage.

These are the principles drawn at the beginning of this movement. However, things changed a great deal, because each leader

understood these ideas in a different way, thus there was not only one manifestation of the regime, but several.

Education, for example, in many States was not used as it was supposed, but mostly as means of propaganda, children being taught to worship the leader.

Religion is not tolerated within the State, any form of religious expression being banned.

Communism was an interesting mixture between politics and economy, it has represented since its appearance a challenge for each leader, with a great trap inside.

The regime is well put together, giving one man full power and eliminating any threats that could rise from the community, but the person in charge must do so in order to maintain a balance within the society, not to give the population the impression of being watched, supervised or oppressed because in the end there is nothing more dangerous than the fury of the mob.

2.4. The Truth between Communism and *Utopia*

The purpose of the present paper is to prove that there truly is a connection between the two ideologies.

Utopia was designed as an imaginary escape from reality, as an alternative for the future, which is without question well constructed. There is a problem, though. The entire regime is mainly based on the morality of the human nature, which is in itself a trap. Thus, a question once again raises: Was *Utopia* built as a successful failure? Or is this only a desperate way out of a cruel violent escape?

The answers are hard to be found, because this particular action has had two consequences, very different in their nature and effects. One of them is the *Manifesto of the Communist Party* and the second one refers to the fact that this document has been actually applied.

Society is indeed in the middle of this discussion in documents, society and State, but the way in which it is conceived is of great difference.

The State is a construction that works in the benefit of the population, it is not a natural giving, it must be taken care of, observed closely, but once efforts are made for its good evolution, the citizen can only gain from this.

In communism, and here we refer to the fact that the regime has been actually applied, because in the end this is what matters the most, only a small number of people could actually enjoy the benefits because the rest lived in poverty. Thus, equality disappeared from the very beginning in all aspects of the community, rights, earnings, liberties.

Utopia is based on liberty; free speech is encouraged, a correct leadership is sought. Communism is a totalitarian regime, a man holding all the power in State, trying to observe closely his ‘kingdom’, to control it. Freedom and liberties are words that seem to be forgotten.

Concerning property, one of the resemblances between the two, once again the motivation from which private property does not exist is a very different one in each case.

Utopia abolishes private property because it finds it useless in a society in which equality is the key purpose, while in the communism’s case, property is used to gain a certain tax that theoretically goes to the State. Therefore, there is the moral motivation and the economic one.

The most debated and the most important difference is religion and its place inside and outside the State. *Utopia* has a high tolerance for religious expressions, while communism bans this practice totally.

Many theorists wondered if not this was the true flaw in the communist regime. Religion is a very powerful instrument, it can bring together and tranquil a mob, or it can make it even more violent.

History has managed to show us that religion is actually a force that should be taken very seriously into consideration. For example, in Romania in the Hunedoara County, it is situated one of the biggest monasteries in the entire country and it was built during the communist period.

How was it possible? The construction of the church was not stopped because it was considered the religion would keep the miners under control, a serious threat to the stability of the regime.

3. CONCLUSIONS

The resemblance between the two works cannot pass unnoticed. Taking into account the timeline, it could be correctly said that the *Manifesto of the Communist Party* had as a main source of inspiration the book *Utopia* written by Thomas More. The differences appear in the way in which these principles announced in the book were interpreted.

Even though Thomas More wanted to build a regime based on human nature, it could not be possible. Power tends to completely change a sovereign, giving him a totally different perspective on life and on his abilities. Surely, the author identified this problem and perhaps this is actually his message to the world. There cannot be a flawless regime; a regime is a human construction, therefore it is bound to fall into traps of all sorts.

This is an example of an ideology, pushed to the extreme and it was applied in the real world.

What is going to happen to our society? Politics is one of the most important parts of life. We cannot ignore it. Would democracy have the same faith? Further investigation in this sense will answer this question.

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MULTI / INTER-CULTURALISM AND GROUP ACTIVITY IN MONICA ALI'S BRICK LANE

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Abstract: *The cultural turn of translation studies of the '70s – '80s placed 'culture' in the core of these studies and transformed the idea of culture. One may understand culture as the Culture (singular) – 'what all human beings have in common as cultural beings or language animals' – or as 'pluralized Cultures' – 'what makes us different' (Cronin, 2006). The meaning of 'cultural translation' that I embraced myself is the one offered by Harish Trivedi in his article, Translating Culture vs. Cultural Translation: cultural translation does not refer to the translation of one or more cultures, but it shows the 'erasure of translation as we have always known and practiced it' (Trivedi, 2007).*

Keywords: *multiculturalism, interculturalism, ethnic group, conflict*

1. INTRODUCTION

This analysis basically starts from the encounter between the West and the East, reflected by the main environment of the novel itself, Brick Lane, a street in the East End of London, now known as Banglatown, as it is mainly inhabited by the Bangladeshi-Sylheti community. This encounter may be seen as a continuous conflict between different cultures or a clash between cultures, or as a continuous negotiation, with 'winners' and 'losers' who exchange places when one expects it the least. It is a conflict that takes up different forms: sometimes it is either an open conflict, when two different groups attack one another, or, most of the times, it is an unspoken interior conflict that manifests itself within one individual with one hybrid identity. There is still another type of conflict, between members of the same community or even of the same family.

2. MULTICULTURALISM VS. INTERCULTURALISM

Brick Lane is a novel in which instances of multiculturalism are better displayed than those of interculturalism. The British society is depicted as one shaken by conflicts between majority and minority groups. This society and the territory it inhabits is the place of encounter of two cultures that, at least during the colonial period, were placed on unequal places of power. Now, the former colonist has become the host for the former colonized. The minority groups, smaller or bigger, are what Bauman calls 'postmodern communities'. Postmodern communities are in fact 'works of the imagination' which 'derive all their confidence-donating power from the stamina and devotion of those who imagine them' (Bauman, 1992:198). Bauman relates the creation of communities to the need of recognition and public support, but at the same time, communities living in a multicultural society need to organize themselves in order to obtain funds and rights to protect their 'diversity'.

> *They [postmodern communities] derive their authority neither from the past nor the guaranteed future, but from their current notoriety. Being in fashion, sitting in the centre of public attention, counting more devotees than any of the competitors, is all the power they have, and all the power they need.* (Bauman, 1992:198)

Minority groups are thus presented as powerless unless supported publicly:

> *Public support is their life juice – and they do not need any other source of strength.* (Bauman, 1992:198)

The group of Muslims (called the Bengal Tigers, set up and led by Karim) who initially started to gather and discuss about their place in the British society, along with discussions about what it takes to be a Muslim, continued by becoming an organized group, with a leader, a secretary and even a Multicultural Liaison Officer. The group's gatherings soon became official meetings with a number of issues on the agenda. The group even printed leaflets to raise awareness among all the members of the Sylheti Bangladeshi community living in Brick Lane and to invite them to take part in their community's marches or to combat other groups' marches, such as the March against the Mullahs or the March against the March against the Mullahs. One critique brought against minority groups in a multicultural society is that it usually focuses on one difference, in favour of other differences which are overlooked, such as the group of women. The Bengal Tigers, although mainly made up of men and bearing a male name, also included women who specifically reclaimed recognition within the group. Later, other groups appeared: the Charitable Foundation or the Bethnal Green Islamic Girls' Group. Communities (read 'groups') are not only minority groups made up of people of a nationality other than British, but also groups of whites – the Lion Hearts. Though she does not put it directly, the author includes titles and descriptions of those groups with a tinge of irony meant to demonstrate the irrationality and lack of meaning of the multicultural-specific society, as well as to hint to the balkanization danger. The Bengal Tigers and its leader, Karim, are but demonstrations of the constructivist theory according to which cultural identity is also a construct of the individual. The immigrant believes in the illusion of identity and by reconstructing that identity s/he defends himself against the majority group whom s/he sees as invading, opposing or even aggressive. Thus, those who are different start seeing themselves as being discriminated and oppressed. The solution at hand to fight it is to get organized in a group. This is what Karim remembers about 'getting together' as a group:

> *'(…) When I was at school, we used to be chased home every day. People getting beaten up the whole time. Then we got together, turned the tables. One of us got touched, they all paid for it. We went everywhere together, we started to fight, and we got a reputation.'* (Ali, 2003:215)

Although almost a kid himself, Karim, who returned to the values and traditions of his parents' culture, does not agree with the new generation of youngsters who, in his opinion, should take action in order to assert their difference instead of letting themselves be assimilated by the host culture:

> *'But now, these kids – they don't remember how it used to be. They're in their gangs, and they fight the posse from Camden or King's Cross. Or from the next estate. Or they stay away from all that, earn good money in the restaurants, and that's all they care about. They don't think they can be touched.'* (Ali, 2003:215)

His words come to confirm Bauman's assertions previously mentioned in this chapter according to which communities need public support in order to exist. The idea is illustrated in the book by the interminable battle of the leaflets. The two most important and opposing groups – the Bengal Tigers and the Lion Hearts – distribute instigating leaflets in support of one or the other group. The conflict between the two cultures is thus mostly expressed by means of words and only seldom by actions. Nevertheless, Ali's attitude is again ironical towards both groups, meaning to emphasize the superfluousness of the conflict. The conflict thus becomes a real

'war' and the words written on paper are deadly weapons:

> *On the estate there was war. The war was conducted by leaflet. They were crudely constructed, printed on the thickness of toilet tissue and smudged by over-eager hands. The type size of the headlines became an important battlefield.* (Ali, 2003:212)

The conflict was almost inevitable as the presence of immigrants who have come to find a job and to build a life for themselves on the land of the hegemonic culture makes the members of this culture become anxious or even feel threatened. The Other (read 'the immigrant' or 'the community of immigrants') is no longer the fear of the unknown, as now the Other is a known threat, capable of triggering changes in a society that so far has been monolithic.

The relations of power are seen differently by the two groups (the immigrants and the natives): once the immigrants were the oppressed, but in time they organized themselves in groups capable to protect their members and to stand up for their rights; now, the 'oppressor' (the majority group) feels oppressed because of the immigrants' assertion and promotion of their diversity. As Chanu says to Nazneen:

> *'You see,'(…), 'in their minds they have become an oppressed minority.'* (Ali, 2003: 210)

The white community (the natives) is not ready to adapt to the diversity brought about by the immigrants and is not prepared to share the power. As Woodward suggests:

> *The scale and scope of the phenomena associated with globalization suggest that there are imbalances of power and that there might be a much stronger weighting in favour of the agency and control of some parts of the world and on the part of some protagonists.* (Woodward, 2002:55).

Chanu understands the nature of the conflict between the two cultures and even tries to figure out for himself who is right and who is not, but, as expected, he does not manage to find an answer:

> *'You see, they feel so threatened.' 'Because our own culture is so strong. And what is their culture? Television, pub, throwing darts, kicking a ball. That is the white working-class culture.'* (Ali, 2003: 209-210)

In a multicultural society, the promotion of diversity may come counter to the preservation of national values, a fact which the majority may understand as oppressive and aggressive. Chanu admits that, in fact, 'it's their country', so 'you can't really blame them' (Ali, 2003: 211). By these words, Chanu acknowledges the privilege of nationality and confirms the importance of territory and space in favour of a globalised world-view in which notions such as spatial boundaries and the territory-limited nation-state have become obsolete. If I look at Trivedi's assertions related to multiculturalism:

> *All the recent talk of multiculturalism relates (…) not to the many different cultures located all over the world, but merely to expedient social management of a small sample of migrants from some of these cultures who have actually dislocated themselves and arrived in the First World, and who now must be melted down in that pot, or tossed in that salad, or fitted as an odd little piece into that mosaic.* (Trivedi, 2007: 27)

I may be more right to underline here the author's lack of support of multiculturalism by resorting to a few assertions in the novel that refer to an individual's identity in a multicultural society – a constructed identity. The main character, who in most of the novel is also the narrator or the author's alter ego, is

herself on the quest of finding her own identity but, unlike many of the other characters in the novel, she is looking for her individual identity, not for a collective one; in other words, she does not need to identify herself with a particular group so as to have a feeling of belonging to something that would help her find herself. Thus, she has more freedom in analyzing and understanding others, white people or Bengali like herself, who are also on the quest of identity-finding. One day, on one of her rare walks taken outside by herself, Nazneen's attention was caught by a young white woman 'in high-heeled boots and jeans' whose 'footsteps rang like declarations.' (Ali, 2003:374) Nazneen interpreted the woman's footsteps as declarations of one's identity:

> *One step in front of the other. Could it say, I am this and I am not this? Could a walk tell lies? Could it change you?* (Ali, 2003:374)

She understood that Karim himself was still in search of his identity; in order to do this, he started looking for aids or substitutes. He organized the Bengal Tigers and started to look for his origins. As he is just a man in a place of 'in-betweenness', he tries to construct a definite place for himself, a place of belonging. Although only a 'simple girl from the village', who did not know anything about multiculturalism and diversity, and who may not even have heard these words, Nazneen understood the source of her lover's need of belonging:

> *Karim did not have his place in the world. That was why he defended it.* (Ali, 2003: 375)

The second aid that Karim wanted to use in order to define himself as a person belonging to a group was Nazneen herself: he started a relationship with Nazneen and eventually wanted to marry her as a symbol and finality of his identity-finding:

> How did Karim see her?
>
> *The real thing, he said. She was his real thing. A Bengali wife. A Bengali mother. An idea of home. An idea of himself that he found in her.* (Ali, 2003: 380)

Having a hybrid identity, Karim cannot find the common ground between the two cultures that influenced his growth. This is why he finally decides to embrace one of them, the one he identifies with.

3. CONCLUSION

Diversity is fully presented in Brick Lane, along with different aspects of it. It is either asserted and reclaimed by members of the minority group, or simply accepted as such and dignifiedly borne by the individual. The conflicts, ironically described by the writer, both between groups and between members of the same group are a mark of the flaws that accompany multicultural theory. I will rather support Trivedi's attitude related to bilingualism: if the 'bilingual bicultural ground is eroded away', we shall run the risk of having 'a wholly translated, monolingual, monocultural, monolithic world' and translation itself will be 'untranslated or detranslated' (Trivedi, 2007). As interculturalism is still an ideal to be achieved, globalisation and migration are two largely discussed and analysed issues that I will deal with in a subsequent paper.

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TO BE OR NOT TO BE … TRANSLATED
CULTURAL TRANSLATION AND IDENTITY ISSUES IN MONICA ALI'S BRICK LANE

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Abstract: *In a globalised and deteritorialized world, the shift between languages and cultures is expected to be simplified and migration encouraged. Identity is now understood as more complex and the migrant is called either a 'global nomad' (Bauman 1998), a 'post-industrial migrant' (King 1995), or 'a translated being': 'The condition of the migrant is the condition of the translated being' (Cronin 2006).*

Keywords: *globalization, migration, cultural translation, assimilation, identity*

1. INTRODUCTION

The new political and economic forces and relationships between countries as well as the amazing powers offered by the new means of communication, especially the Internet, have changed the world and the relationships between people of the same country or 'belonging' to different countries. As Michael Cronin also puts it:

> *The emergence of multiculturalism, interculturalism and cultural diversity as issues for many societies in recent decades is to do with the increased scale of migration attendant on economic and political developments and demographic changes but the prevalence of debate on these topics is also linked to the implications of living in a world of global connectedness.* (Cronin, 2006:49)

As globalization has a certain effect on the local – the 'impact of globalization is to change the very texture of locality' and 'the effects of globalization are felt within a particular locality' (Tomlinson, in Cronin 2006: 49) – one needs to look for the 'local responses to global changes' (Cronin, 2006: 49). One response, as offered by Mary Kaldor (1999), is that locality and specificity become inimical forces directed against difference. The other response is what Tomlinson calls 'deteritorialization', or the gradual fading of geographical and social territories, another synonym for 'globalization':

> *Deterritorialisation, then, means that the significance of the geographical location of culture – not only the physical, environmental and climactic location, but all the self-definitions,*

clear ethnic boundaries and delimiting practices that have accrued around this – is eroding. (Tomlinson, in Cronin 2006: 49).

2.1. Migration and Translation. Being assimilated or being accommodated.

Migrating to the country of the former colonist just as to any other Western country is what Chanu calls a 'tragedy': for him, being a migrant 'is to live out a tragedy' (Ali, 2003:91) that occurs from what the same character refers to as 'the clash of cultures and of generations' (Ali, 2003:91).

The migrant's 'translation' in another culture and another language is not only physical, but also symbolical and psychological. The 'displacement' mentioned by Cronin needs to be interpreted as incorporating the idea of 'in-betweenness', i.e. the 'place' of encounter between the source and the target cultures. The encounter is nothing else than a negotiation that takes place within one individual, a negotiation meant to turn the loss (of being displaced) into a gain:

(…) their individual and collective identities will experience a series of transformations as they adjust to the loss of their place of birth and attempt to turn it into a gain. (Anne Malena 2003:9, in Cronin, 2006: 45)

Translation in the context of globalization and migration is understood both in cultural and linguistic terms. According to Cronin, depending on the direction of the translation, the individual is either assimilated or adapted. If 'translation assimilation' refers to the translation into the language of the host culture and 'translation accommodation'(Cronin, 2006: 47) refers to the translation into the source language, taking the form of a refusal of being translated into the dominant language in order to assert the immigrant's conscious resistance against assimilation, then what is eventually the 'translated being'? If the 'singular Culture allows us to translate' and 'pluralized Cultures make us translate' (Cronin, 2006: 47), where does the 'translated being' stand? Is it more a matter of being translated or one of translating, one of objectivity or one of agency? The migrant is not only a translated being, but also a translating one. If we accept the migrant as being only 'translated', just like a text which is translated into the dominant language, we run the risk of understanding him/her as being merely assimilated, when in fact there is no full assimilation. Hybrid identities, like the migrants', evolve only based on the negotiation process between the two cultures. It is an ongoing process which the migrant must understand as such if s/he wants to be able to adapt himself/herself to the culture s/he chose to adopt. Or, in Sherry Simon's terms, the migrant lives in a 'contact zone' understood as 'a space that is redefining itself, a space of multiplicity, exchange, renegotiation and discontinuities' (Bassnett and Trivedi, 1999: 14).

The ability of speaking the source language is almost vital for the migrant; otherwise, especially in the case of women, they will largely depend on others to communicate with other members of the society and to understand the surrounding world – which Cronin calls 'the failure to be translated' (Cronin, 2006: 53). Immigrant women who do not know the language and who, according to their traditions, are not

allowed to work will depend on their husbands and children. Nazneen, along with the majority of the other Muslim women on the estate (except for Hanufa who was socially isolated by the other women from the community for getting a job in the city), do not speak English and only understand a few words that are more frequently used by others. There are still other cases in which they hear a certain word, are able to pronounce it and to recognize the appropriate context in which it may occur, but they are not able to make a thorough connection between the signifier and the signified. For example, for many years since she arrived in London, Nazneen has heard the word 'pub' several times but she could not explain what it meant as she has never been in one. Thus, at that point, her 'translation' was not complete. Later, she purposefully entered one as she felt that her 'translation' was limited. In a way, children and husbands can be considered interpreters for the women: they translate words and sentences and interpret the target culture for them. Little by little, Nazneen is no longer satisfied with the 'translation' supplied by her husband, especially since Chanu is more eager to translate excerpts of literature to her instead of instances of the real world, which would prove more useful for a migrant, and wants to interpret things for herself.

Until Nazneen was able to interpret the dominant culture and translate it for herself, she could use different interpreters, one of whom was her good friend, Razia, who presumably was somewhat older than her and, anyway, more eager to be 'translated'. Razia can be a good example of the assimilated immigrant or, rather, of the ready-to–be-completely-assimilated immigrant: she has given up wearing her hair long and saris in favour of men trousers and jackets and short hair; she continuously fights with her husband in order to be allowed to get a job; and she even started going to English classes.

Another female character worthy of mentioning as an illustration of assimilation by the host culture is Dr. Azad's wife who wears very short skirts, smokes and goes to the pub and who seems to have a very clear opinion on immigrant attitude: she prefers to rely on facts when it comes to judging the host country. For her, an immigrant who decides to live in a Western society must let himself/herself be alienated (read assimilated):

> *'(…) Fact: we live in a Western society. Fact: our children will act more and more like Westerners. Fact: that's no bad things.'* (Ali, 2003: 93)

She thinks one needs to adapt and re-adapt oneself depending on the country one inhabits. It is the kind of negotiation (adaptation and re-adaptation) one must perform for the 'translation' to take place. The woman understands that the immigrant must understand translation and avoid mistranslation:

> *'(…) when I'm in Bangladesh I put on a sari and cover my head and all that. But here I go out to work. I work with white girls and I'm just one of them. If I want to come home and eat curry, that's my business.'* (Ali, 2003: 93)

On the contrary, for Chanu, assimilation is not to be accepted that easily; he is more aware than the doctor's wife of the need to preserve one's traditions and believes that children are threatened to be 'spoiled' by the white culture, a threat which needs to be

fought against by running away (going back to the country of origin):

> *'I'm talking about the clash between Western values and our own (…), about the struggle to assimilate and the need to preserve one's identity and heritage. I'm talking about children who don't know what their identity is. (…) about the feelings of alienation engendered by a society where racism is prevalent.'* (Ali, 2003: 92)

Both types of translations (assimilation and accommodation) can occur in one individual at different stages in their lives; this occurs in relation to the immigrants' children who are born in the host country and who experience a sort of 'cultural self-reflexivity' (Cronin, 2006: 62). They are usually assimilated (for example, Shahana) by the host culture when very young, but later, some become aware of their origins and start looking for their roots (Karim). It is a 'new cultural self consciousness or awareness' expressed by 'the wish not to make translation invisible but rather to make it more visible, to acknowledge that there are two languages, two cultures (each with its own internal complexity), which come to determine or influence the dialogical self of the immigrant subject or his or her dependants' (Cronin, 2006: 62).

Shahana and Karim are not examples of successful cultural negotiation, especially in Shahana's case, because they take one side in favour of the other. At first, Nazneen's boyfriend speaks perfect English and stammers when he speaks Bengali; later on, he plucks courage, he becomes the leader of the Bengal Tigers, and the more he becomes aware and proud about his parents' country and origins, the better Bengali he speaks. In this character's case, assimilation occurred as a natural consequence of being born in a particular country whose language was acquired as a second mother tongue, but the process began to be interrupted and even rejected by Karim who could not manage to negotiate with the dominant culture.

On the contrary, Shahana is the embodiment of assimilation of Western norms and values. For her, identity is not a place of negotiation, nor is it shaped by birth (read 'nationality') and traditions of the source culture; birth is important only if it is understood as 'place of birth' and the place is the host country. This is why she repeatedly cries out at her father who has made big plans for both her daughters, but which will unfortunately fail to be achieved:

> *'I didn't ask to be born here!'* (Ali, 2003: 148)

This is her statement of complete assimilation and her conscious and obstinate refusal to accept the values and traditions of the source culture. When she realizes she is still too young to make decisions for herself and when she is forced by Chanu to act as a perfect preserver of Bangladeshi culture, Shahana starts kicking. Kicking is another form of refusal and rebellion at Shahana: 'she kicked the furniture, she kicked her sister and most of all she kicked her mother' (Ali, 2003: 152). For Nazneen's little daughter, the host culture was her culture as well, and there was no interior conflict going on within her, which could have been triggered by an impossibility of coping with values pertaining to different cultures. The perspective of going back home as Chanu carefully planned proved so terrifying for her that she actually ran away

from home. Shahana and Karim have not been 'borne across the world' (Rushdie 1991) from a Third World country to England like their parents. Still, they are 'translated' beings who occupy a 'Third Space', or, as Bassnett and Trivedi put it by quoting Bhabha:

> *(…) the translated hybridity of the 'unhomed' migrant now inhabits a Third Space.* (Bassnett and Trivedi, 1999: 12)

Whether s/he accepts it or not, the immigrant remains a 'translated' as well as a 'translating' being, able to understand and adopt the norms of the host culture and at the same time preserving and promoting those of the source culture. S/he must perform the bidirectional process of translation, which is the basic requirement for a successful negotiation between two cultures that meet on a common ground, that of an individual's self. Precisely because s/he lives in the 'contact zone' where the boundaries of cultural identity disappear, the individual fights the battle of negotiation and renegotiation.

3. CONCLUSIONS

The translated being will always perform a negotiation process between cultures. The 'going back home syndrome' may take up several forms (Chanu, because of his incapacity to adapt; Nazneen, only as a retrieving with her beloved sister; Karim, as a discovery of his identity), but will not disappear. A multicultural society encourages the assertion of diversity and, inevitably, conflicts between different groups, who fight for power and recognition. The solution to the conflict may be an intercultural approach, based on harmony and cultural exchange, but it is an ideal to be achieved as long as the national sentiment is still powerful and discrimination is felt by one or another of the groups. Boundaries are transgressed and boundaries are created around the thorny identity issue which defines the contemporary globalised world. To give credit to Bassnett and Trivedi, I will side with their assertion:

> *Contemporary understanding of translation both as reality and as ideal, Simon suggests, has more to do with discontinuity, friction and multiplicity.* (Bassnett and Trivedi, 1999: 14)

Therefore, to be or not to be translated is understood as a negotiation and a renegotiation performed in the Third Space of in-betweeness occupied by that individual preoccupied more or less consciously by his/her identity (social, personal or cultural) called the immigrant. Identity-finding is by no means another process of negotiation. One needs to understand and accept that one's identity is fluid and cannot be calculated or set within rigid parameters. Still, understanding and accepting do not make up the solution for the dilemmas related to the individual caught between multiculturalism and migration.

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ETHNIC MINORITY LANGUAGES IN ISRAEL

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The non-Jewish minorities make up nearly 25% of the population of Israel. Among them are 4 groups differentiated in various ways from the general Arab Israeli population. The Bedouin are differentiated by their traditional residence patterns, the Druzes by religion, the Circassians by religion and ethnicity. The Greek Orthodox Church brings Greek-speaking priests to Israel, who teaches the language in their church schools. There are Arab Christian families with knowledge of Greek. There are speakers of Aramaic (Syriac), but most members of the Syriac community now speak Arabic. For the rest of the Churches, such as the Coptic and Ethiopians, the speakers are generally clerics. The exception to this is the small but significant Armenian community. The Armenians, like the Circassians, are working effectively for maintenance of their own language. In this paper we will look at language issues that affect these groups.

Ethnicity, religion, minority, Aramaic, Druze, Circassian, Arab, Christians

Some 1.8 million people, comprising some 24 percent of Israel's population, are non-Jews. Although defined collectively as Arab citizens of Israel, they include a number of different, primarily Arabic-speaking groups, each with distinct characteristics.

Muslim Arabs, over 1.2 million people, reside mainly in small towns and villages, over half of them in the north of the country. The majority of Israel's Arab population lives in self-contained towns and villages in Galilee and Center.

The **Druze**, some 122,000 Arabic-speakers living in 22 villages in northern Israel, constitute a separate cultural, social, and religious community. While the Druze religion is not accessible to outsiders, one known aspect of its philosophy is the concept, which calls for complete loyalty by its adherents to the government of the country in which they reside.

The **Circassians**, comprising some 4,000 people concentrated in two northern villages, are Sunni Muslims, originally from northern Caucasus. While maintaining a distinct ethnic identity, they participate in Israel's economic and national affairs without assimilating either into Jewish society or into the Muslim community.

Christian Arabs, some 150,000, live mainly in urban areas. Although many denominations are nominally represented, the majority are affiliated with the Greek Catholic, Greek Orthodox and Roman Catholic churches

Religion	Grand Total	Jews	Moslems	Christians	Druze	Other
Thousands	7419.1	5608.9	1254.1	150.2	121.9	284
Percentage	100	75.60	16.90	2.03	1.64	3.83

Table 1 Index of Israel population by religion, based on the Census of 2008 (CBS, 2010)

The Languages of Non-Jewish Minorities

The non-Jewish minorities make up nearly 25% of the population of Israel. Among them are 4 groups differentiated in various ways from the general Arab Israeli population. The Bedouin are differentiated by their traditional residence patterns, the Druzes by religion, the Circassians by religion and ethnicity. Among the Christians, the Armenians are distinct.

Arab Israelis

Although defined collectively as Arab citizens of Israel, the Arab Israeli sector includes a number of different groups – primarily Arabic-speaking – each with its distinct dialect. Muslim Arabs, the largest group, constitute three-quarters of the Arab Israeli sector and most are Sunni Muslims. Arab Israelis are citizens of the Israel with equal rights. In 1948, Israel's Declaration of Independence called upon the Arab inhabitants of Israel to "participate in the upbuilding of the State on the basis of full and equal citizenship and due representation in all its provisional and permanent institutions".

Israeli Arabs sat in the state's first parliamentary assembly; currently, 14 of the 120 members of the Knesset (Israeli Parliament) are Arab citizens, most representing Arab political parties, and one of Israel's Supreme Court judges is an Arab.

Linguistically-speaking, the majority of Arabs of Israel are fluently bilingual, speaking both a Palestinian Arabic dialect and Hebrew; some are also trilingual. In Arab homes and towns, the primary language spoken is Arabic. Some Hebrew words have entered the colloquial Arabic dialect. For example, Arabs often use the word *beseder* (equivalent of "Okay") while speaking Arabic. Other Hebrew words that are regularly interspersed are *ramzor* (stoplight), *mazgan* (air conditioner), *maxshev* (computer) etc.

The Zionist enterprise in Israel started with the revival of Hebrew as the nation legitimate language (Cooper, 1989). Even so, Arabic remained an official language of the State. It is much less employed in official documents and dealings than Hebrew, but the presence of Arabic in Israel nevertheless real. In all universities one finds departments of Arabic. Arabic is supported by daily TV and radio broadcasting, daily newspapers and periodicals. Arabic is the teaching language of the Arabic educational system where more than 90% of Arab children study – from kindergarten to teachers' colleges. Moreover, in the Hebrew-speaking school system, Arabic is an optional third language. On the other hand, Hebrew is obligatory from the third grade on in Arabic-speaking schools. The high competence which Arab students generally achieve in Hebrew – the wide majority of Arabs under forty know Hebrew well – contrasts with the feeble dedication of many Israeli Jews to the learning of Arabic in the Hebrew educational system (Ben-Raphael, 1994).

The determinant factor of inter-group interaction is the dominant culture, which legitimizes a linguistic and cultural pluralistic model of majority-minority relations. Within this context Arabic is by no means held in high respect by the majority, which tends to downgrade its value. The underprivileged status of Arabs in Israel and other factors explain why Arabic is most often left out of the Jews cultural repertoire – even though it is diffused by schools. On the other hand, the minority which is dependent on the language majority is determined to acquire it. The price it pays for this enrichment is the downgrading of the social value of its own language (Ben-Raphael, 1994).

Bedouin Arabs, also Sunni Muslim, estimated at approximately 250,000, belong to some 30 tribes, living in Negev, Center and North. Formerly nomadic shepherds, the Bedouin are currently in transition from a tribal social framework to a permanently settled society.

The Bedouin are linguistically marked by use of dialects that are quite distinct from those of the cities and villages. Tribal differences remain and are important, and until recently their society has been traditional, tribal and feudal.

The Druzes

The Druze community in Israel is officially recognized as a separate religious entity with its own courts (with jurisdiction in matters of personal status: marriage, divorce, maintenance and adoption) and spiritual leadership. Their culture is Arab and their language Arabic but they opted against mainstream Arab nationalism in 1948 and

have since served in the Israel Defense Forces and the Border Police.

Worldwide there are probably about one million Druze living mainly in Syria and Lebanon, with 122,000 in Israel, including about 18,000 in the Golan (which came under Israeli rule in 1967).

The Druze community in Israel has a special standing among the country's minority groups, and members of the community have attained high-level positions in the political, public and military spheres. The Druzes in Israel live in 22 villages in the Galilee and on Mount Carmel. Most of those villages are populated exclusively by Druze, although in some of them minorities of Christians and Muslims have become residents. The community is said to have remained feudal and patriarchal, with continuing opposition to mixed education of the sexes. The fact that Druze man all serve in the Army has had a major effect on their social and political integration, and there is increasing knowledge of Hebrew. The 1983 census (the last to include this question) found a higher index of Hebrew speaking among Druzes than among the non-Jewish population as a whole. The index is higher among men than women, and highest in age groups that include those who have served in the army (Spolsky & Shohami, 1999).

The Circassians

Circassian, or Cherkess, is a general name for a group of peoples who formerly inhabited the northwestern Caucasus and part of the east coast of the Black Sea. In the 1860s and the 1870s, when the Russians began their conquest of the Caucasus, most of the survivors were forced to migrate to Ottoman Turkey. In the 1870s, some of the Circassians settled in villages in Palestine. Today there are some 4000 Circassians in Israel. 2500 live in Kfar Kama, a village on the Tabor Mountain road on the way to Tiberias. Almost 1000 more live in Reihaniya, a village located along the Lebanese border. About 25 families are in Jewish towns. The entire community of the Circassian population in Israel speaks the vernacular mother tongue. It is just as clear that the Circassian language symbolizes Circassian ethnicity and constitutes the 'core value' of their culture. The Circassian language can be regarded as the 'cultural marker' of the Circassian's minority existence and a model of the cultural pluralism in the ethnically heterogeneous society of Israel. (Stern, 1991).

The Christian Communities of Israel

Of the over 7 million people living in Israel today, Christians constitute about 2% of the population. Christian Arabs, who constitute Israel's second largest minority group of some 150,000, live mainly in urban areas. Although many denominations are nominally represented, the majority are affiliated with the Greek Catholic (42%), Greek Orthodox (32%) and Roman Catholic (16%) churches. Except for national churches, such as the Armenian, the indigenous communities are predominantly Arabic-speaking.

The Chalcedonian-Orthodox Churches (Eastern)

The Chalcedonian-Orthodox (Eastern Orthodox) churches are a family of self-governing churches that follow the doctrines of the seven Ecumenical councils, and acknowledge the honorary primacy of the Patriarch of Constantinople. The Greek Orthodox Patriarchate of Jerusalem considers itself to be the "mother church" of Jerusalem. It is the largest of the Christian communities.

Two historic Eastern Orthodox national churches have representation in Israel: the Russian and the Rumanian.[1]

The Non-Chalcedonian Orthodox Churches (Oriental)

The non-Chalcedonian Orthodox churches are churches of the East (Armenian, Coptic, Ethiopian and Syrian) that refused at the time to acknowledge the decrees issued by the Council of Chalcedon in 451.

The Armenian Orthodox (Apostolic) Church dates from the year 301, the first nation to embrace Christianity. They are around 2000-3000 in Israel and liturgical language is Armenian.

The Coptic Orthodox Church has its roots in Egypt, where most of the population became Christian during the first centuries CE. Their liturgy is in Coptic language, one of ancient Cushitic languages of Egypt.

Today the Ethiopian Orthodox Church in Israel is a small community consisting mostly of a few dozen monks and nuns living in Jerusalem.

The Syriac Orthodox Church (Jacobits) is a successor to the ancient Church of Antioch. Among its traditions is the continued use of the Syriac language (Western Aramaic) in liturgy and prayers.[2]

The Roman Catholic and Uniate Churches

The Roman Catholic and Uniate churches are churches that are in communion with Rome. In matters of liturgy, the Eastern churches in communion with Rome follow their own languages and traditions.

Until a few years ago, there were just a few hundred Hebrew-speaking Catholics in Israel. But they are growing steadily, and today number at least seven communities. They are called Messianic Jews and they incorporate elements of Judaism with the tenets of Christianity.

In popular parlance, local Roman Catholics are referred to as "Latins", in reference to their historic liturgical language. Since the Second Vatican Council, however, the liturgy is generally celebrated in the vernacular, except at some of the holy places, such as the Church of the Holy Sepulcher and the Church of the Nativity, where the mass and other services are still celebrated in Latin[3].

The Maronite Church is a entirely Catholic community of Syrian origin, most of whose members live in Lebanon. As a uniate body[4] it possesses its own liturgy in the Syriac language (Christian Aramaic). Most members of the Maronite community in Israel reside in the Galilee.

The (Melkite) Greek Catholic Church is the result of a schism in the Greek Orthodox Church of Antioch.[5] The traditional languages of worship are Arabic or Greek.

The Syriac Catholic Church, a uniate breakaway from the Syriac Orthodox Church, is a small local community in Jerusalem and Bethlehem. They use the West Syrian Rite.

The Armenian Catholic Church separated from the Armenian Orthodox Church, had been in contact with Rome since the Crusader period. The community is Arabic-speaking and the liturgical language is Armenian.

The Chaldean Catholic Church is a uniate descendant of the ancient Assyrian Apostolic Church of the East (Nestorian) and numbers no more than a few families. Its members still preserve the use of East Syrian Rite (Eastern Aramaic).

The Protestant Churches

The Protestant communities in the Middle East only date from the early 19th century. The intention of these missions was to evangelize the Muslim and Jewish communities, but their only success was in attracting Arabic-speaking Orthodox Christians.

The new Anglican Protestant Episcopal Church in Jerusalem and the Middle East is the largest Protestant community in the Holy Land with the first Arab bishop in Jerusalem. This community attracted an increasing number of Arabic-speaking members.

There are also small Danish, Swedish, German and English-speaking Lutheran congregations for the benefit of members who are visiting or resident in Israel.

The Association of Baptist Churches in Holy Land has eighteen churches. The majority of the congregants are Arabic-speaking.

The (Presbyterian) Church of Scotland and the Church of Mormons has a small, mostly expatriate community serving pilgrims and visitors.

Some marginalized minorities

The Hebrew Israelite Community

Labeled over the years as "the Black Hebrews," community members began arriving in Israel in 1969. They came from the United States via Liberia stating they are descendants of the tribe of Judah. They presently number about 2000 in Dimona in the Negev, with additional families in other towns.

The community has become most noted for its healthy holistic lifestyle. All members are vegans, they do not smoke or drink alcohol. They speak mostly English as well many of them Hebrew.

The Gypsies in Israel

Communities of Dom (the term that many in Middle East refer to themselves) can be seen in Jerusalem, Gaza and the West Bank. The Domari population is estimated between 2000 and 5000.

Dom people often "hide their ethnic identity by declaring themselves to be nationals. The term "nawar" is one of the most widely used designations in the Arab world. The word is commonly used as an insult, not only as an ethnic designation, but also to designate them as worthless (Eliyahu, 2001)

Nawari is also a dialect of Domari language. Dom people know the local dialect of Arabic. When their native language lacks a word, they borrow that term from the Arabic that is spoken in the area.

The Samaritans

The Samaritans are a small tribe, totaling as of November 1, 2007, there were 712, both a religious and an ethnic group located in the West Bank and in Israel. Ethnically, they are descendents of the inhabitants of ancient Samaria, the center of the Northern Kingdom of Israel. Religiously, they hold to a tradition based on the ancient Israelite religion, but they reject normative Judaism. About half of the Samaritans live in Kiryat Luza, close to Mount Gerizim, just south of Nablus in West Bank, which is their religious centre. The rest live in Holon district right outside Tel Aviv in Israel.

With the revival of Hebrew as a spoken language in Israel, most Samaritans today speak Modern Hebrew. The spoken mother tongue of the Samaritans in the West Bank is Arabic. For liturgical purposes, Samaritan Hebrew and Samaritan Aramaic are used, all of which are written in the Samaritan alphabet, a variant of the Old Hebrew alphabet, distinct from the so-called square script "Hebrew alphabet".

The Ahmadis

The Ahmadis are a Muslim sect which was founded in Qadian, Punjab, in the nineteenth century. The Ahmadis accept four of the five basic principles of Islam, namely prayer five times a day, the Ramadan fast, the Pilgrimage to Mecca *(Haj)* and alms-giving. They do not accept the fifth principle, that of the *Jihad* or Holy War against non-believers. Many Muslims regard them as heretics and refuse to accept them as a legitimate part of Islam. The core community is in Pakistan, about 3-4 million (Gualtieri, 2004).

Kababeer, a small town on Mount Karmel in Haifa, is the center of Ahmadis activities in Israel. Established in 1928, 99% of the residents of this town are Ahmadis. Some 2000 members of this community belong to more or less to the same family.

The Baha'is

The Baha's is a religious minority whose numbers worldwide probably exceed 5 million. Baha'ism is a modern religion, founded in the mid-nineteenth century in southern Iran as an offshoot of Shia Islam. Baha'is believe in a completely transcendent and unknowable God, manifestation of whose divine essence is revealed to believers in the form of prophets or messengers who appear through the ages.

The Bahá'í Faith's relationship with the land of Israel was formed in 1868 when the founder was exiled with members of his family and a small band of his followers, to

the Holy Land, which was then part of the Ottoman Empire. The Bahá'í World Centre, the spiritual and administrative heart of the Bahá'í community, is located in the cities of Acre and Haifa in northern Israel.

Summary: Pluralism and segregation

As a multi-ethnic, multi-cultural, multi-religious and multi-lingual society, Israel has a high level of informal segregation patterns. While groups are not separated by official policy, a number of different sectors within the society are somewhat segregated and maintain their strong cultural, religious, ideological, and ethnic identity.

However, despite a fairly high degree of social cleavage some economic disparities and an often overheated political life, the society is relatively balanced and stable. The moderate level of social conflict between the different groups, notwithstanding an inherent potential for social unrest, can be attributed to the country's judicial and political systems, which represent strict legal and civic equality.

Thus, Israel is not a melting pot society, but rather more of a mosaic made up of different population groups coexisting in the framework of a democratic state.

Notes

[1] A mission representing the Rumanian Orthodox Church was established in 1935. It is led by an archimandrite and consists of a small community of monks and nuns resident in Jerusalem.

[2] Syriac is a Middle Aramaic language, and as such a language of the Northwestern branch of the Semitic family.

[3] The largest contingent of Israeli Catholics is immigrants from the former Soviet Union. In the great wave of immigration to Israel in 1990s, up to 300,000 Christians arrived along with about a million Jews. In addition, some 200,000 foreign workers now reside in Israel, including Africans, Eastern Europeans, Latin Americans, and Filipinos. They are overwhelming Christian. Many have settled in Israel. Their children attend Israeli public schools and speak Hebrew.

[4] An Eastern Church in communion with Rome, which retains its respective language, rites, and canon law.

[5] The term "Melkite", literally "royalist", is derived from the Syriac, Western-Aramaic word malko, which means "royal" or "king.

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HEBREW LANGUAGE STATUS AND CORPUS PLANNING

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The initial problem faced by those few that sought to revernacularize Hebrew was a complex one in that daily conversational use of Hebrew could not occur unless traditional Jewish multilingualism could be overcome on the one hand, and unless the Hebrew language itself could be modernized and standardized on the other hand. The entire beginning of revernacularization of Hebrew was far from being planned by any public authorized body. It was rather on an individual and sporadic basis. Only later came attempts at organization of some fragmentary "planning", especially in the areas of pronunciation, spelling and lexicon, made by some semi-public bodies. With the official recognition of Hebrew on the part of the British Mandate authorities in 1922 as one of the official languages of Palestine, Hebrew's legal status was similarly fixed. Although Hebrew had to undergo many challenges in later years, nevertheless its status as the national language of Israel was never again in doubt.

Hebrew, language planning, language revival, Israel, corpus planning, status planning

The development of Modern Hebrew may be viewed as consisting of three periods, in each of which at least one language planning "goal" has been sought. The first of these periods is that of "Language Revival" 1890-1914 (Nahir, 1984), in which the revival of the Hebrew language in Palestine at the turn of the 20th century took place, and my discussion here will start with this period. Much of the study of the Revival has focused on the status of the language, because the unprecedented transformation of the status of Hebrew from a language of religion back to a vernacular and a national language has been rightly viewed as the product of status planning (Nahir, 1998). Much corpus planning, however, was also involved. Restoring the status of the language was only going to succeed if its speakers would have an adequate code, most of all a lexicon, to communicate with. Here I will discuss first the lexical codification work carried out in the Revival period, mostly by individuals, informally, even though a massive amount of lexical codification had been done previously by generations of writers in Hebrew, a language which never actually "died", but, following its demise two millennia ago, continued to be used as a "living written language". Despite these contributions, however, at the beginning of its revival the Hebrew lexicon was so gravely inadequate for modern life—lacking words for concepts such as "tomato", "a match", "serious", "polite", and "newspaper" – that some leaders questioned the capacity of the language to be restored.

I will define codification: "the work of a body or an individual who more or less knowledgeably, decides to give explicit, usually written, form to the [language] norm... chosen" (Haugen, 1983).

Macro-corpus planning; The Hebrew Language Committee

Eliezer Ben-Yehuda (1857-1922), who is the "father" of the revival movement, understood that the revival of Hebrew was not possible without adapting it to modern life. Therefore, in addition to his own work on the lexicon, he and some friends established in Jerusalem in 1890 the Hebrew Language Committee, whose major task, other than "extending the use of the Hebrew language and of spoken Hebrew among all sections of the people" (Rabin, 1973), would be to codify Hebrew in order to prepare it for its new function. A subcommittee was to search for existing words through Hebrew literature of all periods and to create new words where none existed.

In 1912, the Committee decided to become active in preparing its own critically

needed Hebrew terminologies. It first dealt with 120 terms in arithmetic, some proposed by teachers but mostly drawn from ancient literature. These were words for concepts such as "number", "digit", "addition", "subtraction", "multiplication", "division", "remainder", "sum", etc. The next terminology lists were in gymnastics, sowing, food, and plants. In gymnastics, for example, the published list included words for "right turn!", "left turn!", "forward!", "(stand) at ease!", etc., also currently in general use. Many more lists were soon published, dealing with terms for one subject at a time. Until 2011 the Committee (from 1953 "Academy") published some 125,000 terms in 230 Glossaries. The last glossary published in November 2010 is in general biology and includes 2730 terms such as "symbiosis", "mutation", "instinct", "biota", "hatchling", etc. (http://hebrew-academy.huji.ac.il/).

The Committee also assumed the task of resolving language queries from the public. A selection of letters sent to the Committee was recently published in the Hebrew Academy's Newsletter (Akadem, 7, 1995). Today the Academy involves the public in search for new terms. The last task was to propose terms for "compost". The Academy published more than a hundred proposals from the public received till end of February 2011 (http://hebrew-academy.huji.ac.il/).

The Committee had its critics too, who took exception to what they viewed as mass production of words, or "a word factory". Even Ahad Ha'am, the highly influential writer, thought that new words should only be created by writers and only as needed. The famed Shuy Agnon (later Nobel Laureate) called for more effort to draw words from existing sources, even though he, like other critics of word innovators, eventually used most of their innovations (Bar-Adon, 1977).

Micro-corpus planning and lexical codification

Most new word creation in the Revival, then, was the informal product of individuals, mostly in the process of solving communication problems in their work. Some were known literary figures or leaders, but countless lexical items were created by unidentified individuals, whose creation nevertheless has since become part of the Hebrew lexicon. We will discuss briefly some of the most prolific lexical innovators and the methods applied generally in the process of lexical codification.

Eliezer Ben-Yehuda, mentioned earlier, was the most prominent and prolific codifier of the new Hebrew lexicon. He compiled the first comprehensive Hebrew Dictionary, whose impact on the Revival, however, was rather limited since the first volume was only published in 1909, when the Revival was approximately five years from completion, and only half the Dictionary was completed by the end of the Revival. But Ben-Yehuda also made significant contributions to Hebrew codification by writing several school textbooks and translating literary works. In all of these he used the Hebrew words he had discovered or created for his newspapers and for his large Dictionary. His innovations which are still in use included words for, "omelet", "salami ", "jam", "fashion", "stockings", "gloves ", "fur", "cauliflower", "cactus", "telegram", "municipality", "front", "soldier", "invasion", "bomb", "maneuver", "exercise", "newspaper", "dictionary" etc.

Itamar Ben-Avi, Ben-Yehuda's oldest son, unlike his father, though, he restricted himself to coining words only as he needed them rather than as a scholarly activity. This may explain why, having met actual communicative needs, his innovations were accepted by users much more readily than were his father's.

H. N. Bialik, a highly acclaimed Poet Laureate, also created numerous words as he needed them for his work. According to some scholars (e.g., Sivan, 1980; Kutscher, 1982), Bialik had a unique ability to introduce new life into old, even ancient words, filling them with "vitality". He particularly favored combinations of older words, which he used abundantly in both his poetry and prose. We can recognize two types in his innovations:

new words and new combinations, blends, or compounds. His innovations which are in use included words for "import", "export", "car", "kitchen" etc.

Many others created new words – among them writers, journalists, educators, translators, publishers and editors – e.g., /naxat/, 'to land', /palaš/, 'to invade', by a leading journalist, /agvaniyya/, 'tomato', /xamtzan/, 'oxygen' by Y. M. Pines, Ben-Yehuda's friend and colleague, writer and teacher. A revered poet, Avraham Shlonsky, coined countless words as he needed them in translating foreign literary works into Hebrew. Israel's first Foreign Minister, Moshe Sharet, was considered to be the creator of the now established /darkon/, 'passport', /ašra/, 'visa', /etgar/, 'challenge', but he later admitted that he had "ordered" them from someone else. He did create several other words, though, e.g., /takrit/, 'incident', from /kara/, 'happen', and /šmar-taf/, 'baby-sitter', from /šamar/, 'watch', and /taf/, 'infants'. David Remez, the first Israeli Minister of Transportation, created the still used /monit/, 'taxi', from /mana/, 'to count'.

Methods of lexical codification in the Hebrew Revival

Some of the major methods used in lexical codification may now be summarized:

(1) Inserting new roots to existing patterns: the pattern /CaCaC/ for profession (e.g., /sappar/, 'barber'; /tabbax/, 'cook'); the pattern /CaCeCet/ for disease (e.g., /ademet/, 'rubella'; /nazelet/, 'a cold'); the pattern /maCCeC/ for tools (e.g., /masmer/, 'a nail'; /mavreg/, 'screwdriver'; /maxshev/, 'computer'.

(2) Adding suffixes or infixes to create words of different patterns from existing words. Some of the major ones are: **-on**/ (e.g., /ša'on/, 'a watch', from /ša'a/, 'an hour'; /iton/, 'newspaper', from /et/, 'time'; /yarxon/, 'a monthly', from /yerax/, 'month').

/**-an**/, for profession, occupation or having certain characteristics (e.g., /ta'asyan/, 'industrialist', from /ta'asiyya/, 'industry'; /yarkan/, greengrocer', from /yarak/, 'vegetables'.

/**-ay**/, for trade or having certain features (e.g., /xašmalay/, 'electrician', from /xa šmal/, 'electricity'; /mexonay/, 'mechanic', from /mexona/, 'machine'.

/**-iyya**/ (borrowed from Arabic) (e.g., /sifriyya/, 'library', from /sefer/, 'book'; ; /'iriyya/, 'city hall, municipality', from /'ir/, 'city').

(3) Drawing words from old sources and assigning them new meanings /xashmal/, 'electricity'; /mexona/, 'machine'; /totax/, 'cannon') from Biblical Hebrew; /'itzumim/, 'sanction'; /tekes/, 'ceremony' from Mishnaic Hebrew

(4) Merging pairs of words into single words (e.g., /migdalor/, 'lighthouse', from /migdal/, 'tower', and /or/, 'light'; /madxom/, 'thermometer', from /mad/, 'measure', and /xom/, 'temperature').

(5) Adding Aramaic, European and Hebrew prefixes and suffixes (e.g., /tat-aluf/, 'brigadier general'; /xad-sitri/, 'one-way'; /micro-gal/, 'micro-wave'; /dugmanit-al/, 'super model').

(6) Loan-translation (e.g., /gibbuy/, 'backing'; /kissuy/, 'coverage'; /gan-yeladim/, 'kindergarten'; /'ittuy/, 'timing'; /yissum/, 'application'; /haslama/, 'escalation').

(7) Borrowing from European languages: from Yiddish (especially colloquialisms, /menadned/, 'nag'; /shprits/, 'spray'; /mashvits/, 'boast'; /kumzits/, 'sitting and singing around a bonfire'; /shnorer/, 'one who lives off others'), Russian (including suffixes, e.g., /-chik/ diminutive; /-nik/, 'one who belongs to a given group' and from Arabic (including colloquialisms, e.g., /adiv/, 'polite'; /nadir/, 'rare'; /mabsut/, 'happy', 'content'; /zift/, 'trash, no-good'; /kef/, 'fun') and Aramaic. Usually borrowed words went through a Hebraization process.

Status Planning

Establishing an official language in a multi-language state is a complex and

extremely important task. This decision is only the first stage, since implementation of the language policy is no less important that its formal declaration. Every new state must cope with the challenge of determining which language will be its official national language and the status of the languages of the minority groups. The language is recognized as a central symbol of the state's identity and functions as an extremely important cultural institution**.**

Consociational democracies define themselves as dual- or multi-lingual states. They grant the minority's language a respected official status. Among deeply divided states which have succeeded in establishing a democratic regime for more than fifty years, Canada, Belgium and Switzerland. In Israel, which was established as an ethnic state as the state of the Jews, one would be expect less compromise with minorities, and that languages other than Hebrew would not be made official languages of the state. Nevertheless, the Jewish leadership decided not to eliminate Arabic as an official language (Harel-Shalev, 2005).

When Britain captured Palestine from the Ottoman Empire in 1918 it found two national communities, one Arab and one Jewish. By that time Hebrew had become the principal language of public discourse among the Jewish population. When the Zionist Organization made in 1916-18 a census of the Jewish Population of Palestine, 34,000 people, 40% of the 85,000 who then made up Palestine's Jewry, stated that Hebrew was their main language (Rabin, 1973). There was of course no rival whatsoever to Arabic as the language of the Arab population.

The state of Israel has never enacted a statute which clearly established its official languages. Article 82 of the Palestine Order-in-council (1922) states that Palestine has three official languages: English, Arabic and Hebrew – and this action, as amended, remains valid even today. The main change to Article 82 was enacted by the Knesset in the Law and Government Ordinance (1948), which eliminates English as an official language, leaving two official languages: Arabic and Hebrew (Harel-Shalev, 2005).

In the Israeli Declaration of Independence from May 14, 1948 is a sole mention of language: "Israel … will guarantee freedom of religion, conscience, language, education and culture (Declaration, 1948).

Attempts in the Knesset to make Hebrew the sole official language has failed up until the present day. However, Israeli law has not formulated a comprehensive normative dual-language regime. As a result, Arabic has a vastly inferior status to that of Hebrew. The superior position accorded to Hebrew is not by virtue of a statute or government regulation, but results from governmental policy.

While Hebrew and Arabic have the same status in law, Hebrew is clearly dominant as the language of day-to-day government activity. Whereas Hebrew and Arabic each symbolize a nationality, only Hebrew symbolizes the Jewish state. Although the official status of English is no longer protected by law, it continues in use for many government functions. For example, money currency, metal coins and postal stamps are printed in English as well as in Hebrew and Arabic. Till 1951 the Anglo Palestine Banknotes were in English and Hebrew on one side and in English and Arabic on other side. In 1951 Bank Leumi le-Israel issued a new series of banknotes almost identical to the old, except the color, the name of currency and the languages: one side Hebrew and the other English and Arabic (Bank of Israel, 2011).

When highway and street signs are bilingual, the second language is more likely to be English than Arabic. In a verdict done in 2002 the Supreme Court decided that the street signs in Israel must add the Arabic language to the Hebrew (HC 4112, 1999). When government publications, such as reports issued by the Central Statistical Office are bilingual, the second language is more likely to be English than Arabic. On the other hand, transactions of the Knesset, Israel's parliament, are published fully in Hebrew, but only the chapter headings are published in

English and Arabic. The Knesset Website is in Hebrew and some chapters are in English and Arabic equal and in Russian partial.

Thus with respect to the three types of official language in Israel, Hebrew is official in all three senses, Arabic is both a statutory and working official language, but not a symbolic official language, and English is a working official language only.

The languages status usage can be summed up as following:

Language	Hebrew	Arabic	English
King's order in Council (1922)	a	a	a
Declaration of Independence (1948)	a	c	c
Knesset Transactions (2011)	a	c	c
Banknotes of Bank of Israel (2011)	a	b	b
Central Statistic Office (2011)	a	c	b

a: official in 3 senses; b: statutory; c: working; d: none

The Israeli public life is dominantly in Hebrew; the nominal official status for Arabic is reflected in the use of the language in many public signs, but usually alongside similar use of unofficial English. The heavy migration of nearly a million and half new immigrants from the former Soviet Union in the 1990s has been reflected in much wider use of Russian both on the street and in signs (Spolsky, 2004).

Determining media of instruction for school systems is perhaps the status planning decision most frequently made, the one most commonly subject to strong political pressures, and the one most often considered by educationists and by students of language planning (see for example Fishman, 1976). The educational status planning of Hebrew was: the decision by nineteenth-century East European immigrants to use Hebrew as an all-purpose medium of instruction in the schools of new settlements in Palestine; the decision by a German-Jewish foundation in the second decade of the twentieth century to use German as the medium of instruction in its new technical institute in Palestine; and the boycott by the teachers and the students of the schools in Palestine to force the foundation to use Hebrew instead (Cooper, 1989).

With the exception of Arabic, one of the effects of the revival of Hebrew has been the endangerment of other languages. Jewish languages developed over the centuries in the Diaspora as well as non-Jewish languages brought by immigrants from various countries are slowly disappearing. It is in evidence then of the "success" of Hebrew revival that once revived, it functions effectively as a national language working towards the 'one nation, one language' favored in most nation states.

Nonetheless it would be oversimplified to consider Israel a strictly monolingual nation. First, language practices are obviously multilingual. Second, there is the role of Arabic, the language of the largest minority. Third, there is regular argument for linguistic as well cultural pluralism, encouraged by continuing immigration of speakers of other languages. Fourth, there is the growing presence of English as a global language, reinforced by the existence of a significant number of English-speaking immigrants and by the close relationship of Israel with English-speaking communities abroad.

Summary

The revivers of the Hebrew at the turn of the 20th century had two monumental tasks. One involved the corpus of the language and called for its codification to allow its potential speakers to communicate freely in a modern world. A number of codification areas were involved, including the choice and harmonization between the different phonological systems. Decisions also had to be made on the unification of spelling and related issues. But crucial as these issues were in the process, they could not compare with the task of filling the vast lexical gap that existed in Hebrew. Like the shift from several languages to Hebrew, this aspect of revernacularization of Hebrew was also achieved within 2.5 decades through the cumulative efforts of the "language planning agents" in the field – educators, writers, poets, translators, editors, etc. – as well as countless language-conscious individuals in and out of the technological occupations. This was carried out in various ways, retrieving old words and roots, creating new words from old

words and roots, loan-translations, combining existing words, blending, filling in pattern with root "fillers", borrowing words and roots, etc. All this arduous, seemingly endless campaign eventually paid off, and Hebrew is now a modern language, standardized and "normalized" in every respect. When the Revival was completed about 1914, the drive has shifted to ensure that it keeps up with new developments in the modern world. As in all other developed, "mature" languages, codification in pursuit of lexical modernization is an ongoing process.

The other task involved the status of the language and called for bringing about a shift in Palestine's Jewish community from the use of dominant Yiddish and some other languages to Hebrew. Within twenty five years of the start of the revival in the 1880s' Hebrew became the dominant official language of a modern state, vital in that it was passed on the children in the home, vernacularized in that it was used as the daily spoken language of all classes, standardized in what it had not just dictionaries and grammars and an academy but a school system ranging from kindergarten to postgraduate university levels, and modernized in what it could be used to talk about sport or physics or politics or any topic.

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EDUCATION AND DEMOCRACY. THE DEVELOPMENT OF SOCIAL SCIENCES AFTER 1989. THE CASE OF THE UNIVERSITY OF BUCHAREST

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Abstract: *The collapse of the communist regime in 1989 brought numerous transformations and changes within the Romanian society: political, economic, cultural ones.*
A very important issue for the formation of future citizens is the education. We will have a particular focus on the introduction on the curricula and the development of social sciences after 1989, since various disciplines were cancelled and unified with others within the faculties in Romania. Another were unified under the umbrella of a very ideological process of learning and teaching, namely Academia "□tefan Gheorghiu" in Bucharest.
The interest for the faculties of social sciences was very high after 1989 and we can relate this interest inside the University of Bucharest with the new teaching of anthropology, psychology, sociology (in its variety), political science, European studies and so on. The spread of such disciplines included also in the Masters programs show the need of the students for developing an esprit critique and to learn also how to contribute to the needs of the society in its way towards modernization.

Keywords: *education, social sciences, democracy, post communism, university, citizens*

1. INTRODUCTION

1989 is the year of the transformations, on a way of no return. Democracy, transition, freedom, free market, free election, political parties seem to be some of the *lieux communs* of every citizen who are trying to describe the period and to participate to the political life. Democracy becomes a place to be and a lesson to learn or teach. The revival of the social sciences after 1989 is partially explained by the need of teaching and learning how to be a citizen. Old faculties regained their position, new faculties were created, and new disciplines appeared following the path towards democracy, such as psychology, journalism, political science, administrative science, European studies, public relations etc.

Education represents one of the most powerful issues related to the transition of a democratic regime. Such regimes need educated citizens and well trained civil servants, in order to populate the newly created institutions. On the other hand, education is a source of legitimating of new political parties, without any roots in the society.

We are taking the case of the University of Bucharest and focus on the creation of new faculties and disciplines of study after 1990.

2. THE DEVELOPMENT OF SOCIAL SCIENCES AFTER 1989

2.1 Breaking with the past. The development of the social sciences is struggled by the need of eliminating any form of ideology after the chute of the communist regime. Within a symbolic action, the first government Petre Roman on 13 February 1990 decided to close the Institute of historical, social and political studies and in March 1990, the same government decided that some

research institutes, which previously belonged to the Ministry of Education, will be part of the Romanian Academy: the Institute for Philosophy, Institute for Sociology, Institute for Psychology, Institute for Social Theory.

Similar decisions are taken in the first years of transition in order to manifest at least formally the elimination of any links with the past regime, such as the closure of all higher education institutions aimed to the education and training of the members of Communist Party, the cancelling of any discipline related to the communist ideology, the forms of the communist education in the university etc.

One of the most important decisions in January 1990 is to close the Academy *tefan Gheorghiu*, created in 1954 by the unification of *Andrei Jdanov* School and the University of the Workers of the Communist Party. In 1965 the *tefan Gheorghiu* School became the Academy of Social and Political Sciences (Mihai Dinu Gheorghiu, 2007: 91-93). This Academy offered diplomas in political and economic sciences, philosophy, sociology or history of the workers movement, delivered by the Ministry of Education.

As a consequence of the creation of the Academy of the Communist Party, the faculties of sociology are closed; the faculty of history was unified with the faculty of philosophy. Another consequence of this type of higher education is the strong trend in technical studies, following the communist idea of linking the teaching with the production system.

2.2 New faculties in the University of Bucharest. In 1990 the University of Bucharest comprises only six faculties. The Faculty of History-Philosophy includes chairs of economics, sociology, political science and psychology. During the debates in the Senate in January-March 1990, the Faculty of History requires its separation from the Faculty of Philosophy and becomes independent.

On 19 January 1990 the Government decides to create the Faculty of Psychology and Sociology with the headquarters in the Leu complex, the former headquarter of the Communist Party Academy *tefan Gheorghiu*, and the first dean of this faculty is prof. Ioan Mihăilescu (Mihăilescu, Rostás, 2007: 233). The Faculty of Psychology became autonomous in 1992, following a decision of Mihai Golu, ministry of education at this time.

The same decision (55/19.01.1990) created the Faculty of Journalism, which took the logistics and the location of the Faculty of Journalism of the *tefan Gheorghiu* Academy. In order to continue their studies, the students of the former Faculty of Journalism had to pass an exam in front of a commission composed by civil servants from the ministry of education, professionals from the press and cultural institutions.

The Academy *tefan Gheorghiu* is closed by the government on 19 January 1990 and the members of the Senate of the University of Bucharest don't recognize the PhD degrees of the professors delivered by the former academy, so that they are not allowed to teach in the University of Bucharest after 1990.

The same governmental decision from 19 January intends to create the Faculty of Higher Political Studies in the University of Bucharest, by organizing postgraduate degrees of two years, in order to contribute to the education of the professionals working for the political parties, the Ministry of Foreign Affairs and for higher education institutions. The courses to be taught in this faculty organized in two chairs (Political Analysis and International relations) were History of political thought, Contemporary political systems, Theory and practice of negotiation, Comparative constitutional law, Theory of international relations, Important issues of worldwide politics etc.

A year later, the National School of Political and Administrative Sciences was created by the governmental decision 183/1991 with the mission to serve the institutions of the state. The specializations offered by SNSPA were at the time political science, administrative science, international relations, management, sciences of mass communication. It is very interesting to note that the members of the Senate of Romania, the Chamber of Deputies, the prime minister or other ministers were allowed to decide upon the nomination of the directors of the

specializations and the curricula of the SNSPA for the respective specializations. The Senate of SNSPA includes also members of the Government, Ministry of Education, Ministry of Foreign Affairs, Justice, Finances, and Culture.

In 1995 SNSPA comprises also the Romanian Institute for Management and the former CEPECA (a center with the mission to train the elite of the Communist Party, created in 1967).

Back in 1991 the Senate of the University of Bucharest decides the creation of the francophone faculty, namely the International Faculty of Human Sciences (with courses in French language), which became the Faculty of Political and Administrative Sciences in 1995, with a very strong accent on the distance from the communist tradition. This faculty is primarily supported by AUPELF-UREF (actually the Association des Universités Francophones) and has three directions of study: political science, international relations and public policies. After the BA programs in French, Romanian and English, the faculty will organize master and PhD programs in political science, in order to offer a complete teaching of political science.

Few years later, other Faculties of Political Science were created in Romania.

For example the University *Babe□-Bolyai* in Cluj Napoca organized the Department of Political Science within the Faculty of History in 1993, which became the Faculty of Political Science in 1995, with Vasile Pu□ca□ as the first dean (Barbu, 2002: 229-232).

The University *Alexandru Ioan Cuza* of Ia□i organized a master program in political science within the Faculty of Philosophy since 1996.

Another important issue of post communist education is the creation of the private higher education institutions. As for political science, we remind the creation of the Faculty of Political and Administrative Sciences of the University *Banatul* from Timi□oara in 1997 and the Faculty of Political Science from the *Dimitrie Cantemir* University in 1998 (Barbu, 2002: 232).

The private universities (in Romanian the term used is not "private" but "particular") enclose often in their names the adjectives *European* or *international*, so that it predicts the type of studies offered, or in order to create a very powerful image in the 1990, of the myth of returning to Europe.

2.3 New disciplines. As far as we have seen, new disciplines as psychology, political science, European studies, sociology, social work, business administration, human resources, public relations commenced to be taught, first at BA level, after at master and doctorate and were encouraged by the funding offered by the World Bank, Foundation Soros or various EU programs, starting with TEMPUS and Erasmus.

Their spread is also due to the creation of the private universities. It is worth to remind that all the private universities in Romania were created via foundations, in cities with or without any academic tradition and in reaction to the fact that the promotions of the university staff were blocked since 1980 and also in order to take advantage of the *numerus clausus* from public universities in the 1990s, where the competition was very high.

The interest of students for the new disciplines is increasing, even if there is still in place a very competitive access system in order to enroll as a student. For example in the Faculty of Political Science of the University of Bucharest enrolled 22 students in 1991/1992, 124 students in the academic year 1993/1994 and 950 students in 2000/2001.

The same interest was manifested for the law studies, foreign languages, history,

sociology, journalism etc. As for the academic year 1990/1991 the students enrolled in the Faculty of Philosophy are 116; 377 for the Faculty of Sociology-Psychology-Pedagogy; 1983 students enrolled at the Faculty of Law; 234 students studied at the Faculty of Journalism, 626 students at the Faculty of Letters (*Statistical Yearbook of the University of Bucharest*, 1995). During the academic year 1993/1994 the students enrolled as it follows: 312 at the Faculty of Philosophy; 1314 at the Faculty of Sociology-Psychology-Pedagogy; 3141 at the Faculty of Law; 338 students in Journalism; 1586 at the Faculty of Letters.

In the University of Bucharest there are more proposals to create the Superior School of Journalism in 1995 or the postgraduate School of management and public policies proposed by the Faculty of Philosophy in 1997, but without any concrete follow-up.

A possible explanation for the increasing interest in studying social sciences after 1989 is the fact that during the communist regime the social sciences were completely ideologized and as a matter of consequence, the Faculties of Sociology, Journalism or Psychology were closed.

2.4 Political elites and social sciences. The interest for social sciences explains the fact that the members of the Romanian Parliament are enrolling in BA, master or PhD degrees in social sciences during their mandate. It is more a legitimating strategy used by member of different political parties and we can observe the trend in accumulating more degrees in order to get access to teaching and management positions in the private or public universities (Udrescu, 2011). We can see this trend from the private universities point of view, as they hired political personalities in order to increase the visibility of their university.

The members of the Parliament had also have courses offered by different foundation such as: Foundation for political education (FEPAC Bra□ov), Foundation Jean Jaurès, European Foundation Constantin Drăgan, Foundation XX Century, Foundation for pluralism, Foundation Alfred Mozer or by the institutes created by different political parties such as Institute for Social Studies *Ion Aurel Stoica* or the Institute for Social Studies *Ovidiu □incai*.

The courses focused on management and business administration, leadership and economic development, entrepreneurship, analysis of the military conflicts, political communication, conflict resolution and mediation, campaigning on local elections etc (Udrescu, 2011).

4. CONCLUSIONS

The development of the social sciences after 1989 is explained by many reasons. First at all, there is the need to build up theories about society, politics and also to create instruments to understand and analyze the profound changes during the post communist transition.

Another reason is that the past should also be valorized and the future has to be taken in consideration. There are also needs requested by the market driven economy, by the accession in the European Union and the most important, the need to educate and train the newly democratic citizens. This is also because the mission of the Romanian university, as for example, the University of Bucharest, is to educate citizens and to train civil servants, following a Napoleonic tradition of universities. This dimension could also explain the permeable relationship of the university with politics after 1989.

On the other hand, the interest for studying social sciences in post communist transition is related to the need to prepare students for such disciplines by teaching civic education, democratic education or civic culture classes in the high schools of Romania. The theoretical part is doubled by the volunteering programs offered by numerous Romanian NGO's such as Centras, Pro-Democra□ia, Soros Foundation, the Foundation for the Development of Civil Society (FDSC) and many others. This aspect is important and related to the programs for developing the

civic culture and participation of young people to the social and political life.

The need for experts is another reason of the development of the social sciences in post communist regimes. This aspect could also have perverse effects in terms of Raymond Boudon, because of the mechanisms of designing the experts.

Another paradigm of analyzing the long march of the social sciences after 1989 is the knowledge/power regimes in Michel Foucault interpretation. The mission of our universities and the past tradition of educating citizens and civil servants justify this paradigm.

As a final conclusion, the education is the primary step towards a democratic regime and the interest for education (in any of its forms) represents a measure for the degree of development of a democracy.

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COMMUNICATION SKILLS IN THE CLASSROOM

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Effective communication is at heart of good classroom management. The manner in which a teacher communicates with his students sets the overall tone for the classroom. Managing a classroom requires patience, confidence and respect. Ultimately, teachers should strive to create an environment where students feel respected, trusted and comfortable enough to take risks in learning.

What makes you a good teacher? This probably depends on the subject matter and the level of students. Some teachers can make even the most boring material seem interesting and alternately some teachers can make interesting materials boring.

The best way for teachers to encourage communication from all students is through classroom discussion or small group (Rika, 1996).

Games are a great way to help group of teens learn skills for working together. Skills can be learnt and practiced in a fun, non-threatening way says Susan Carney.This is an example:

Tell Three Things

Each person writes down three things about himself: two of each are true and one of which is a lie. After everyone has finished making his (or her list) , students take turns reading their lists aloud and asking other students to guess which one is a "lie". Students can answer either individually or in a "raise your hand if you agree" format. Students can also be asked to justify their guesses if time allows. Whether groups are just getting to know one another or have been together a longer time, they can still learn things about each other from this activity.

- Teachers should avoid yes/no questions and short answered question if they want to have a quality discussion;
- Debate is a way teachers can provide their students with the opportunity to practice their communication skills;

Another way to encourage students to communicate, especially if they are too shy to speak up, is to have their journal. Research suggests (Terrell Young,1999) that dialogue journals provide a purposeful activity in which students communicate their thoughts and feelings. Teachers must provide students with an environment that is conducive to learning. If a student feels uncomfortable, unsafe, or not respected, then their chances of success in that class dramatically decrease. Also, as our society becomes more diverse, it is important that students learn to value and use diversity to the greater good. Teachers already have a

number of roles in the classroom; yet, valuing diversity is one of the most important ones a teacher must fill. Below is a list of just a few things that teachers can do to create an environment where each student feels valued and respected.

- Take the time to learn about your students' background, interests, and learning style.
    - This will allow you to create an environment that is conducive to each individual student.
- Allow time for the students to learn about each other and gain an appreciation for the diversity they bring to the classroom.
    - Remind them how boring it would be if we were all alike and there were no differences among us to make each person unique.
    - Teach students that everyone has strengths and weaknesses. When working in teams encourage students to take advantage of the strengths of the team members in order to produce the best possible results.
- Bring in different people to the class as resources that students might be able to connect with.
    - Search out people that are different from yourself and that might share certain qualities with your students.
    - Students need role models. Many times when they see they are connected in some way to a person they will be more apt to listen and learn from them.
- Never tolerate bullying, teasing, and other put-down behavior at any time in the classroom.
    - Implement a "zero tolerance" for anything that is disrespectful, hurtful, or intolerant of diversity.
-

Teaching is a very challenging and rewarding profession. Some teachers have more success than other because they have developed certain teaching skills that motivate students to learn, help students to stay focused, and provide students with self-learning skills.

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3. MATHEMATICS, COMPUTER SCIENCE, IT&C

3.1. *APPLIED MATHEMATICS*

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A SPLITTING ALGORITHM FOR VARIATIONAL INEQUALITIES

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Abstract: *Let X be a Banach space, X^* its dual, $(\cdot,\cdot)$ the duality on $X^*\times X$, and $T:X\to X^*$ an operator (nonlinear and multi-valued, in general), and $\varphi:X\to \mathbf{R}\cup\{+\infty\}$ is a convex lower semi-continuous function with the effective domain $D(\varphi)=\{v\in X \mid \varphi(v)<\infty\}$. Given a closed convex subset $K\subset X$ and $f\in X^*$, the problem of finding $u\in K$ such that $(Tu-f, v-u)+\varphi(v)-\varphi(u)\geq 0$ for all $v\in D(\varphi)$ is called a variational inequality.In this paper we applied a splitting algorithm for the stationary inclusion $Tu+\partial\varphi(u)\ni 0$, equivalent with a variational inequality, when T is a maximal monotone mapping on a Hilbert space H. Also we establish conditions to prove the weak convergence of the algorithm..*

Mathematics Subject Classifications 2010: *47J20, 47J25, 49J40.*

Keywords: *Douglas-Rachford algorithm, splitting algorithm, variational inequality.*

1. INTRODUCTION

A fundamental algorithm for finding roots of a monotone operator is the *proximal point algorithm* (see [12]). This method requires evaluation of *resolvent* operators of the form $(I+\lambda S)^{-1}$, where S is monotone and set-valued, λ is a positive scalar, and I denotes the identity mapping. The main difficulty with the method is that $I+\lambda S$ may be hard to invert, depending on the nature of S. One alternative is to find maximal monotone operators W and V such that $W+V=S$, but $I+\lambda W$ and $I+\lambda V$ are easier to invert than $I+\lambda S$. One can then devise an algorithm that uses only operators of the form $(I+\lambda W)^{-1}$ and $(I+\lambda V)^{-1}$, rather than $(I+\lambda(W+V))^{-1}$. Such an approach is called a *splitting method***,** and is inspired by well-established techniques from numerical linear algebra (see, for example [10]).

A number of authors have extensively studied monotone operator, splitting methods, which fall into four principal classes: forward-backward [13], double-backward [8], Peaceman-Rachford [9], and Douglas-Rachford [9].

We will focus on the Peaceman-Rachford algorithm,for variational inequalities in the case of multi-valued monotone operators. We will prove the convergence of this algorithm.

2. SPLITTING ALGORITHMS FOR STATIONARY PROBLEMS

Let H be a real Hilbert space with inner product $(\cdot,\cdot)$ and norm $\|\cdot\|$. Let $S:H\to 2^H$ be a monotone operator. We study the nonlinear multi-valued stationary equation $Su\ni 0$.

We consider the case when $S=W+V$ and W,V are maximal monotone. For that we get

V,W single-valued operators. In conclusion we have to solve the inclusion

$$Wu+Vu \ni 0 \quad (1)$$

equivalent with

$$u+\lambda Wu \ni (u-\lambda Vu),$$

where $\lambda>0$ is a constant. Since W is a maximal monotone operator, we deduce that

$$u=(I+\lambda W)^{-1}(I-\lambda V)u. \quad (2)$$

Analogously, (1) can be written as

$$u+\lambda Vu \ni (u-\lambda Wu),$$

where $\lambda>0$ is a constant, and finally we obtain

$$u=(I+\lambda V)^{-1}(I-\lambda W)u. \quad (3)$$

Combining (2) and (3) we have

$$u=(I+\lambda V)^{-1}(I-\lambda W)(I+\lambda W)^{-1}(I-\lambda V)u. \quad (4)$$

Relation (4) suggests the following algorithm

$$u^{n+1}=(I+\lambda V)^{-1}(I-\lambda W)\,(I+\lambda W)^{-1}(I-\lambda V)u^n \quad (5)$$

which was introduced, in the case of linear operators, by Peaceman-Rachford (see [11]).

When V is single-valued, we have the identity

$$(I+\lambda V)(I+\lambda V)^{-1}=I. \quad (6)$$

From (2) and (6), we obtain

$$u=(I+\lambda V)^{-1}[(I+\lambda W)^{-1}(I-\lambda V)+\lambda V]u. \quad (7)$$

Relation (7) suggests the iterative scheme

$$u^{n+1}=(I+\lambda V)^{-1}[(I+\lambda W)^{-1}\,(I-\lambda V)+\lambda V]u^n \quad (8)$$

which was introduced by Douglas-Rachford [6].

These algorithms are both unconditionally stable (u^n remains bounded independently of n for any λ). This set of properties is remarkable if we compare them to what we get with more standard algorithms.

The first one is

$$u^{n+1}=(I+\lambda W)^{-1}(I-\lambda V)u^n, \quad (9)$$

which is not unconditionally stable, but converges to the solution of the stationary problem for λ sufficiently small if V is Lipschitz continuous (see [7], [4]).

The second one is

$$u^{n+1}=(I+\lambda W)^{-1}(I+\lambda V)^{-1}u^n,$$

which is unconditionally stable but does not converge to the solution of the stationary problem for any λ, except with some special modification (see Lions [8]).

All these are called *splitting algorithms* since, up to the introduction of a fractionary step, they can be interpreted as the combination of a step for W and a step for V. As an example, (9) can be written

$$\frac{1}{\lambda}(u^{n+1/2}-u^n)+Vu^n=0,$$

$$\frac{1}{\lambda}(u^{n+1}-u^{n+1/2})+Wu^{n+1}=0,$$

which shows that (9) results from the combination of a forward step on V and backward step on W. In this section, we show that these algorithms can be used to solve variational inequalities

We shall assume that $T:H\to 2^H$ is a maximal monotone operator. We denote by D(T) the domain of T and by

$$J_T^{\lambda}=(I+\lambda T)^{-1}$$

the resolvent of T. Let $\varphi:H\to \mathbf{R}\cup\{+\infty\}$ be a proper convex lower semi-continuous (l.s.c) function and let f be defined on H. We consider the following variational inequality:

Find $u\in D(\varphi)$ such that there exists $w\in Tu$ satisfying

$$(w-f,v-u)+\varphi(v)-\varphi(u)\geq 0 \quad \forall\, v\in D(\varphi). \quad (10)$$

It is easy to notice that the above problem is equivalent with the problem:

Find $u\in H$ such that

$$Tu+\partial\varphi(u) \ni f \quad (11)$$

where $\partial\varphi$ is the subdifferential of φ.

We shall assume that the problem (10) has at least one solution. Hence there exists $u\in H$, $t\in Tu$, $s\in\partial\varphi(u)$ such that $t+s=f$. We do not affect the generalization of the problem if we assume in the sequel that $f\equiv 0$.

Since T and $\partial\varphi$ are maximal monotone operators, we can apply the Peaceman-Rachford algorithm to solve the problem:

Find $u\in H$ such that

$$Tu+\partial\varphi(u) \ni 0. \quad (12)$$

In the case considered here, where T and $\partial\varphi$ are multi-valued, we need to make precise the definition of the algorithms (5) and (8). For both, $u^0\in D(T)$ is given, and we choose $t^0\in Tu^0$ and set $v^0=u^0+\lambda t^0$ in such a way that $u^0=J_T^{\lambda}(v^0)$. We then define by induction the sequence $\{v^n\}$ in the following way:

Algorithm

$$v^{n+1}=(2J_{\partial\varphi}^{\lambda}-I)(2J_T^{\lambda}-I)v^n \quad (13)$$

Convergence of the Algorithm . We obtain the algorithm above after a simple computation. Since $t+s=0$ and $v=u+\lambda t$ in such way that $u=J_T^{\lambda}(v)$, we have

$s=-t$, $u+\lambda s=u-\lambda t=2u-u-\lambda t=2J_T^\lambda(v)-v$.

From this relation, we obtain

$u=J_{\partial\varphi}^\lambda(2J_T^\lambda-I)v$,

$2u=2J_{\partial\varphi}^\lambda(2J_T^\lambda-I)v$,

$v+2J_T^\lambda(v)-v=2J_{\partial\varphi}^\lambda(2J_T^\lambda-I)v$,

$v=(2J_{\partial\varphi}^\lambda-I)(2J_T^\lambda-I)v$,

relation which suggests our algorithm, and the following notations

$v=u+\lambda t$, $w=u+\lambda s$,

$w^n=2u^n-v^n$, $t^n=\frac{1}{\lambda}(v^n-u^n)$, $s^n=\frac{1}{2\lambda}(w^n-v^{n+1})$.

We prove the following result.

Proposition 2.1. *Under the assumption: there exists* $u\in H$, $t\in Tu$, $s\in\partial\varphi(u)$ *such that* $t+s=0$, *the sequences* $\{u^n\}$, $\{v^n\}$, $\{w^n\}$, $\{s^n\}$, $\{t^n\}$, *remain bounded. Moreover*

$$\lim_{n\to\infty}(t^n-t,\ u^n-u)=0 \qquad (14)$$

$$\lim_{n\to\infty}(s^n-s,\ \frac{v^{n+1}+w^n}{2}-u)=0. \qquad (15)$$

Proof. From the definition of t^n, we have $v^n=u^n+\lambda t^n$. As $u^n=J_T^\lambda v^n$, we have $v^n\in u^n+\lambda Tu^n$, hence $t^n\in Tu^n$. From the monotonicity of T, we get:

$$0\le(t^n-t,u^n-u)=\frac{1}{4\lambda}(\|v^n-v\|^2-\|w^n-w\|^2), \quad (16)$$

using the relations

$u^n=\frac{1}{2}(v^n+w^n)$, $u=\frac{1}{2}(v+w)$,

$t^n=\frac{1}{2\lambda}(v^n-w^n)$, $t=\frac{1}{2\lambda}(v-w)$.

On the other hand, from (13), we have

$$v^{n+1}=(2J_{\partial\varphi}^\lambda-I)w^n\Rightarrow\frac{1}{2}(v^{n+1}+w^n)=J_{\partial\varphi}^\lambda(w^n).$$

Hence

$$w^n\in\frac{v^{n+1}+w^n}{2}+\lambda\partial\varphi(\frac{v^{n+1}+w^n}{2}),$$

$$s^n=\frac{w^n-v^{n+1}}{2\lambda}\in\partial\varphi(\frac{v^{n+1}+w^n}{2}).$$

From the monotonicity of $\partial\varphi$ we deduce

$$0\le(s^n-s,\ \frac{v^{n+1}+w^n}{2}-u)=$$

$$(\frac{w^n-v^{n+1}}{2\lambda}-\frac{w-v}{2\lambda},\ \frac{w^n+v^{n+1}}{2}-\frac{w+v}{2})=$$

$$\frac{1}{4\lambda}(\|w^n-w\|^2-\|v^{n+1}-v\|^2). \qquad (17)$$

From (16) and (17) we obtain the inequalities

$\|v^{n+1}-v\|^2\le\|w^n-w\|^2\le\|v^n-v\|^2$,

which show that the sequences $\{v^n\},\{w^n\}$ are bounded. Implicitly, $\{u^n\}$ is bounded. Finally, as

$\|v^n-v\|^2-\|v^{n+1}-v\|^2\to0$ as $n\to\infty$,

(16), (17) imply (14) and (15). ■

Definition 2.2. We say that $A:H\to H$ satisfies *condition (C)* if for all x^n, $x\in D(A)$ such that Ax^n is bounded, $x^n\rightharpoonup\bar{x}$ (weak convergence), and

$(Ax^n-Ax,\ x^n-x)\to0$ as $n\to+\infty$, imply $x=\bar{x}$.

Theorem 2.3. *If* T *is single-valued and satisfies condition (C), then the sequence* $\{u^n\}$ *obtained from Algorithm converges weakly to* u, *the solution of (12), which is unique.*

Proof. We first prove uniqueness. Let u_1, u_2, be two solutions of (12). We have, using the monotonicity of $\partial\varphi$,

$0\le(Tu_1-Tu_2,\ u_1-u_2)=$

$-(\partial\varphi(u_1)-\partial\varphi(u_2),\ u_1-u_2)\le0$,

hence $(Tu_1-Tu_2,\ u_1-u_2)=0$ which, together with condition (C) implies $u_1=u_2$.

Let $\{u^{n_i}\}$ be a subsequence of the bounded sequence $\{u^n\}$ such that $u^{n_i}\rightharpoonup\bar{u}$. From (14) and condition (C), one gets $u=\bar{u}$, and from the uniqueness, the whole sequence $\{u^n\}$ converges weakly to u. ■

Remark 2.4. We can prove that, if a subsequence $\{v^{n_i}\}$ of $\{v^n\}$ is bounded, then

the problem (12) has one solution u. Indeed, let $A=(2J^{\lambda}_{\partial\varphi}-I)(2J^{\lambda}_{T}-I)$, we have $v^{n+1}=Av^{n}$.As $2J^{\lambda}_{\partial\varphi}-I$ and $2J^{\lambda}_{T}-I$ are nonexpansive, A itself is nonexpansive. Because the subsequence $\{v^{n_i}\}$ is bounded, we obtain that A has a fixed point v, with Av=v. Let $u=J^{\lambda}_{T}v$ we have $u\in D(T)$ and $v=(2J^{\lambda}_{\partial\varphi}-I)(2u-v)$, $u=J^{\lambda}_{\partial\varphi}(2u-v)$.

Hence $u\in D(\partial\varphi)$. Let $t\in Tu$ satisfy $v=u+\lambda t$. We have $u=J^{\lambda}_{\partial\varphi}(u-\lambda t) \Rightarrow (u-\lambda t)\in u+\lambda\partial\varphi(u)$ that is $-t\in\partial\varphi(u)$, hence u is a solution of the problem (12).

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A VERSION OF ROBBINS-MONROE ALGORITHM

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Abstract: *In the present paper, we present a better version than the Robbins-Monroe algorithm, which uses the speed of convergence of Robbins-Monroe strings of real functions.*

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1. INTRODUCTION

Let $f:R\to R$ be an unknown function, and x^* the unique unknown root of f(.)([1],[2]). We suppose that:

1) f(.) is not decreasing on R

2) f(.) can be observed at each real value x from R, but each observation, noted by y_x, is not very accurate, she is corrupted by observations errors (noises). So, we have

$$y_x=f(x)+\varepsilon_x \qquad (1)$$

where ε_x: $\Omega\to R$, is the random variable which means noises of observations, and it has the next property:

$$E[\varepsilon_x]=0, \forall\, x\in R \qquad (2)$$

So, for f(.) we have random variables families $\{\varepsilon_x\}_x$, $x\in R$([4], p.2,5). Let be known, a sequence of the real numbers, $(a_n)_{n\in N^*}$, and $x_0\in R$, called the initial point. It will be made a sequence of the random variables, called the Robbins-Monroe sequence of the approximations, which has the next forms ([4], p5):

$$x_{n+1}(.)=x_n(.)+(a_{n+1})\, y_{x_n}(.), \qquad x_0\in R,$$

$$(a_n)_n\subset[0,+\infty) \qquad (3)$$

and

$$y_{x_n}(.)=f(x_n)+\varepsilon_{n+1}, \quad E[\varepsilon_{n+1}]=0, \quad y_{x_n}, \varepsilon_{n+1}: \Omega\to R, \forall\, n\in N \qquad (4)$$

We have an almost sure convergence theorem of the Robbins-Monroe sequences from (3).

Theorem 1. ([5], p.214-215)

In addition, we suppose that we have the next conditions:

(a) $E[y_{x_n}|x_1, x_2, \ldots, x_n]=f(x_n)$ (a.s.), $\forall\, n\in N$

(b) $a_n>0, \forall\, n\in N^*, \sum_{n=1}^{+\infty} a_n=+\infty, \sum_{n=1}^{+\infty} a_n^{\,2}<+\infty$

(c) There exists a continuously twice differentiable function on R, named Lyapunov function, V: $R\to R$, satisfying the following conditions:

(c.1.) there exists V''(.) on R, and V''(.) is bounded on R (that means, it's second derivative is bounded on R)

(c.2.) there are two functions a, b:[0,+∞)$\to$R, so that:

(c.2.1.) a(.) and b(.) is continuously on [0,+∞)

(c.2.2.) a(.) and b(.) is no decreasing on [0,+∞)

(c.2.3.) a(x) $\geq$0, b(x) $\geq$0, $\forall$ x$\in$[0,+∞)

(c.2.4.) a(0)=b(0)=0 and $\lim_{x\to\infty} a(x)=+\infty$

(c.2.5.)$a(|x|)\leq V(x)\leq b(|x|), \forall x\in R$

(c.3.) $\forall 0<\alpha_1<\alpha_2$, exists the real number $\inf_{\alpha_1\leq|x-x^*|\leq\alpha_2}\{V'(x-x^*)f(x)\}>0$

(d) $E[|y_x^2| | x_1, x_2, \dots, x_n] <\sigma^2$ (a.s.)

In this conditions, we have that $x_n(.)\xrightarrow{a.s.} x^*$, when n $\to+\infty$ (or, with other words we have $\lim_{x\to+\infty} x_n=x^*$(a.s)).

In real applications, it will be frequently taken $a_n=\frac{1}{n}$([3], p.4). The practical method to use the Robbins-Monroe algorithm is:

Step 1. First, we elect (in random way) a real value, which is noted by x_0.

Step 2. Now, we make an observation (with noise) of f(.) in x_0, noted by $\tilde{y}_{x_0}$, this means that we have the error-corrupted observations, and the observation errors are noted by $\tilde{\varepsilon}_{x_0}$, so we have $\tilde{y}_{x_0}=f(x_0)+\tilde{\varepsilon}_{x_0}$. This observation is a real value, and it represents a selection of the random variable $y_{x_0}(.)=f(x_0)+\varepsilon_{x_0}(.)$, where $\tilde{\varepsilon}_{x_0}$ is a selection of the random variable $\varepsilon_{x_0}(.)$. In this moment, the only value which is obtained from external observation on f (.) in x_0, is the real number $\tilde{y}_{x_0}$ (which is called the observation of f(.) in x_0, corrupted by the observation errors).

Step 3. With the real number $\tilde{y}_{x_0}$ from step 2, and with (3), we obtain the real number

$$\tilde{x}_1=x_0-\frac{1}{1+0}\tilde{y}_{x_0} \qquad (5)$$

Now, we repeat the step 2 and 3, and we change on x_0 with $\tilde{x}_1$, obtaining another number $\tilde{x}_2$, and so on. After we repeat steps 2 and 3 for n-times, you get a string of real numbers, noted with $(\tilde{x}_n)_n$. Each value $\tilde{x}_n$ is a selection (real value) of random variable $x_{n+1}(.)$ from (3), and is achieved by formula (3) such that:

$$\tilde{x}_{n+1}=\tilde{x}_n-\frac{1}{n+1}\tilde{y}_{x_n}, \forall n\in N \qquad (6)$$

If f(.) satisfies the conditions of the theorem 1, then we have:

$$(\tilde{x}_n)\xrightarrow[n\to+\infty]{} x^*. \qquad (7)$$

The solid application of the steps before, can generate a number of issues related to the convergence of string $(\tilde{x}_n)_n$, such as:

1. The first category of issues that may arise in the practical way, it is related to the influence of the observation error of function f (.) in each point $\tilde{x}_n$.

2. The second category of issues, it is related to the speed of convergence of string $(\tilde{x}_n)_n$ obtained with the formula (3). This problem is very important when this algorithm is implemented on computers for process, where the obtaining time for a single x* root has great importance in the management efficiency of that process through the computer.

3. Another category of problems are those related to the choice of initial point x_0, so that string (6) to be convergent, and with greater speed of convergence.

4. Problems may also appear in transforming this algorithm - which is a sequential arrangement, in a parallel one.

5. A last category of problems that may appear related to the algorithm (3) of Robbins-Monroe, is concerned about the optimum way in which we choose $(a_n)_n$ string, to fulfill the conditions of Theorem 1 (or equivalent), and to provide an increased speed of convergence.

In this paper we will mainly deal with the second category of issues, and partly with the last ones. There are examples of functions, which provides us $\tilde{y}_{x_n}$ observation strings and which obtain converged (6) form strings, but which have little convergence speed. We make the observation that, checking the theorem 1 hypothesis in practical situations, can create

technical problems (depending on the complexity of the correspondence law of that function).

2. THE MAIN RESULTS

Now, we start this section with an example about the convergence speed of a particular function.

Example 1. We consider the function

$$f:[0,+\infty)\to R, f(x)=\sqrt{x}-2, \quad (8)$$

having as unique root $x^*=4$. It will be taken another helping function, noted by $f_1(.)$

$$f_1(x)=\begin{cases}-2, x\le 0\\ f(x), x\in(0,10],\\ \sqrt{10}-2, x\ge 10\end{cases} \quad f_1:R\to R, \quad (9)$$

$f_1(.)$ is bounded on R.

This function took this form because we make the assumption that it is known before (additional information) that the only root of function $f_1(.)$ is in the range [0, 10], and for that the new function to be bordered. To be noticed that the equations $f(x)=0$ and $f_1(x)=0$ have the same root, $x^*=4$. From now on (in this example) we will work only with function $f_1(.)$.

For the function $f_1(.)$ in this example, it can be created a Lyapunov function that to fulfill the conditions of Theorem 1 and that to look like the Robbins-Monroe string from the previous example, string attached on function $f_1(.)$ that satisfies the assumptions (a) and (d) of Theorem 1 with $a_n=1/n$, $n\ge 1$.

If, for the function $f_1(.)$ from example 1. it is assumed that we have observations about it, in any point $x\in R$, a certain error, known in advance, then if it is chosen the initial point x_0 selected too far away from the unique root of $f_1(.)$, then the algorithm Robbins-Monroe converges very slow to this root. For example, if you take as the initial point on the $x_0=12.0$, and if we assume that the error of observation of $f_1(.)$ in each point x of R has the order 10^{-2} (meaning that in all $x\in[0,+)$, we have $|y_x - f(x)| < 0.01$, where $y_x= f_1(x) + \varepsilon_x$, with error ε_x that has the property $|\varepsilon_x| < 0.01$), then are obtained the next terms of the Robbins-Monroe string attached of $f_1(.)$, x_0, and the maximum precision 0.01. These results were obtained with a C++ program and are presented following the model in [6], p. 23. In this program, the initial value of $x_0=12.0$, and the number of iteration, n= 10. The final results are the following (presented with 6 decimal) presented like in ([7], p.20) and [6], p.23):

Table 1.

x[0]=12.000000
x[1]=10.837722778
x[2]=10.256584167
x[4]=9.585001945
x[5]=9.366808891
x[6]=9.190338135
x[7]=9.043643951
x[8]=8.917922974
x[9]=8.808657646
x[10]=8.711833954

The average error is equal to the Em = -002267.

Here $x[n+1]=x[n]-\frac{1}{n+1}y_{xn}$, where

$y_{xn}=f(x[n])+\varepsilon_{n+1}$, n=0,2,…,8, and

$\varepsilon_{n+1}=z$, from the (n+1)

iteration on C++ program. Also, the error is the average (simple arithmetic average) of all the errors recorded in the 9 observations on $f_1(.)$, i.e. $Em=(\varepsilon1+...\varepsilon9)/9=0.002267$.

The crop was done to the 7th decimal (and have been retained the first 6 decimals). We give below the centralized values table of $f_1(.)$ function, seen (with given perturbations data of ε_i, i = 1,2, ...,8) in the points x[i], values noted by $y_{x[i]}$, i = 1,2,..,8.

Table.1'.

(i) Number of Iterations (1)	($y_{x[i]}$) The observed value of $f_1(.)$ on x[i] (2)	(f(x[i])) The exact value of $f_1(.)$ on x[i] (3)	The observations errors ε_{i+1} (on x[i]) ($\varepsilon_{i+1}=y_{x[i]} - f(x[i])$) (4)
0	$y_{x[0]}$= 1.162278	f(x[0])= 1.162278	ε_1 = 0.000000
1	$y_{x[1]}$= 1.162278	f(x[1])= 1.162278	ε_2 = 0.000000
2	$y_{x[2]}$= 1.162278	f(x[2])= 1.162278	ε_3 = 0.000000
3	$y_{x[3]}$= 1.136622	f(x[3])= 1.141522	ε_4 = - 0.004900
4	$y_{x[4]}$= 1.090965	f(x[4])= 1.095965	ε_5 = - 0.005000
5	$y_{x[5]}$= 1.058824	f(x[5])= 1.060524	ε_6 = - 0.001700
6	$y_{x[6]}$= 1.026857	f(x[6])= 1.031557	ε_7 = - 0.004700
7	$y_{x[7]}$= 1.005765	f(x[7])= 1.007265	ε_8 = - 0.001500
8	$y_{x[8]}$= 0.983389	f(x[8])= 0.986289	ε_9 = - 0.002900
9	$y_{x[9]}$= 0.968238	f(x[9])= 0.967938	ε_{10} = 0.000300

If we operate 100 iteration (in same conditions above), the following results are obtained:

x[100]=6.934031010

The average error is equal to the Em= - 0.000495

If we do now (with the same function in the same conditions) 500 iteration, we obtain:

Table 2.

x[493]=6.066642284
x[494]=6.065702915
x[495]=6.064774990
x[496]=6.063833237
x[497]=6.062898636
x[498]=6.061974525
x[499]=6.061045647
x[500]=6.060128212
x[501]=6.059205055

The average error is equal to the Em= - 0.000041

If we take 1000 iterations, in the same conditions (x_0 = 12.0 and 6-digit accuracy), we have:

Table 3.

x[992]=5.765196800
x[993]=5.764791965
x[994]=5.764384747
x[995]=5.763985157

x[996]=5.763581753
x[997]=5.763183594
x[998]=5.762779713
x[999]=5.762382984
x[1000]=5.761984348

The average error is equal to the Em= - 000071

We notice that after 1000 iteration, we are still far away from the root x^*= 4. After 5000 iteration we obtain the following results:

x[5]=5.216153145 and the error in the observations of $f_1(.)$ is 0.002800 and f_1(x[4,999])=0.283902 and
y(x[4,999])=0.286702

The average error is equal to the Em= -0.000069

After 10000 iteration, we obtain:

x[10000]=5.033749104 and the error in the observations of $f_1(.)$ is - 0.000600

This demonstrates that, in this case, the weak convergence of the algorithm, is caused by the chosen value for x_0, too far from x*=4. It is clear that the classic Robbins-Monroe algorithm, applied to this modified functions provided by departure, x_0 = 12.0, it is weakly convergent (by unique root x*=$\sqrt{2}$).

Now we slightly change the Robbins-Monroe algorithm form, about which we will show that is faster than Robbins-Monroe string.

Let it be the $(x_n)_n$ random variables string, attached to the function f:R$\rightarrow$ R, from the first part, string given by the recurrence formula:

$x_{n+1}(.)=x_n(.)+(a_{n+1})\, y_{x_n}(.), x_0 \in R$, cu

$y_x=f(x)+\varepsilon_x$ (10)

which has a weak convergence to the root x*. Usually, the weak convergence of this series is because of the high speed low variation of $f_1(.)$ in a neighborhood V_{x^*} of x*, meaning that the fraction $\frac{|x_{n+1}(\omega)-x^*|}{|x_n(\omega)-x^*|}$ has a value nearly equal to 1 (or equivalently, the difference $|x_{n+1}-x^*|$ is approximately equal to x^*)([6], p. 21-22). We suppose that the function $f_1(.)$ has all the properties from part A, and meet the assumptions of the theorem 1. Then we have:

and f (x[9999])=0.243607
and y(x[9999])=0.243007

The average error is equal to the Em= -0.000091

As we can see, studying the numerical results above (including those in table 1) shall we consider that, starting from

x0 = 12.0, we get a weakly convergent Robbins-Monroe string.

Theorem 2. If the function $f_1(.)$ has the above conditions and assumptions of the theorem 1, then the function $g_1(x)=Kf(x)$, K>1, has the same assumptions of the theorem 1, and so, the Robbins-Monroe string attached on the function $g_1(.)$, is almost certainly convergent to x* root of his $g_1(.)$ ($g_1(.)$ and $f_1(.)$ have the same root, x*=4).

Proof: Simple checking:

Returning to example 1, we make a new Robbins-Monroe string for $f_1(.)$ of (9) given by $x_{n+1}(.)=x_n(.)-\frac{1}{2n+1}(3\, y_{x_n}(.))$, $x_0 \in R$, $\forall n \in N$. We numerically simulate this variant of the algorithm, for the function $f_1(.)$ f_1:R $\rightarrow$R, $f_1(x)=\begin{cases}\sqrt{x}-2.0, x\in[0,10]\\ \sqrt{10}-2.0, x\geq 10\\ -2, x\leq 0\end{cases}$, x_0=12.0 and

$g_1(x)=\begin{cases}-6, x\leq 0\\ 3*(\sqrt{x}-2), x\in(0,10]\\ 3*(\sqrt{10}-2), x>10\end{cases}$, g_1:R $\rightarrow$R.

For algorithm Robbins-Monroe, applied his $f_1(.)$, see some results in the part A, in tables 1, 1', 2, and 3. We run the same number of iterations (10, 100, 500, 1000, 5000, and 10,000) starting from the same initial point x1 = 12.0, and with the same precision display (as

number of decimals displayed) in the algorithm Robbins-Monroe for f1(.) and 3f1(.), implemented in the C++ program for the function f1 (.), and with another C++ program, for function g1(.), with increase of the errors by multiplication with 3 to function $g_1(.)$, we reach to the results shown in the table below:

Table 4.

Nr. de iteration (n)	$f_1(.)$	$3f_1(.)=g_1(.)$
10	x[10]=8.711833954	x[10]=8.140531540
100	x[100]=6.934031010	x[100]=6.013100624
500	x[500]=6.060128212	x[500]=5.158834457
1000	x[1000]=5.761984348	x[1000]=4.907297134
5000	x[5000]=5.216153145	x[5000]=4.508469105
10000	x[10000]=5.033749104	x[10000]=4.394921303

For the same function $g_1(.)$, but with the stagnation of the order of magnitude of the error of observation at the multiplication by 3, the simulation gives the following results:

Table 5.

n=10, x[10]=8.137619972
n=100, x[100]=6.011349201
n=500, x[500]=5.157924652
n=1000, x[1000]=4.906517982
n=5000, x[5000]=4.507922173
n=10000, x[10000]=4.394413471, if we compare them with those in table 4. we see that this variant of the Robbins-Monroe algorithm (with or without raising the error of observation from $f_1(.)$ to $g_1(.)=3f_1(.)$) it is much more efficient than the "classic".

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BEST PATTERN OF MULTIPLE LINEAR REGRESSION

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Abstract: *In the economical domain we often analyze the influence of several causal variables on a resulting variable, using a pattern of multiple linear regression. Among the independent factorial variables taken initially into account in the study, we can deduce throughout the process that a part of them have an insignificant statistic influence on the effect variable. The article presents a method of eliminating insignificant variables and determining the best pattern of multiple linear regression.*

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1. INTRODUCTION

The connection between two or among several factorial variables and a resulting variable is called multiple connection, therefore the choice of the factorial variables is very important so that the variation of the resulting variable should be real. Factorial variables exert a greater or smaller influence on the resulting variable, consequently some of the factorial variables are more important and must be taken into account in the study which is made, while for other variables it is proven that they are not so important for the study of the resulting variable variation and must be eliminated. Factorial or causal variables are ordered according to the importance of their actions on the effect phenomenon and one looks for a regression equation which is the best.

A best pattern of regression can be obtained by the retrograde elimination method, which consists of the successive elimination of the factorial variables taken initially into the multiple regression equation until the pattern becomes the best, carefully observing to statistically verify the emergence criterion.

2. STATISTICAL HYPOTHESIS USED FOR THE CHOICE OF VARIABLES WHICH ARE ELIMINATED FROM THE PATTERN

We take the dependent variable Y and k the independent variabiles; there are $X_1, X_2, ..., X_k$ connected by a multiple regression equation :

$$Y = a_0 + a_1 X_1 + ... + a_{j-1} X_{j-1} + a_j X_j + \\ + a_{j+1} X_{j+1} + a_{j+1} X_{j+1} + ... + a_k X_k + \varepsilon \text{ ,}$$

where the coefficients' matrix of the pattern is $a^T = (a_0\ a_1 ... a_j ... a_k)$ and the matrix of the parameter estimators of the pattern is $\hat{a}^T = (\hat{a}_0\ \hat{a}_1 ... \hat{a}_j ... \hat{a}_k)$, estimators obtained through the smaller quadrants method.

We assume that the estimators obtained are unbiased , having a minimal variance and following the normal law.

Variable X is normal $N(m, \sigma^2)$ when the standardized variable $Z = \dfrac{X - m}{\sigma}$ follows the reduced normal law $N(0,1)$.

The main diagonal of the covariance matrix of the vector a is formed by the

estimators variances, the matrix expression being:

$$V = \sigma^2 \cdot (X^T \cdot X)^{-1} = \sigma^2 \cdot S^{-1},$$

where $S^{-1} = (\hat{s}_{ij}^2)_{(k+1)\times(k+1)}$ therefore:

$a_0 \in N\left(\hat{a}_0, \sigma^2 \cdot \hat{s}_{11}^2\right)$, $a_1 \in N\left(\hat{a}_1, \sigma^2 \cdot \hat{s}_{22}^2\right), \ldots,$

$a_k \in N\left(\hat{a}_k, \sigma^2 \cdot \hat{s}_{(k+1),(k+1)}^2\right).$

If σ^2 is unknown then the variables:

$$Z_j = \frac{a_j - \hat{a}_j}{\sigma \cdot \sqrt{\hat{s}_{j+1,\,j+1}^2}},\ j = \overline{0,k} \qquad (1)$$

Follow the reduced normal law $N(0,1)$.

As σ^2 is unknown this is replaced by the unbiased estimator:

$$s_\varepsilon^2 = \frac{1}{n-k-1} \cdot \sum_{i=1}^{n} (y_i - \hat{y}_i)^2,$$

n is the number of observations, from which we obtain:

$$\sum_{i=1}^{n} (y_i - \hat{y}_i)^2 = (n-k-1) \cdot s_\varepsilon^2 \qquad (2)$$

The values of the residual variable $\varepsilon_i = y_i - \hat{y}_i,\ \forall i = \overline{1,n}$ are normally distributed, that is $\varepsilon_i \in N(0,\sigma^2), \forall i = \overline{1,n}$ which leads to the conclusion that $\frac{\varepsilon_i}{\sigma} \in N(0,1), \forall i = \overline{1,n}$ and

$$\frac{1}{\sigma^2} \sum_{i=1}^{n} \varepsilon_i^2 = \frac{1}{\sigma^2} \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 = \chi_{n-k-1}^2$$

From which we obtain:

$$\sum_{i=1}^{n} (y_i - \hat{y}_i)^2 = \sigma^2 \cdot \chi_{n-k-1}^2 \qquad (3)$$

From (2) and (3) we obtain:

$$s_\varepsilon^2 = \frac{\sigma^2}{n-k-1} \cdot \chi_{n-k-1}^2 \qquad (4)$$

We calculate the estimator average s_ε^2:

$$M(s_\varepsilon^2) = M\left(\frac{\sigma^2}{n-k-1} \cdot \chi_{n-k-1}^2\right) =$$

$$= \frac{\sigma^2}{n-k-1} M\left(\chi_{n-k-1}^2\right) = \qquad .$$

$$\frac{\sigma^2}{n-k-1} \cdot (n-k-1) = \sigma^2$$

That is the estimator s_ε^2 id unbiased.

The variables $t_j = \frac{Z_j}{\sqrt{\frac{\chi_{n-k-1}^2}{n-k-1}}},\ \forall j = \overline{0,k}$ follow the law Student with $n-k-1$ degrees of freedom, therefore using the relations (1) and (4) we obtain:

$$t_j = \frac{\frac{a_j - \hat{a}_j}{\sigma \cdot \sqrt{\hat{s}_{j+1,\,j+1}^2}}}{\sqrt{\frac{\chi_{n-k-1}^2}{n-k-1}}} = \frac{\frac{a_j - \hat{a}_j}{\sigma \cdot \sqrt{\hat{s}_{j+1,\,j+1}^2}}}{\frac{s_\varepsilon}{\sigma}} =$$

$$= \frac{a_j - \hat{a}_j}{s_\varepsilon \cdot \sqrt{\hat{s}_{j+1,\,j+1}^2}},\ \forall j = \overline{0,k}$$

For a determined value $\hat{a}_{j0}$ and statistical $t_{j,\text{calculat}} = \frac{a_j - \hat{a}_{j0}}{s_\varepsilon \cdot \sqrt{\hat{s}_{j+1,\,j+1}^2}}$ we set the hypothesis:

$H_0^{(j)} : \hat{a}_j = \hat{a}_{j0}$

$H_1^{(j)} : \hat{a}_j \neq \hat{a}_{j0}$

And if $\left|t_{j,\text{calculat}}\right| > t_{1-\frac{\alpha}{2};n-k-1}$ then we reject the hypothesis $H_0^{(j)}$ and accept the hypothesis $H_1^{(j)}, \forall j = \overline{0,k}$.

For $\hat{a}_{j0} = 0$ we obtain $t_{j,\text{calculat}} = \frac{a_j}{s_\varepsilon \cdot \sqrt{\hat{s}_{j+1,\,j+1}^2}} = \frac{a_j}{s(a_j)},\ \forall j = \overline{0,k}$,

these are distributed with Student with $n-k-1$ degrees of freedom, the statistical hypotheses being:

$H_0^{(j)} : \hat{a}_j = 0$ $\forall j = \overline{0,k}$

$H_1^{(j)} : \hat{a}_j \neq 0$

And for $\left|t_{j,\text{calculat}}\right| > t_{1-\frac{\alpha}{2};n-k-1}$ we reject the hypothesis $H_0^{(j)}$.

The distribution $F_{\alpha;1,n-k-1}$ is the distribution of the statistics $\left(t_{j,\text{calculat}}\right)^2 = \frac{a_j^2}{s^2(a_j)}$, $\forall j = \overline{0,k}$ and for $\left(t_{j,\text{calculat}}\right)^2 > F_{\alpha;1,n-k-1}$ we reject the null hypothesis $H_0^{(j)} : \hat{a}_j = 0$.

3. RETROGRADE ELIMINATION METHOD TO OBTAIN THE BEST REGRESSION WE DO THE FOLLOWING

3.1. We obtain $\hat{y}_i^L$, $\forall i = \overline{1,n}$ by the smaller quadrants method using all the initial factorial variables $X_1, X_2, ..., X_k$.

3.2. The statistics of the test is:

$$F_{X_j,\text{calculat}} = \left(t_{j,\text{calculat}}\right)^2 = \frac{a_j^2}{s^2(a_j)}, \forall j = \overline{1,k}$$

And we determine $\min\limits_{1\le j\le k}\{F_{X_j,\text{calculat}}\}$ and assume that the searched minimal is $F_{X_r,\text{calculat}}$ or we use the statistics $t_{j,\text{calculat}} = \frac{a_j}{s(a_j)}$, $\forall j = \overline{1,k}$ and where there is r so that $\left|t_{r\ \text{calculat}}\right| = \min\limits_{1\le j\le k}\{\left|t_{j\ \text{calculat}}\right|\}$.

3.3. We set the hypotheses :

$$H_0^{(r)} : a_r = 0$$
$$H_1^{(r)} : a_r \neq 0$$

And if $F_{X_r,\text{calculat}} < F_{\alpha;1,n-k-1}$ then we accept the hypothesis $H_0^{(r)}$ therefore the factorial variable X_r is eliminated from the pattern, we write the new fitting equation without X_r and we obtain a partial best regression pattern or, if

$$\left|t_{r\ \text{calculat}}\right| < t_{1-\frac{\alpha}{2};n-k-1}$$

we accept the hypothesis $H_0^{(r)}$ that is $a_k = 0$ and we obtain the partial best pattern of the stage.

3.4. To the pattern obtained at 3.2 we apply the stages 3.2 and 3.3again until the stage where the obtained result does not allow the elimination of other variables and that final pattern obtained is the best .

Example:

Table 1

Nr. crt.	x_{1i}	x_{2i}	x_{3i}	y_i	x_{1i}^2	x_{2i}^2	x_{3i}^2
1	0,1	3,25	22,3	17,2	0,01	10,5625	412,09
2	0,2	2,90	18,6	22,5	0,04	8,41	345,96
3	0,1	3	21,4	18	0,01	9	457,96
4	0,15	2,8	23,5	20,4	0,0225	7,84	552,25
5	0,3	3,4	25	24,3	0,09	11,56	625
Total	0,85	15,35	108,8	102,4	0,1725	47,3725	2393,26

$$\hat{Y}_i = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + \varepsilon$$

$$\begin{cases} 5a_0 + a_1\sum x_{1i} + a_2\sum x_{2i} + a_3\sum x_{3i} = \sum y_i \\ a_0\sum x_{1i} + a_1\sum x_{1i}^2 + a_2\sum x_{1i}x_{2i} + a_3\sum x_{1i}x_{3i} = \sum x_{1i}y_i \\ a_0\sum x_{2i} + a_1\sum x_{1i}x_{2i} + a_2\sum x_{2i}^2 + a_3\sum x_{2i}x_{3i} = \sum x_{2i}y_i \\ a_0\sum x_{3i} + a_1\sum x_{1i}x_{3i} + a_2\sum x_{2i}x_{3i} + a_3\sum x_{3i}^2 = \sum x_{3i}y_i \end{cases} \quad (5)$$

Table 1. Follow up

$x_{1i}x_{2i}$	$x_{1i}x_{3i}$	$x_{2i}x_{3i}$	$x_{1i}y_i$	$x_{2i}y_i$	$x_{3i}y_i$	y_i^2
0,325	2,03	65,975	1,72	55,9	349,16	295,84
0,58	3,72	53,94	4,4	65,25	418,5	506,25

0,3	2,14	64,2	1,8	54	385,2	324
0,42	3,525	65,8	3,06	57,12	479,4	416,16
1,02	7,5	85	7,29	82,62	607,5	590,49
2,645	18,915	334,915	18,37	314,89	2239,76	2132,74

$$\begin{cases} 5a_0 + 0{,}85a_1 + 15{,}35a_2 + 108{,}8a_3 = 102{,}4 \\ 0{,}85a_0 + 0{,}1725a_1 + 2{,}645a_2 + 18{,}915a_3 = 18{,}37 \\ 15{,}35a_0 + 2{,}645a_1 + 47{,}3725a_2 + 334{,}915a_3 = 314{,}89 \\ 108{,}8a_0 + 18{,}915a_1 + 334{,}915a_2 + 2393{,}26a_3 = 2239{,}76 \end{cases} \quad (6)$$

$$X^T \cdot X = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 0{,}1 & 0{,}2 & 0{,}1 & 0{,}15 & 0{,}3 \\ 3{,}25 & 2{,}9 & 3 & 2{,}8 & 3{,}4 \\ 20{,}3 & 18{,}6 & 21{,}4 & 23{,}5 & 25 \end{pmatrix} \times$$

$$\times \begin{pmatrix} 1 & 0{,}1 & 3{,}25 & 20{,}3 \\ 1 & 0{,}2 & 2{,}9 & 18{,}6 \\ 1 & 0{,}1 & 3 & 21{,}4 \\ 1 & 0{,}15 & 2{,}8 & 23{,}5 \\ 1 & 0{,}3 & 3{,}4 & 25 \end{pmatrix} = S$$

$$S = X^T \cdot X = \begin{pmatrix} 5 & 0{,}85 & 15{,}35 & 108{,}8 \\ 0{,}85 & 0{,}1725 & 2{,}645 & 18{,}915 \\ 15{,}35 & 2{,}645 & 47{,}3725 & 334{,}915 \\ 108{,}8 & 18{,}915 & 334{,}915 & 2393{,}26 \end{pmatrix}$$

$$\det S = 5^4 \begin{vmatrix} 1 & 0{,}17 & 3{,}07 & 21{,}76 \\ 0{,}17 & 0{,}0345 & 0{,}529 & 3{,}783 \\ 3{,}07 & 0{,}529 & 9{,}4745 & 66{,}983 \\ 21{,}76 & 3{,}783 & 66{,}983 & 478{,}652 \end{vmatrix} =$$

$$= 0{,}535286$$

$$S^{-1} = \begin{pmatrix} 51{,}843741 & 21{,}202339 \\ 21{,}202339 & 52{,}152074 \\ -12{,}711121 & -5{,}027453 \\ -0{,}745634 & -0{,}672514 \end{pmatrix}$$

$$\begin{pmatrix} -12{,}711121 & -0{,}745634 \\ -5{,}027453 & -0{,}672514 \\ 5{,}100591 & 0{,}096187 \\ -0{,}096187 & 0{,}053091 \end{pmatrix}$$

System (2) written metrical $S \cdot \begin{pmatrix} a_0 \\ a_1 \\ a_2 \\ a_3 \end{pmatrix} = \begin{pmatrix} b_0 \\ b_1 \\ b_2 \\ b_3 \end{pmatrix}$.

to the left with S^{-1} it becomes:

$$\begin{pmatrix} a_0 \\ a_1 \\ a_2 \\ a_3 \end{pmatrix} = \begin{pmatrix} 51{,}843741 & 21{,}202339 \\ 21{,}202339 & 52{,}152074 \\ -12{,}711121 & -5{,}027453 \\ -0{,}745634 & -0{,}672514 \end{pmatrix}$$

$$\begin{pmatrix} -12{,}711121 & -0{,}745634 \\ -5{,}027453 & -0{,}672514 \\ 5{,}100591 & 0{,}096187 \\ -0{,}096187 & 0{,}053091 \end{pmatrix} \times \begin{pmatrix} 102{,}4 \\ 18{,}37 \\ 314{,}89 \\ 2239{,}76 \end{pmatrix}$$

From which

$a_0 = 25{,}6399463$

$a_1 = 39{,}78848117$

$a_2 = -3{,}28379714$

$a_3 = -0{,}08423005$

Therefore

$$Y = 25{,}6399463 + 39{,}78848117\, X_1 - 3{,}28379714\, X_2 - 0{,}08423005\, X_3$$

represents the multiple linear regression pattern obtained after the fitting using all the factorial variables.

We determine the statistics $t_{X_j \text{calculat}}$, $j = 1,2,3$ so that :

$$t_{X_j \text{calculat}} = \frac{a_j}{s(a_j)} \quad \text{where}$$

$$s(a_j) = s_\varepsilon \cdot \hat{s}_{j+1,\, j+1}, \quad j = 1,2,3$$

$$s_\varepsilon^2 = \frac{1}{5-3-1} \sum_{i=1}^{5} (y_i - \hat{y}_i)^2 =$$

$$= \sum_{i=1}^{5} (y_i - a_0 - a_1 x_{1i} - a_2 x_{2i} - a_3 x_{3i})^2 =$$

$$= \sum_{i=1}^{5} (y_i - 25{,}6399463 - 39{,}78848117 x_{1i} +$$

$$+ 3{,}28379714 x_{2i} + 0{,}08423005 x_{3i})^2$$

$$= 0{,}003906$$

$$t_{X_1 \text{calculat}} = \frac{a_1}{s(a_1)} = \frac{a_1}{s_\varepsilon \hat{s}_{22}} =$$

$$= \frac{39{,}78848117}{\sqrt{0{,}003906 \cdot 52{,}152074}} =$$

$$= \frac{39{,}78848117}{0{,}451338} = 88{,}1811$$

$$t_{X_2 \text{calculat}} = \frac{a_2}{s(a_2)} = \frac{a_2}{s_\varepsilon \hat{s}_{33}} =$$
$$= \frac{-3,28379714}{\sqrt{0,003906 \cdot 5,100591}} =$$
$$= \frac{-3,28379714}{0,1411485} = -23,2648$$
$$t_{X_3 \text{calculat}} = \frac{a_3}{s(a_3)} = \frac{a_3}{s_\varepsilon \hat{s}_{44}} =$$
$$= \frac{-0,08423005}{\sqrt{0,003906 \cdot 0,053091}} =$$
$$= \frac{-0,08423005}{0,01440047} = -5,8491$$
$$\min_{1 \le j \le 3} \{|t_{X_j \text{calculat}}|\} =$$
$$= \min\{88,1811; 23,2648; 5,8491\} =$$
$$= 5,8491 = |t_{X_3 \text{calculat}}|$$

The hypothesis $H_0^{(3)} : a_3 = 0$ is accepted if $|t_{X_3 \text{calculat}}| < t_{1-\frac{\alpha}{2}, 5-3-1}$.

We consider

$$\alpha = 0,05 \Rightarrow t_{1-\frac{\alpha}{2};1} = t_{0,975;1} = 12,706$$

and indeed

$$|t_{X_3 \text{calculat}}| = 5,8491 < 12,706 = t_{1-\frac{\alpha}{2}, 5-3-1}$$

So we eliminate the 3rd column from the matrix X and we obtain :

$$X = \begin{pmatrix} 1 & 0,1 & 3,25 \\ 1 & 0,2 & 2,9 \\ 1 & 0,1 & 3 \\ 1 & 0,15 & 2,8 \\ 1 & 0,3 & 3,4 \end{pmatrix}$$ then we determine the

matrixes $S = X^T \cdot X$ and $B = X^T \cdot Y$

$$S = X^T \cdot X = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 0,1 & 0,2 & 0,1 & 0,15 & 0,3 \\ 3,25 & 2,9 & 3 & 2,8 & 3,8 \end{pmatrix} \times$$
$$\times \begin{pmatrix} 1 & 0,1 & 3,25 \\ 1 & 0,2 & 2,9 \\ 1 & 0,1 & 3 \\ 1 & 0,15 & 2,8 \\ 1 & 0,3 & 3,4 \end{pmatrix} =$$
$$= \begin{pmatrix} 5 & 0,85 & 15,35 \\ 0,85 & 0,1725 & 2,645 \\ 15,35 & 2,645 & 47,3725 \end{pmatrix}$$
$$B = X^T \cdot Y = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 0,1 & 0,2 & 0,1 & 0,15 & 0,3 \\ 3,25 & 2,9 & 3 & 2,8 & 3,8 \end{pmatrix} \times$$
$$\times \begin{pmatrix} 17,2 \\ 22,5 \\ 18 \\ 20,4 \\ 24,3 \end{pmatrix} = \begin{pmatrix} 102,4 \\ 18,37 \\ 314,89 \end{pmatrix},$$

The adequate extended matrix is $A(S|B|I_3)$, that is

$$A = \begin{pmatrix} 5 & 0,85 & 15,35 & 102,4 & 1 & 0 & 0 \\ 0,85 & 0,1725 & 2,645 & 18,37 & 0 & 1 & 0 \\ 15,35 & 2,645 & 47,3725 & 314,89 & 0 & 0 & 1 \end{pmatrix}$$

We apply Gauss method and obtain :

$$A'(I_3|B'|S^{-1}) =$$
$$= \begin{pmatrix} 1 & 0 & 0 & \frac{111174,4}{4547} & \frac{188117}{4547} & \frac{53460}{4547} & -\frac{63940}{4547} \\ 0 & 1 & 0 & \frac{176036}{4547} & \frac{53460}{4547} & \frac{198400}{4547} & -\frac{28400}{4547} \\ 0 & 0 & 1 & -\frac{15628}{4547} & -\frac{63940}{4547} & -\frac{28400}{4547} & \frac{22400}{4547} \end{pmatrix}$$
$$= \begin{pmatrix} 1 & 0 & 0 & 24,450055 \\ 0 & 1 & 0 & 38,714757 \\ 0 & 0 & 1 & -3,436991 \end{pmatrix}$$
$$\begin{pmatrix} 41,371674 & 11,757203 & -14,062019 \\ 11,757203 & 43,633165 & -6,245876 \\ -14,062019 & -6,245876 & 4,926325 \end{pmatrix}$$

After this stage the partial best regression pattern is:

$$Y = 24,450055 + 38,714757 X_1 - 3,436991 X_2$$

and $s_\varepsilon^2 = \frac{1}{5-2-1} \cdot \sum_{i=1}^{5} (y_i - 24{,}450055 -$

$- 38{,}714757 x_{1i} + 3{,}436991 x_{2i})^2 =$

$= \frac{1}{2} \cdot 0{,}138513298 = 0{,}069256649$

The calculated values of the test ***t*** are:

$$t_{X_1 \text{calculat}} = \frac{38{,}714757}{\sqrt{0{,}069256649 \cdot 43{,}633165}} =$$

$$= \frac{38{,}714757}{1{,}738357} = 22{,}2709$$

$$t_{X_2 \text{calculat}} = \frac{-3{,}436991}{\sqrt{0{,}069256649 \cdot 4{,}926325}} =$$

$$= -\frac{3{,}436991}{0{,}584107} = -5{,}8842$$

and $\min\{|t_{X_1 \text{calculat}}|, |t_{X_2 \text{calculat}}|\} =$

$= |t_{X_2 \text{calculat}}| = 5{,}8842$.

For

$\alpha = 0{,}01 \quad t_{1-\frac{\alpha}{2};5-2-1} =$

$= 9{,}925 > |t_{X_2 \text{calculat}}| = 5{,}8842$

resulted which requires the acceptance of the hypothesis $H_0^{(2)} : a_2 = 0$, therefore we eliminate from the pattern the variable X_2 and the equation of the best regression pattern after this stage is:

$$Y = 24{,}450055 + 38{,}714757 X_1$$

for which

$$s_\varepsilon^2 = \frac{1}{5-1-1} \sum_{i=1}^{5} (y_i - 24{,}450055 -$$

$$- 38{,}714757 x_{1i})^2 =$$

$$= 186{,}581866$$

the adequate extended matrix is:

$$A = \begin{pmatrix} 5 & 0{,}85 & 102{,}4 & 1 & 0 \\ 0{,}85 & 0{,}1725 & 18{,}37 & 0 & 1 \end{pmatrix} =$$

$$= \left(S \middle| C \middle| I_3\right), C = X^T \cdot Y$$

And $A' = \left(I_3 \middle| C' \middle| S^{-1}\right) =$

$$= \begin{pmatrix} 1 & 0 & 14{,}639286 & 1{,}232143 & -6{,}071429 \\ 0 & 1 & 34{,}357143 & -6{,}071429 & 35{,}714286 \end{pmatrix}$$

And

$$t_{X_1 \text{calculat}} = \frac{38{,}714757}{\sqrt{186{,}581866 \cdot 35{,}714286}} =$$

$$= \frac{38{,}714757}{81{,}631110} = 0{,}4743$$

For

$\alpha = 0{,}05 \; t_{X_1 \text{calculat}} = 0{,}4743 > t_{1-\frac{\alpha}{2};3} = 3{,}482$

therefore we reject the hypothesis $H_0^{(1)} : a_1 = 0$, so the best pattern is $Y = 24{,}450055 + 38{,}714757 X_1$.

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VALUES AND PROPER VECTORS USED IN ECONOMIC-STATISTICS ANALYSIS

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Abstract: *The study of a statistics population through a poll aims at more topics of great interest. The answers to the used questionnaire contain some items of information (factors) among whom there are dependence connections. The methods of the multivariate analyses allow the reduction of the number of the initial factors, such a method is the factorial analysis.*

The paper presents the correspondence analysis as a factorial analysis method, the study being made on the basis of the values and proper vectors associated to a matrix resulted from the statistical units distribution according to two qualitative variables.

Mathematics Subject Classification 2010*: *62H25.
Keywords: *contingence*, *covariance matrix*, *principal component analysis*, *vectors*.

The socio-economical problems or the problems specific to the phenomena and processes which take place in nature can be solved using numerical or qualitative characteristics. The models methods used in the definition and analysis of the qualitative characteristics are varied and numerous, depending on the specific of the approached problems.

In any scientific research we resort to partial observations from which we can deduce general truths, the poll method proving to be fundamental.

As a result of a poll among the managers of the societies from the following field activities: working industry, commerce and buildings, one of questionnaire questions refers to the actions meant to counteract the impact of the present economical situation on the developed activities. The proposed variants for the actions would be: the increase of the prices/catered services, the reduction of the expenses, the reduction of production, the cut in personnel, loans, the postponing of investments.

The results of the answers to one of the given questions are presented in a contingence table, the data analysis being made on the basis of the correspondence analysis as factorial analysis method.

Contingence table

Nature of actions	Activity fields			Total
	working industry	commerce	buildings	
0	**1**	**2**	**3**	**4**
increase of the prices	5	7	7	19
reduction of the expenses	25	39	26	90
reduction of production	8	5	7	20
cut in	10	21	23	54

personnel				
loans	6	10	9	25
postponing of investments	20	15	13	48
	74	97	85	256

The contingence table $(N)=(n_{ij})_{\substack{i=\overline{1,6}\\ j=1,3}}$ where n_{ij} represents the number of managers from the sample who chose the answers to the two characteristics:

X = actions meant to counteract the impact on the present economical situation and

Y = activity field.

The model of factorial analysis defines the matrixes:

$$D_1 = X^T \cdot X = \begin{pmatrix} 19 & 0 & 0 & 0 & 0 & 0 \\ 0 & 90 & 0 & 0 & 0 & 0 \\ 0 & 0 & 20 & 0 & 0 & 0 \\ 0 & 0 & 0 & 54 & 0 & 0 \\ 0 & 0 & 0 & 0 & 25 & 0 \\ 0 & 0 & 0 & 0 & 0 & 48 \end{pmatrix} \text{ and}$$

$$D_2 = Y^T \cdot Y = \begin{pmatrix} 74 & 0 & 0 \\ 0 & 97 & 0 \\ 0 & 0 & 85 \end{pmatrix}$$

The matrix for the lines profiles is:

$$D_1^{-1} \cdot N = \left(\frac{n_{ij}}{n_{i\bullet}}\right)_{\substack{i=\overline{1,6}\\ j=1,3}} =$$

$$= \begin{pmatrix} 0,2632 & 0,3684 & 0,3684 \\ 0,2778 & 0,4333 & 0,2889 \\ 0,4 & 0,25 & 0,35 \\ 0,1852 & 0,3889 & 0,4259 \\ 0,24 & 0,4 & 0,36 \\ 0,4167 & 0,3125 & 0,2708 \end{pmatrix}$$

, $\sum_{j=1}^{3} \frac{n_{ij}}{n_{i\bullet}} = 1$

And the matrix for the columns profiles is:

$$D_2^{-1} \cdot N = \left(\frac{n_{ij}}{n_{\bullet j}}\right)_{\substack{i=\overline{1,6}\\ j=1,3}} =$$

$$= \begin{pmatrix} 0,0676 & 0,0722 & 0,0824 \\ 0,3378 & 0,4021 & 0,3059 \\ 0,1081 & 0,0515 & 0,0824 \\ 0,1351 & 0,2165 & 0,2706 \\ 0,0811 & 0,1031 & 0,1058 \\ 0,2703 & 0,1546 & 0,1529 \end{pmatrix}, \sum_{i=1}^{6} \frac{n_{ij}}{n_{\bullet j}} = 1$$

The statistical hypotheses to check the independence of the two characteristics X and Y are:

$$H_0 = \left\{ \frac{n_{ij}}{n} = \frac{n_{i\bullet} \cdot n_{\bullet j}}{n}, i = \overline{1,6},\ j = \overline{1,3} \right\}$$

$$H_1 = \left\{ \frac{n_{ij}}{n} \neq \frac{n_{i\bullet} \cdot n_{\bullet j}}{n}, i = \overline{1,6},\ j = \overline{1,3} \right\}$$

And the test to be used is test χ^2 for which we determine the calculated and theoretical value.

$$\chi^2_{\text{calculat}} = \sum_{i=1}^{6} \left(\sum_{j=1}^{3} \frac{\left(n_{ij} - \frac{n_{i\bullet} \cdot n_{\bullet j}}{n} \right)^2}{\frac{n_{i\bullet} \cdot n_{\bullet j}}{n}} \right) =$$

$$= \sum_{i=1}^{6} \left[\frac{\left(n_{i1} - \frac{n_{i\bullet} \cdot n_{\bullet j}}{n} \right)}{\frac{n_{i\bullet} \cdot n_{\bullet j}}{n}} + \frac{\left(n_{i2} - \frac{n_{i\bullet} \cdot n_{\bullet j}}{n} \right)}{\frac{n_{i\bullet} \cdot n_{\bullet j}}{n}} + \right.$$

$$+\frac{\left(n_{i3}-\frac{n_{i\bullet}\cdot n_{\bullet j}}{n}\right)}{\frac{n_{i\bullet}\cdot n_{\bullet j}}{n}}\Bigg]=10,65538$$

For a risk $\alpha=5\%$ the theoretical value from the distribution table χ^2 having $(r-1)(q-1)=(6-1)(3-1)=10$ degrees of freedom is $\chi^2_{1-\alpha;(r-1)(q-1)}=\chi^2_{0,95;10}=3,94$ and, as $\chi^2_{calculat}=10,65528>\chi^2_{0,95;10}$ means that the H_0 hypothesis is rejected, therefore the two qualitative variables are correlated.

As the variables are correlated it is necessary to do an analysis of the main components either for the lines profile, or the columns profile.

We define g_r weight center of the lines profiles by $g_r=\left(\frac{n_{\bullet j}}{n}\right)^T_{j=\overline{1,3}}$ that is $g_r=\left(\frac{74}{256}\ \frac{97}{256}\ \frac{85}{256}\right)^T$ and the weight center of the columns profiles is $g_q=\left(\frac{n_{i\bullet}}{n}\right)^T_{j=\overline{1,6}}$ that is

$$g_q=\left(\frac{19}{256}\ \frac{90}{256}\ \frac{20}{256}\ \frac{54}{256}\ \frac{25}{256}\ \frac{48}{256}\right)^T.$$

The total inertia calculated for the two weight centers has the expression:

$$I(g_r)=I(g_q)=\frac{1}{\sum_{i=1}^{6}\sum_{j=1}^{6}n_{ij}}\cdot\chi^2_{calculat}=$$

$$=\frac{10,65538}{256}=0,04162.$$

As the obtained result is small we draw the conclusion that the two qualitative characteristics are independent.

For the correspondence of the lines profiles analysis we build the centered data matrix noted with B such as:

$$B=\left(\frac{n_{ij}}{n_{i\bullet}}-\frac{n_{\bullet j}}{n}\right)_{\substack{i=\overline{1,6}\\ j=\overline{1,3}}}=$$

$$=\begin{pmatrix}-0,0259 & -0,0105 & 0,0364\\ -0,0113 & 0,0544 & -0,0431\\ 0,1109 & -0,1289 & 0,018\\ -0,1039 & 0,01 & 0,0939\\ -0,0491 & 0,0211 & 0,028\\ 0,1276 & -0,0664 & -0,0612\end{pmatrix}.$$

The covariance matrix V, as compared to the weight center of the lines profiles g_r is:

$$V=\frac{1}{n}\cdot B^T D_1 B=\frac{1}{256}\cdot B^T D_1 B=$$

$$=\frac{1}{256}\begin{pmatrix}1,69495 & -0,82475 & -0,52525\\ -0,25295 & 0,82890 & -0,00412\\ -0,8702 & -0,00415 & 0,87435\end{pmatrix}$$

The reverse of the matrix D_2 is:

$$D_2^{-1}=\frac{1}{\det D_2}\cdot D_2^*=$$

$$=\frac{1}{74\cdot 97\cdot 85}\begin{pmatrix}97\cdot 85 & 0 & 0\\ 0 & 74\cdot 85 & 0\\ 0 & 0 & 74\cdot 97\end{pmatrix}=$$

$$=\begin{pmatrix}\frac{1}{74} & 0 & 0\\ 0 & \frac{1}{97} & 0\\ 0 & 0 & \frac{1}{85}\end{pmatrix}.$$

The normalized proper vectors of the matrix $nV \cdot D_2^{-1}$ are the main axes a_i, $i = 1,2,3$.

The characteristic polynomial of the matrix $nV \cdot D_2^{-1}$ is:

$$\left| nV \cdot D_2^{-1} - \lambda I_3 \right| = P(\lambda)$$

And the solutions of the equation $P(\lambda) = 0$ are the proper values of the matrix $nV \cdot D_2^{-1}$:

$$nV \cdot D_2^{-1} =$$

$$= 256 \cdot \frac{1}{256} \begin{pmatrix} 1,69495 & -0,82475 & -0,52525 \\ -0,25295 & 0,82890 & -0,00412 \\ -0,8702 & -0,00415 & 0,87435 \end{pmatrix} \cdot$$

$$\cdot \begin{pmatrix} \frac{1}{74} & 0 & 0 \\ 0 & \frac{1}{97} & 0 \\ 0 & 0 & \frac{1}{85} \end{pmatrix} =$$

$$= \begin{pmatrix} 0,02290 & -0,01115 & -0,00710 \\ -0,00261 & 0,00854 & -0,00004 \\ -0,01024 & -0,00005 & 0,01029 \end{pmatrix}$$

$$P(\lambda) = \left| 256V \cdot D_2^{-1} - \lambda I_3 \right| =$$

$$= \begin{vmatrix} 0,02290 - \lambda & -0,01115 & -0,00710 \\ -0,00261 & 0,00854 - \lambda & -0,00004 \\ -0,01024 & -0,00005 & 0,01029 - \lambda \end{vmatrix} \Rightarrow$$

$P(\lambda) = -\lambda^3 + 0,04173\lambda^2 - 0,000333\lambda$ with the solutions $\lambda_1 = 0,03098$, $\lambda_2 = 0,01075$, $\lambda_3 = 0$.

For $\lambda_1 = 0,03098$ we obtain the main axis $a_1 = \begin{pmatrix} \alpha \\ \beta \\ \gamma \end{pmatrix}$ solving the equations $nV \cdot D_2^{-1} \cdot a_1 = \lambda_1 a_1$ and for $\lambda_2 = 0,01075$ we get the main axis $a_2 = \begin{pmatrix} \alpha' \\ \beta' \\ \gamma' \end{pmatrix}$ solving the equation $nV \cdot D_2^{-1} \cdot a_2 = \lambda_2 a_2$.

The vectors $a_1 = \begin{pmatrix} -1,04378 \\ 0,11962 \\ 1,00000 \end{pmatrix}$ respectively $a_2 = \begin{pmatrix} 0,27246 \\ -0,33987 \\ 1,00000 \end{pmatrix}$ are not rectangular, that is $a_1 \cdot a_2 \neq 0$ and according to the Gram-Schmidt procedure the normalized proper vectors corresponding to the vectors a_1 and a_2 are:

$$V_1 = \frac{a_1}{\|a_1\|} = \begin{pmatrix} -0,71963 \\ 0,08247 \\ 0,68945 \end{pmatrix}, V_2 = \begin{pmatrix} 0,61565 \\ -0,38342 \\ 0,68846 \end{pmatrix}.$$

As $\lambda_3 = 0$ it means the corresponding proper vector is not interesting .

For the proper values we determine the "explained inertia" percentage such as:

– for

$$\lambda_1 = \frac{0,03098}{0,03098 + 0,01075} \cdot 100 = 74,24\%$$

– for

$$\lambda_2 = \frac{0,01075}{0,03098 + 0,01075} \cdot 100 = 25,76\%$$

– for $\lambda_3 : 0\%$,

therefore the factorial values associated to the proper values λ_1, λ_2 explain the whole inertia.

The main factors u_i, $i = \overline{1,3}$ are the proper vectors of the matrix $n \cdot D_2^{-1} V = D_2^{-1} N' D_1^{-1} N$ determined from the equations $nD_2^{-1} V u_i = \lambda_i \cdot u_i$, $i = \overline{1,3}$, where:

$$n \cdot D_2^{-1} V = D_2^{-1} N' D_1^{-1} N =$$

$$= \begin{pmatrix} 0,31199169 & 0,36774672 & 0,32026159 \\ 0,28056804 & 0,38745276 & 0,33197920 \\ 0,27884725 & 0,37884022 & 0,34231253 \end{pmatrix}.$$

We determine the main factors:

$$n \cdot D_2^{-1} V u_1 = 0,03098 u_1 \Rightarrow u_1 = \begin{pmatrix} -2,6298 \\ 1,1386 \\ 0,9699 \end{pmatrix}$$

$$n \cdot D_2^{-1} V u_2 = 0,01075 u_2 \Rightarrow u_2 = \begin{pmatrix} 0,1380 \\ -0,9842 \\ 0,9768 \end{pmatrix}$$

And the main components are:

$$C^1 = D_1^{-1} N n D_2^{-1} u_1 = \begin{pmatrix} -0,2114 \\ -0,3814 \\ -1,8655 \\ 0,7278 \\ 0,0701 \\ -2,0610 \end{pmatrix}$$

$$C^2 = D_1^{-1} N n D_2^{-1} u_2 = \begin{pmatrix} 0,2525 \\ -0,1430 \\ 0,5712 \\ 0,3312 \\ 0,1347 \\ 0,1839 \end{pmatrix}$$

Matrix $C = (C_1 \; C_2)$ contains the coordinates of the 6 weights line: the first column presents the corresponding components of the first factorial axis, the second column offers the components for the second axis.

The weight- columns are obtained from the weight-lines coordinates using the congruence:

$$Z = \Lambda \cdot C' \left(N D_2^{-1} \right)$$

where $\Lambda = \begin{pmatrix} \frac{1}{\sqrt{\lambda_1}} & 0 \\ 0 & \frac{1}{\sqrt{\lambda_2}} \end{pmatrix}$,

Where $Z = \begin{pmatrix} -4,5333 & -2,378 & -2,2646 \\ 0,1359 & 0,1042 & 0,1561 \end{pmatrix}$.

The components of the three weight-columns situated on the first line from Z represents the coordinate of the first factorial axis, the second line representing the coordinate of the second axis.

On the same factorial level we graphically represent the six types of actions meant to counteract the impact of the present economical situation and the three field activity.

The graphic representation on the factorial level is interpreted as follows:

- On the level of the action categories ensemble meant to counteract the impact of the present economical situation, the bond (association) indicates a similarity of frequencies form the point of view of the activity fields. It is the case of managers who have chosen as actions the expenses reduction (Y_2) respectively performing some loans (Y_5), affirmation confirmed by the corresponding percentages very close to the second and respectively fifth line from the matrix $D_1^{-1} N$.

- On the level of the ensemble of answer variants, the bond or association between the two weight-column representing two categories relative to the field activities, indicates a similarity of the frequencies regarding the mangers' distribution from the analyzed sample. This is achieved between the working industry (Z_1) and buildings (Z_3).

- Simultaneously for the two ensembles we assume taking into account the weight lines and the weight-columns to identify the groups (classes) which are responsible for certain associated. For example the managers who have chosen as action reducing the expenses (Y_2) respectively

performing some loans (Y_5) come from the working industry (Z_1) and buildings (Z_3).

CONCLUSION

After the analysis performed, the managers' actions represent an important factor of influence on the present economical situation, regardless the activity field from where the companies whose managers they are.

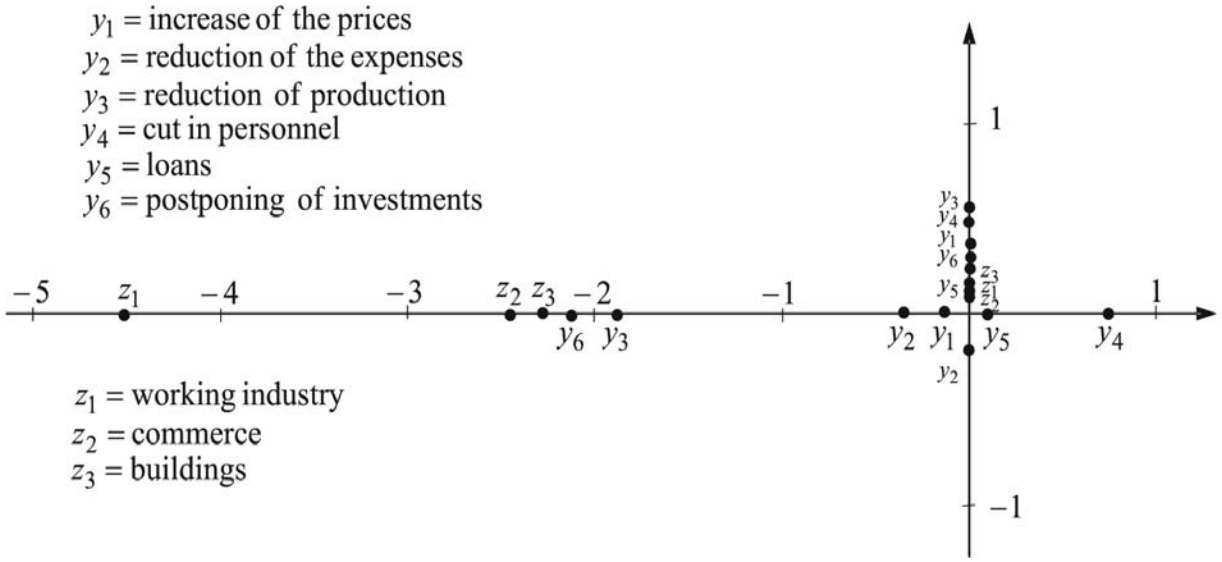

Fig.1 The graphic representation on the same factorial level of the categories of actions and activity fields.

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SOME MODELS ON PHASE TRANSFORMATIONS ON A WIDE RANGE OF TEMPERATURE CHARACTERIZING DISSIPATIVE PROCESSES

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Abstract: *The phase transitions in solid materials (called solid-solid transformations) are connected with the thermo dynamical processes with hysteresis, leading to the dissipative models. Obvious, the liquid-solid transitions are governed by the reversible processes (without dissipation of internal energy). The analysis of a loop of hysteresis reveals some feature about elastic-plastic properties, like the hardening. We emphasize some retrospective results along a temperature scale. Some considerations about the phase transitions are made for a 0,8 %C steel, a cast ingot steel at 1500^0C subject to the prescribed cooling conditions, supposing a non isotherm process. Along a large interval of temperature the steel changes some typical interne structures: volume - centered cubic, face -centered cubic, again volume- centered cubic, according to the phases followed by the steel in a cooling process: liquid - δ, austenite, perlite, martensite, so on.*

The microstructure is dominated by the dendrite structure, as a result between the two intimate phenomena which arise during the cooling process: the nucleation of the new phase and crystal growing of the dendrite network, the result of this competition is a dendrite structure. For a local study we extract an elementary representative volume (ver), to whom we can attribute some thermo-dynamical or geometrical parameters. During manufacturing process it is acted by a sequence of transformations which define the particular constitutive laws underlying by the ver in phase transitions of the material. The mathematical models of phase transitions are described by the nonlinear problems of the heating diffusion (the cooling of the molten metal), by the mass and heat transfer problem (solidification), by the elastic-plastic deformation with phase transition into the solid materials.

Mathematics Subject Classification 2010: 74-XX, 74A15, 65-XX.
Key words: *crystal growth, dissipation functional, heat accumulation, nucleation, productivity of entropy, solidification latent heat.*

1. INTRODUCTION

2.

For a 0,8%C steel, we make a study on cast ingot steel at 1500^0C in prescribed cooling conditions, supposing a non isotherm process. During this process, along a large interval of temperature the steel changes some typical interne structures, according to the phases followed by the steel in a cooling process. The microstructure reveals a dendrite design, so we have in view a schema from figure 1.

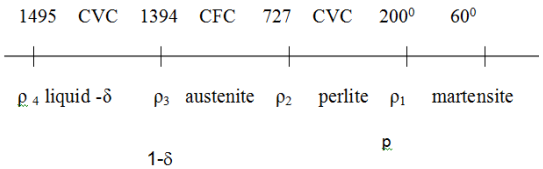

Figure 1. *The cooling structure diagram of the steel*

The microstructure is dominated by the dendrite structure, as a result between the two intimate phenomena which arise during the cooling process: the nucleation of a new phase and crystal growing. The mathematical literature have tried to realize an agreement between a dendrite structure of the metal and a lattice structure of the processes and implicitly

of the elementary domains set, as an ingredient which appears in the mixture of an intermediate zone.

For a local study we extract an elementary representative volume (*erv*), to whom we can attribute some thermo-dynamical or geometrical parameters, it is acted by a suite of transformation processes, which define the particular constitutive laws underlying phase transitions of the *erv*. The mathematical models of phase transitions are described by the nonlinear problems of the heating diffusion (the cooling of the molten metal), by the mass and heat transfer problem (solidification), by the elastic-plastic deformation with phase transition into the solid materials.

Obviously, the liquid-solid transitions are governed by the reversible processes (without dissipation of internal energy). The phase transitions in solid materials (so called *solid-solid transforma-tions*) are connected to the thermo-dynamical processes with hysteresis, leading to the dissipative models. The analysis of a loop of hysteresis reveals some features about elastic-plastic properties of the materials, like hardening.

2. ENERGETIC ACCUMULATION DURING THE TRANSITION PROCESSES

We have considered a metal melting in liquid-δ phase, as a fluid and at the same time, as a union of elementary volumes, each of them submitted at the thermal process; the thermal change develops by the loss of heat at different hotness.

The mechanism of heat changing corresponding to a scale of temperatures (a cooling range) can be explained by the *heat accumulation* concept (dissipation of heating) associated to one process; this concept is viewed as a measure of the accumulated heat (lost heat).

The most liquid - δ - austenite transitions are described by the free boundary value problems of *Stefan type* in different studies about the thermodynamics of dissipative materials. Here, the behavior of the interface characteristics reveals the phase growing. The model equations are compatible with the principles of thermo-dynamics, see *C. Truesdell*, 1984, *M. E. Gurtin*, 1983, 1990, *R. N. Hills*, *D. E. Loper & M. E. Gurtin*, 1989, *S. Luckhaus & L. Modica*, 1989.

We intend to introduce an abstract shot presentation of an adequate formalism about these transformations. Denote by $\mathcal{U}$ a family of the elementary representative volumes, $V \in \mathcal{U}$ is an *erv* and $\mathcal{P}$ a family of the transition processes which are submitted the systems of $\mathcal{U}$. We take as a subfamily of $\mathcal{P}$ the set of conservative processes (cyclic processes), denoted $\mathcal{P}_C$. Our aim is to define a lattice structure associated to the material, viewed as molten, so we form a vector bundles $(\mathcal{U}, \mathcal{P}, \sigma)$, where $\sigma: \mathcal{U} \to \mathcal{P}$ is a surjective application, the image $P(V) = \sigma^{<}(V)$ is a fiber of the all processes compatible with the *erv* V, $P_C(V) = P(V) \cap P_C$ and, it is also the fiber of the cyclic processes. We will introduce a union of the *erv* systems and also a union of the processes which are compatible with them: for $\mathcal{K} \subset \mathcal{U} \times \mathcal{U}$ define $\oplus: \mathcal{K} \to \mathcal{U}$, $(K_1, K_2) \to K_1 \oplus K_2 \in \mathcal{U}$.

Denote by $(\mathcal{H}, \leq)$ a total ordered set, called the *variety of hotness* applied to the family $\mathcal{U}$, which is isomorphic to $(R, \leq)$; for each hotness we associate a temperature. Any homeomorphism $h \in Hom(\mathcal{H}, \mathrm{R})$ is a *temperature scale*, we denote by $\mathcal{G}_+$ the scale family of positive temperatures, $\mathcal{G}_+ = \{\rho \in Hom(H, R) / \rho: H \to [0, +\infty)\}$.

For a *erv*-system $\sigma^{-1}(P)$, which lies in the process P, the *absorption* or the *emission phenomenon* can be characterized by the distributions C^+, $C^-: \mathcal{P} \to \mathcal{G}_+$.

Definition 2.1. The heat accumulation of the *erv* along the transformation P, from the fiber $P(\sigma^{-1}(P))$, is the quantity $C(P) = C^+(P) - C^-(P)$.

We will associate to the union operation $\oplus$ another application π, named a projection over the processes compatible with the union, $\pi: P(\oplus K) \to \mathcal{P} \times \mathcal{P}$, π is injective, here $P_{\oplus} = P(\oplus K)$ is the family of the

united processes associated to united systems (enchained systems) $\oplus K$.

Definition 2.2. We name the *reference hotness threshold* $I, I \in \mathcal{H}$, such that $\chi_{\{h \in H \,/\, h \le I\}} := h_I$, where χ_A is the characteristic function of the set A, so $\chi_A(x) = \begin{cases} 1, x \in A \\ 0, x \notin A \end{cases}$.

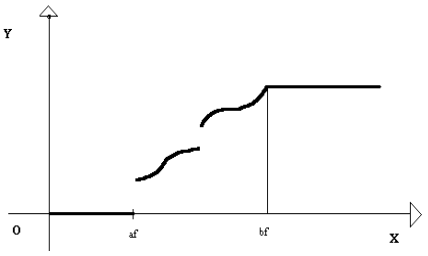

Figure 2. *An example of the accumulation function*

In all that follows, the set of non decreasing, right continuous functions will be of a great importance, as the example from the *figure* 2, $f : (0,\infty) \to (0,\infty)$, for which there exist $a_f, b_f \in R$, $a_f \le b_f$, such that $f(x) = \begin{cases} 0, x < a_f \\ \bar{f}, x \ge b_f \end{cases}$. Based on the positive and continuous functions we can introduce the family of bounded variation functions $\mathcal{F} = F^+ - F^-$.

Definition 2.3. We name an *integral accumulation* with density $f \in \mathcal{F}$, denoted $A_c(f) = \int_0^\infty \frac{1}{x} df(x)$, the numerical value given by this *Stieltjes-Riemann* integral of the ratio $\frac{1}{x}$ according to *f*.

Remark 2.1. If the density function *f* lies in the distributional space $C_0^\infty([0,+\infty))$, then $A_c(f) = \int_0^\infty \frac{1}{x^2} f(x) dx$.

Considering a united process consisting in elementary processes compatible with the family $\mathcal{U}$ of *erv*-systems from the intermediate zone of the material, denoted $P \in P_\oplus$, which is endowed with a heat accumulation $C(P)$ (emitted, or absorbed quantity), $C(P) = C^+(P) - C^-(P)$ and a temperature scale $\rho \in \mathcal{G}_+$, we perform a *heat distribution* of the system $\sigma^{-1}(P)$ along the process *P*, using a temperature scale ρ as $C_\rho(P,.) = C(P) \circ \rho^{-1} \in \mathcal{F}$. We give

Definition 2.4. Let $A: \mathcal{P} \to R$, $A(P) = A_c(C_\rho(P,.))$, $\rho \in \mathcal{G}_+$, to be the *heat accumulation* of the *erv*-system $\sigma^{-1}(P)$, along the process *P*, in the scale ρ.

3. THE ANALYSIS OF THE MOLTEN METAL (LIQUID δ)

From the point of view of our research, we have investigated the heat change into the molten metal, assimilating the fluid with a union of *erv*-systems, but the change with the exterior medium have been approached by a suite of small changes at different hotness. We recall the idea of *Serrin* (see *C. Truesdell*, 1984) regarding the accumulation along the process, corresponding to a temperature scale and we will introduce a classical capacity, which is the same as the measure of heating change from the material. Suppose that the quantity

$q(\alpha(t)) := C \circ \varphi^{-1}(\alpha(t))\dot{\alpha}_2(t) + p \circ \varphi^{-1}(\alpha(t))\dot{\alpha}_1(t)$ can be considered as a specific heat of the fluid (molten alloy) and

$$I(\alpha, T) = \{t \in [0,\infty) / \alpha_2(t) < T\}$$

is called the *temporal level* imposed by the temperature *T*.

Supposing the molten as an ideal fluid satisfying the law $p(V,L)V = R\varphi(L)$, for all $\varphi \in \mathcal{G}_+$, $L \in \mathcal{H}$, $V \in R_+$, we derive the central result.

Theorem 3.1. For any curve $\alpha \in C$, identified with the composed process $i\alpha \in P_\oplus$, for any $\varphi \in Hom(H,R)$ a temperature scale, the integral accumulation $A_\varphi(i\alpha)$ can be expressed by $A_\varphi(i\alpha) = \int_0^1 \frac{q(\alpha(t))}{\alpha_2(t)} dt$ (see also the classical expression of the entropy $S = \int_\alpha \frac{dq}{T}$)

Remark 3.2. At this stage we can define the particular transformations of a *erv*-system: if $\alpha_2(t) = T$, for all $t \in [0,1]$, then $\alpha \in C$ is an isotherm curve of *T* level along the $i\alpha$ process for the *erv*-system $\sigma^{-1}(i\alpha) \in \mathcal{U}$; if any part $\tau \in P([0,1])$ satisfies the relation $\int_\tau q(\alpha(t))dt = 0$, then $\alpha \in C$ is an adiabatic curve along the $i\alpha$ process for the *erv*-system $\sigma^{-1}(i\alpha) \in U$; if $\alpha(0) = \alpha(1)$, then α corresponds to a cyclic process.

Corollary 3.1. Let $\alpha \in C$ be a curve of the transformation, such as $i\alpha \in \mathcal{P}_C$, then $A_\varphi(i\alpha) = 0$, i.e. any cyclic process is realized without heat accumulation.

In what follows, the accumulation function permits us an irreversible or a reversible treatment.

3.1. The austenitic transform-transition from liquid state δ to solid (austenite)

We make some thermo-dynamic considerations about the transition process of the *erv*-system, where the heat diffusion is made by the thermal conduction, a non isotherm process governed by a classical problem of *Stefan* type. Consider that the *erv*-system occupies a bounded measurable domain $\mathcal{E}$ in the physical space, denoting by B_1 the sub-domain occupied by the solid phase and the complementary sub-domain by B_2 and $S = \overline{B}_1 \cap \overline{B}_2$ is the separation interface, see figure 3.

For a *transition hotness* h_M we associate a reference temperature $T_M = \varphi(h_M)$, called the solidification temperature; later we use a reduced temperature

$$\theta = T - T_M = \varphi(h) - \varphi(h_M).$$

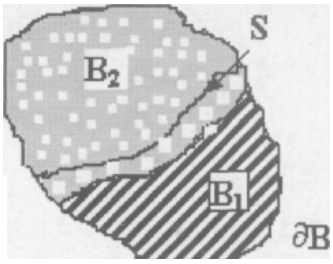

Figure 3. Sketch of an erv

The *erv*-system has an internal energy during the phase transition as an absolute continuous measure (obviously a distribution) according to the *Jordan* measure on the $\mathbf{R}^3$-space. The heat transfer is realized between connected *erv*-systems if there exists one difference of hotness between some two systems and can be characterized by the *q* heat flux vector. Denote by θ_0 the *reduced equilibrium temperature* of the two phases and we take $l = \varepsilon_2(\theta_0) - \varepsilon_1(\theta_0)$ the difference of energy at the phase transition, named the *solidification latent heat*.

Sometimes the temperature can decrease under the value θ_0 and the transformation from the liquid to solid can't take place, one says that the system presents the *super-thermal state*, which is named a *sub-cooling of the interface*. The existence of the super-thermal zone leads us to impose the

presence of the *mushy zone*, which is a mixture of phases in equilibrium. Analytical characterization of the mushy zone needs the introduction of the *fraction solid function* $\chi : \mathcal{B} \to R_+$, $\chi(t,x) = \begin{cases} 1, x \in B_1(t) \\ 0, x \notin B_1(t) \end{cases}$, it can be understood as a measure of *nucleation phenomenon* near the separation interface. In this way a thin free interface (as a surface of null volume) must be replaced by an entire mixture zone, where the germs of the new phase arise and where their growing takes place. We adopt the new expressions for the internal energy and heat flux according to the *transition process with nucleation*,

$\varepsilon(\theta,\chi) = \chi\varepsilon_1(\theta) + (1-\chi)\varepsilon_2(\theta)$,

$q(\theta,\nabla\theta,\chi) = -\chi K_1(\theta)\nabla\theta - (1-\chi)K_2(\theta)\nabla\theta$,

for one *erv*-system. We have supposed that the *erv* is submitted to a transition governed by the *Fourier* law; here K is the *thermal conductibility* of the material. Thus the states space of the *erv* is $\Sigma = \left\{(\theta,\chi)/\ \theta \in C^0(B \times R_+, \chi \in D'(B) \times R_+)\right\}$ and ε, q are scalar function and vector function, respectively on Σ, $D'(B)$ is the distributional space on $\mathcal{B}$.

Some results of the phase transitions applied on freezing water, on steel solidification, including *super thermal states* have been obtained by *G. Caginalp*, 1986, *A. Visintin*, 1986, 1987, *G. Caginalp & J. T. Lin*, 1987, *M. E. Gurtin*, 1986, 1987, *J. Chadam*, *S. D. Howison & P. Ortoleva*, 1987.

An important parameter characterizing the state of the *erv*, more used in the treatment of the *Stefan problem*, also counting the super-thermal states, is *the integral accumulation of Clausius type*, named the *global entropy* of the *erv*, denoted A_V, whose density according to *Jordan* measure on Euclidian space R^3 is the function $\eta(t,x)$, the density of entropy.

The first law of thermodynamics for an *erv* – system consists in the equilibrium of total energy, which is

$\left\{\int_{erv}\varepsilon(t,x)dx\right\}' = -\int_{Fr(erv)}q(t,x)nd\sigma + \int_{erv}r(t,x)dx$,

where the r function represents the heat supply, and it will count as an external energy.

The second law of thermodynamics explains the increase of the entropy which accompanies the arising of the new free interface. Here we have the *Clausius-Duhem* inequality

$\left\{\int_{erv}\eta(t,x)dx\right\}' \geq \int_{Fr(erv)}\frac{q(t,x)n}{\theta(t,x)}d\sigma + \int_{erv}\frac{r(t,x)}{\theta(t,x)}dx$.

We suppose that the θ function is continuous on the domain $\mathcal{B}$, but all the other functions: ε, q, K, η have some discontinuities across the interface. Despite this difficulty we can apply the *Gauss-Ostrogradski* Theorem and we obtain the local relations of equilibrium for the *erv*-system

(e) $\dot{\varepsilon}(t,x) = -divq(t,x) + r(t,x)$, almost everywhere $(t,x) \in R_+ \times B$, and the *Clausius-Duhem* inequality

(i) $\dot{\eta}(t,x) \geq -div\frac{q(t,x)}{\theta(t,x)} + \frac{r(t,x)}{\theta(t,x)}$, a.e. $(t,x) \in R_+ \times B$.

Assumption 3.1. The *erv*-system is endowed with an internal energy ε, which is taken as *primitive variable* characterizing the physical state, consequently all other parameters depend upon ε. Let $\theta = \tilde{\theta}(\varepsilon)$, $\eta = \tilde{\eta}(\varepsilon)$, $q = -\tilde{K}(\theta)\nabla\theta$ be dependent variables,

where $\tilde{\theta}$, $\tilde{\eta}$, $\tilde{K} \in D'(R)$, and $\tilde{K}$ is a positively defined matrix on R^3.

We suppose that the hotness increases, then the temperature of the *erv*-system increases too and consequently the internal energy grows strictly monotone. We have considered the temperature continuous on $\mathcal{E}$, therefore $\tilde{\theta}$ is an invertible function. We eliminate the *r* function between the two relations (e) and (i) and we obtain the inequality

$$\dot{\eta} - \frac{\dot{\varepsilon}}{\theta} \geq \frac{1}{\theta^2} q \nabla \theta = -\frac{1}{\theta^2} grad\theta . K . grad\theta \geq 0$$

and it underlines another nonlinear characteristic of the *erv*-system $\gamma(\varepsilon) = \frac{1}{\tilde{\theta}(\varepsilon)^2} \nabla \tilde{\theta}(\varepsilon) K \nabla \tilde{\theta}(\varepsilon)$, named the local *productivity of entropy* accumulated by the *erv*-system in a liquid-solid transition, otherwise the last inequality becomes $\tilde{\eta}'(\varepsilon)\tilde{\theta}(\varepsilon) \geq 1$.

Definition 3.1. During a transition, the process P whose characteristics $\tilde{\theta}$ and $\tilde{\eta}$ satisfy the relation $\tilde{\eta}'(\varepsilon)\tilde{\theta}(\varepsilon) \geq 1$, it is a *dissipative process* and the *transition is irreversible*; if $\tilde{\eta}'(\varepsilon)\tilde{\theta}(\varepsilon) = 1$ holds then the *process is conservative* and the transition is named a *reversible transition*.

The last two relations ensure the inequality $\tilde{\eta}'(\varepsilon) > 0$, that is the entropy of the *erv*-system is a strictly increasing function with respect to internal energy. In order to preserve the estimation of the mechanical work consumed means only to assume that dissipation cannot increase the work done.

Assumption 3.2. The density of entropy η hasn't positive second derivative, i.e. $\eta''(\varepsilon) < 0$, meaning that η is a concave function.

For a reversible transition a simple calculus assure

$$\theta'(\varepsilon) = \frac{d}{d\varepsilon}\left(\frac{1}{\eta'(\varepsilon)}\right) = -\frac{\eta''(\varepsilon)}{\eta'(\varepsilon)^2} > 0,$$

then, the θ function is an invertible function on ε, such that $\varepsilon = \tilde{\varepsilon}(\theta)$. I have referred to lack of dissipation for *ervs* capable to follow only reversible processes.

Definition 3.2. The variation of the $\tilde{\varepsilon}$ function according to the temperature, that is the quantity $C(\theta) = \tilde{\varepsilon}'(\theta)$, which is named the specific heat of the *erv*-system.

Obviously, $C(\theta) > 0$, because $\tilde{\varepsilon}$ is a monotone function.

3.2. Entropic analysis of a phase transition

We take again the idea of the two phases in a *erv*-system, the heat conduction produce an irreversible transition along the manifestation of a process *P*, also counting the monotony of the entropy, that in a (ε, η) diagram corresponding to figure 4, the concavity of the function $\tilde{\eta} = \begin{cases} \tilde{\eta}_1, & in \ B_1 \\ \tilde{\eta}_2, & in \ B_2 \end{cases}$ near the critical value ε^* of the energy, having the common slope at ε_1 for the function $\tilde{\eta}_1$, at ε_2 for the function $\tilde{\eta}_2$.

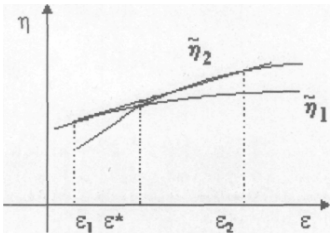

Figure 4. *Convexification of the entropy*

Using the definition of the specific heat, the equilibrium equation becomes

$$C(\theta)\dot{\theta} = div\left(\tilde{K}(\theta)\nabla\theta\right) + r .$$

But the liquid δ-austenite transition is a reversible one, thus

$$\tilde{\theta}_1(\varepsilon_1) = \frac{1}{\tilde{\eta}_1(\varepsilon_1)} = \frac{1}{\tilde{\eta}_2(\varepsilon_2)} = \tilde{\theta}_2(\varepsilon_2) = \theta_0 ,$$

considered as a *transition value* of the temperature, which generates a convex hull of the entropy function and at the same time gives the initial reduced temperature of the liquid-solid transition. We generalize the notion of *latent heat* adding a new function $L = \varepsilon_2 - \varepsilon_1$.

Later on the free energy of the *erv*-system will be very useful, presented as a discontinuous function, having a jump across

the separate interface, revealed in figure 5, $\Psi(\varepsilon)=\varepsilon-\theta_0\eta(\varepsilon)$. We connect this notion with the *super-thermal states* of the *erv*-system. First, we have

$$\tilde{\Psi}_1(\varepsilon_1)=\varepsilon_1-\theta_0\tilde{\eta}(\varepsilon_1),$$
$$\tilde{\Psi}_2(\varepsilon_2)=\varepsilon_2-\theta_0\tilde{\eta}(\varepsilon_2)$$

the two values corresponding to the minimum of the *Gibbs* potentials, passing to the small variations which lead us to the equality $\tilde{\Psi}_1(\varepsilon_1)=\tilde{\Psi}_2(\varepsilon_2)+L$, indeed, $\tilde{\Psi}_1(\varepsilon_1)-\Psi_2(\varepsilon_2)=\varepsilon_1-\varepsilon_2-\theta_0(\tilde{\eta}_1(\varepsilon_1)-\tilde{\eta}_2(\varepsilon_2))\approx$ (using a *Lagrange* formula for a smooth real function) $=L+\theta_0\tilde{\eta}'(\bar{\varepsilon})L=L(1+\theta_0\tilde{\eta}'(\bar{\varepsilon}))$, where $\bar{\varepsilon}\in(\varepsilon_1,\varepsilon_2)$, because the slope is the same on the tangent line, $\tilde{\eta}_1'(\varepsilon_1)=\tilde{\eta}_2'(\varepsilon_2)=\tilde{\eta}'(\bar{\varepsilon})=0$, therefore the relation holds.

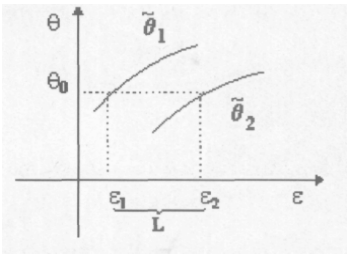

Figure 5. Variation of free energy

The particular case of the phase transition at the constant energy ε^* appears a discrepancy between the individual phase energies, which assures a super thermal state of the *erv*-system. The domain $\{x\in B/\varepsilon^*<\varepsilon(t,x)<\varepsilon_2(t,x), t\in R_+\}$ constitute the part of the mushy zone stated in *sub-cooling of interface* and $\{x\in B/\varepsilon_1(t,x)<\varepsilon(t,x)<\varepsilon^*, t\in R_+\}$ another part of the mushy zone stated in *super-heating*, the two parts are non equilibrium regions of the *erv*-system.

We affirm that any transition into the *erv* at constant energy ε^* governs the entropy production described by a positive quantity $\gamma(\theta)>0$, therefore the material presents the super thermal regions under small variations of some other characteristics.

Remark 3.1. Some features about the shape of the free energy can be viewed, doing simple calculus,

$\tilde{\Psi}'(\varepsilon)=1-\tilde{\theta}'(\varepsilon)\tilde{\eta}(\varepsilon)-\tilde{\theta}(\varepsilon)\tilde{\eta}'(\varepsilon)$ (the *erv*-system is submitted at reversible transformation) $=-\tilde{\theta}'(\varepsilon)\tilde{\eta}(\varepsilon)$, but the function $\tilde{\theta}$ is an increasing function on R_+ and for $\tilde{\eta}<0$, $\tilde{\Psi}$ it is increasing, for $\tilde{\eta}>0$, $\tilde{\Psi}$ is a decreasing function, a fact that justifies the variation given in diagram (η,Ψ).

3.3 Integral and entropy solution for a thermal conservation law

A partial differential equation of the form $u_t+\ divF(u)=f$, in $R^n\times(0,+\infty)$ is called a *conservation law* with unknown u and the flux function $F=(F^1,F^2,...,F^n)$. We can write this equation into non divergence form $u_t+b(u)\nabla u$, for $b=F'$. We will focus on the initial homogeneous value problem

(CL) $u_t+divF(u)=0$, in $R^n\times(0,+\infty)$, $u=g$ on $R^n\times\{t=0\}$,

where $g\in L^1_{loc}$ is the initial value of u. Our aim is to use the variational method in treating of this problem. First of all we introduce

Definition 3.3. We say that $u\in L^1_{loc}$ is an integral solution of (CL) if there exists $\int_0^\infty\int_{R^n}\{uv_t+F(u)\nabla u\}dxdt+\int_{R^n}gv(.,0)dx=0$, for all $v\in C_c^1$, where C_c^1 is the space of real valued function with compact support.

Now we introduce a thermo-dynamical notion

Definition 3.4. Let Φ, Ψ be a real valued function and a vector valued function, respectively, we call (Φ,Ψ) an *entropy/ entropy flux pair* for the conservation law

(CL) provided Φ is convex and Ψ satisfies $\Psi' = bgrad\Phi$.

We consider an approach problem: for $\varepsilon > 0$ find $u_\varepsilon \in L^1_{loc}$ satisfying the non homogeneous problem $u_{\varepsilon t} + divF(u_\varepsilon) = \varepsilon \Lambda u^\varepsilon$. Compute

$\Phi(u^\varepsilon)_t + \nabla(\Psi(u_\varepsilon)) = \Phi'(u_\varepsilon)u_{\varepsilon t} + \Psi'(u_\varepsilon)\nabla u_\varepsilon$

$= \Phi'(u_\varepsilon)\{-b(u_\varepsilon)\nabla u + \varepsilon\Delta u_\varepsilon\} + \quad \Psi'(u_\varepsilon)\nabla u_\varepsilon =$

$= \varepsilon\Phi'(u_\varepsilon)\Delta u_\varepsilon = \varepsilon\nabla(\Phi'(u_\varepsilon)\nabla u_\varepsilon) -$

$\varepsilon\Phi''(u_\varepsilon)|\nabla u_\varepsilon|^2$ (Φ is a convex function, $\Phi'' \le 0$) $\le \varepsilon\nabla(\Phi'(u_\varepsilon)\nabla u_\varepsilon)$.

Taking into account some regularity conditions and convergent results we obtain

$$\frac{d}{dt}\Phi(u) + \nabla\Psi(u) \le 0 .$$

Definition 3.4. We say that u is an *entropy solution* of the conservation law providing that $\frac{d}{dt}\Phi(u) + \nabla\Psi(u) \le 0$, in the distribution sense for each pair (Φ, Ψ).

This definition can be extended on the conservation laws defined by the system

$u_t + divF(u) = 0$, in $R^n \times (0,+\infty)$, where the unknown is $u = (u^1, u^2, ..., u^m)$ and the flux function

$F = \begin{pmatrix} F_1^1 & \dots & F_n^1 \\ \dots & \dots & \dots \\ F_1^m & \dots & F_n^m \end{pmatrix} \in M(m,n)$ is given. The initial value problem

$u_t + divF(u) = 0$, in $R^n \times (0,+\infty)$, $u = g$ on $R^n \times \{t = 0\}$, for a given $g \in L^1_{loc}$, has an integral solution and the entropy/ entropy flux pair in the same manner as above.

Definition 3.5. We say that $u \in L^1_{loc}$ is an integral solution of (CL) if there exists

$\int_0^\infty \int_{R^n} \{uv_t + F(u) : \nabla v\} dxdt + \int_{R^n} gv(.,0)dx = 0$,

for all $v \in C_c^1$, where C_c^1 is the space of real valued function with compact support.

Definition 3.6. We call (Φ, Ψ) an *entropy/entropy flux pair* of the conservation law provided $\Phi : R^m \to R$ is convex, $\Psi = (\Psi^1, \Psi^2, ..., \Psi^n)$ satisfies $\nabla\Psi = B\nabla\Phi$, for $B = \nabla F$.

At the end of section we gives

Definition 3.7. We say that u is an entropy solution providing that $\frac{d}{dt}\Phi(u) + \nabla\Psi(u) \le 0$, in the distribution sense for each pair (Φ, Ψ).

4. ANALYSIS OF THE *GIBBS* POTENTIAL

We take the *Gibbs* function $\varphi = \varepsilon - \theta_0\eta$, see *figure* 6 and the reduced temperature $u = \frac{\theta - \theta_0}{\theta_0}$, otherwise u is a local perturbation near the transition value θ_0. We have also like in the previous section $\tilde{u}_1(\varepsilon_1) = \tilde{u}_2(\varepsilon_2) = 0$, $\tilde{\varphi}_{1(\varepsilon_1)} = \tilde{\varphi}_2(\varepsilon_2) = ct$, indeed $\tilde{\varphi}(\varepsilon) = 1 - \theta_0\tilde{\eta}(\varepsilon)$, particularly $\tilde{\varphi}_1(\varepsilon) = 1 - \theta_0\tilde{\eta}_1(\varepsilon)$ and

$\tilde{\varphi}_2(\varepsilon) = 1 - \theta_0\tilde{\eta}_2(\varepsilon)$, thus

$\tilde{\varphi}_1'(\varepsilon_1) = \tilde{\varphi}_2'(\varepsilon_2)$, consequently $\tilde{\varphi}_1(\varepsilon_1) = \tilde{\varphi}_2(\varepsilon_2)$, after doing void potential value. As in the previous section where we used the entropic analysis, we can define the super- thermal states according to *Gibbs* potential.

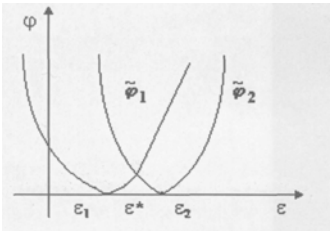

Figure 6**.** *Evolution of potentials Gibbs of the two phases*

Physically, it exists there a solid dispersed phase into the matrix of liquid phase at the level of mushy zone, perhaps the mixture zone occupies a thin domain, therefore it can be considered of null measure. We have seen that the solid fraction function χ can characterize the distribution of the solid germs into *erv*-system. In this way, the

internal energy ε is consistent with the function χ, that is $\mathcal{E}$ is continuous similar to χ, but the internal energy has at most discontinuities of the first kind. For our transformation governed by a thermal conduction process we adopt the framework of the two parameters (φ, u) taking account for the independent variable χ,

$\tilde{\varphi}(\varepsilon,\chi) = \chi\tilde{\varphi}_1(\varepsilon) + (1-\chi)\tilde{\varphi}_2(\varepsilon)$,

$\tilde{u}(\varepsilon,\chi) = \chi\tilde{u}_1(\varepsilon) + (1-\chi)\tilde{u}_2(\varepsilon)$,

$q = -\chi\tilde{K}_1(u)\nabla u - (1-\chi)\tilde{K}_2(u)\nabla u$,

u being continuous on $\mathcal{E}$, a.e. $\varepsilon \in R_+$. The energy and the entropy of the interface are neglected. The thermodynamics of the *erv*-system assure relations in a local form:

$\dot{\varepsilon} = -divq + r$, $\dot{\varphi} + div(uq) - ru \le 0$, in $B - S(t)$, where $S(t)$ is the free interface,

$[\varepsilon]v = [q]m$, $[\varphi]v \ge u[q]m$ on C,

where v is the displacement speed of the interface, m an outer unit normal of $S(t)$.

The quantity defined by

$$\Gamma(ver) = \left\{\int_{erv}\varphi dx\right\}' + \int_{Fr(erv)} uqnd\sigma - \int_{erv} urdx,$$

is the *dissipation functional* of the *erv*-system. Obviously, we have $\Gamma(erv) \le 0$. The non dissipative phenomenon of the interface can be expressed by the stability conditions of the functional $\Gamma(erv)$: $\lim_{n\to\infty}\Gamma(erv_n) = 0$, when $\lim_{n\to\infty} mes(erv_n) = 0$, or locally $Lv = [q]m$. We don't detail other results about the dynamic models of the phase transition in metals with mass transport of *Mullins-Sekerka* type. Such models were initiated by *W.W. Mullins& R.F. Sekerka*, 1963, *R.F. Sekerka*, 1968, *N. Goldenfeld*, 1969. We made an energetic and mass balance from which derive the global growth relations of the area of interfaces and the phase volumes. For this particular model the state of the *erv*-system is characterized by the parameters $\{u, c\} \in \Sigma$, where u is a reduced temperature, c is a concentration of dissolved element in excess from liquid phase. Moreover, the state point $\{u, c\}$ is a steady point for the functionals:

$f_1(t) = Lvol(B_2(t)) + a\int_B u(t)dx$,

$$f_2(t) = \beta\sigma(S(t)) + \frac{a}{2}\int_B u^2(t)dx + \alpha L\int_B c(t)dx;$$

5. SOLID-SOLID TRANSITION: AUSTENITE-PERLITE

The cooling process austenite-perlite develops over the interval of temperature $[\rho_1, \rho_2]$ and defines an irreversible transformation during a time period. For a temperature θ greater then ρ_2 the austenite phase is stable, when $\rho_1 < \theta < \rho_2$ appears a perlite phase (bainite) and for θ less then ρ_1 and nearest for ρ_1, an instantaneous and reversible transition holds. The austenite fraction transformed in martensite grows at the same time as the rapidly decreasing of the temperature from $\rho 2$ value to $\rho 1$ value. Models of solid-solid phase transition were studied by *A. Visintin*, 1987, *R. Abeyaratne & K. Knowles*, 1992, *M. E. Gurtin*, 1993, *P. Cermelli & M. E. Gurtin*, 1994, taking account for the nonlinear constitutive laws. Some processes for the transformations of the mixture using as variable the concentration was investigated by *G. Ruddock*, 1994.

The austenite-perlite transition as an isotherm process (with liberation of latent heat) is governed by the *Johnson-Avrami-Mehl* law.

Let $\theta \in [\rho_1, \rho_2] \to F(t) \in [0,1]$ be a vector valued function, we define $\phi(\theta, t) = F(t) = 1 - e^{-b(\theta)t^{a(\theta)}}$, where b is a rate function of *nucleation* of the perlite

phase, and a, $b \in C^0([\rho_1, \rho_2])$, $a(0)>0$, $b(\rho_2)=0$. When θ decrease near ρ_1 the nucleation falls and the element size of the structure grows. In this case we obtain a *column structure*. When θ tend to ρ_2 the nucleation became greater and the germ size growing develops slowly. In this way we obtain an *equi-axe structure*. We characterize the *erv*-system transition from the nucleation point of view and the growing of the new phase taking as an internal energy $\varepsilon(t,x) = C\theta(t,x) + \lambda F(t,x) + \mu$, where C is the latent heat at constant volume, F is the austenite fraction transformed and μ a scale factor, we introduce the energetic equilibrium equation

$\rho(C(\theta)\theta(x,t) + \lambda F(x, t))^{\circ} - K\Delta\theta(t,x) = h(t,x)$, a.p.t. $(t,x) \in [0,T] \times B = Q$.

6. CONCLUSIONS

We have investigated some models of phase transition on the range of temperature from 60° to 1495°C. By their balance equations and their own characteristics, these models answer to the exigencies of the thermodynamics. We recall a model of an elastic-plastic deformation consisting in a weak formulation compatible to the *Perrin principle*, a new formulation of the second principle of thermodynamics, which says: *The state parameters change along a phase transition, their initial values differ from final values*. The treatment of the equations of *Stefan* type corresponding to these models was made by the classical variational technics, using results of monotony and compacity of Nonlinear Analysis.

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CRITERIA AND APPLICATIONS REGARDING THE ABSOLUTE STABILITY FOR THE SHIPS AUTOPILOT ROUTE ADJUSTMENT

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Abstract: *In this paper are presented the methods of study of the automatic regulation of the absolute stability for some nonlinear dynamical systems. Two methods for the absolute stability are specified: a) the A.I. Lurie method with the effective determination of the Liapunov function; b) the frequencies method of the Romanian researcher V.M. Popov that uses the transfer function in the critical cases. The authors develop a new sufficient criterion of absolute stability, with efficient technique of calculus. With this theoretical support are presented the numerical – analytical solutions regarding the stability of the ships and the absolute stability of the airplane autopilot route.*

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Keywords*: absolute stability, automatic frequencies control, autopilot, Lurie methods.*

1. INTRODUCTION

The automatic regulation for the stability of dynamical systems occupies a fundamental position in science and technique, following the optimization of the technological process of the cutting tools, of the robots, of the movement vehicles regime or of some machines components, of energetic radioactive regimes, chemical, electromagnetic, thermal, hydro-aerodynamic regimes, etc.

The studies and the technical achievements are complex by mathematical models for closed circuits with input - output, following for the automatic regulation the integration of some mechanisms and devices with inverse reaction of response for the control and the fast and efficient elimination of the perturbations which can appears along these processes or dynamical regimes. Generally these dynamical regimes are nonlinear and it was necessarily some contributions and special achievements for automatic regulation, generating the automatic regulation of absolute stability (a.r.a.s.) for these classes of nonlinearities.

We highlight two special methods (a.r.a.s.):
• Liapunov's function method discovered by A.I. Lurie [13,15,20] and developed into a series of studies by M.A Aizerman, V.A. Iakubovici, F.R. Gantmaher, R.E. Kalman, D.R. Merkin [14] and others [1,17].
• Frequency method developed by researcher VM Popov [18] generalizing the criterion of Nyquist, then developed in many studies [1,2,15].

We note the contributions of Romanian researchers recognized by the works and monographs on the stability and optimal control theory: C. Corduneanu, A. Halanay, V. Barbu, Th. Morozan, G. Dinca, M. Megan, Vl. Rasvan,

V. Ionescu, M.E. Popescu, S. Chiriacescu, A. Georgescu and also who studied directly on (a.r.a.s.): I. Dumitrache [4] D. Popescu [16], C. Belea [2], V. Rasvan [19], S. Chiriacescu [3] and other recent works [6,…,12].

The research has shown that both methods are equivalent, and studies can be qualitatively or numerically. In this paper we presented the actual making methods in cases of singularity studies across applications.

2. (A.R.A.S.) USING THE LIAPUNOV'S FUNCTION METHOD

In this part we'll present the Lurie's ideas and the effective method for found the Liapunov's function [13,14,2,19]. Generally, the systems of automatic regulation are composed from the controlled processor system, and sensory elements of measurement, acquisition board, and the mechanism feedback controller. The regulator will mean all the sensors and the acquisition board, but the controller is included feedback mechanism. Parameters characterizing the object control system to control work mode are measured by sensors, and their records with the sensor response mechanism ζ is transmitted acquisition board. This processes the command σ, which is mechanically transmitted to the controller which, on its turn, distributes the object state and interact simultaneously adjusting the response mechanism. We highlight the dynamic system equations. We note by $x_1, x_2, \ldots, x_n$ the state parameters of the regime's subject which it must controlled, the coordinates and the sensorial speeds. We rename that the variation of these parameters if the open circuit (excluding the controller) system described by linear differential equations with constant coefficients: $\dot{x}_k = \sum_{j=1}^{n} a_{kj} x_j, k = 1,\ldots,n$. If the system is with closed loop then on the variables $x_1, x_2, \ldots, x_n$ will influence the regulation body, and we note by ξ its state. In this case for the autonomous closed system we have the equations:

$$\dot{x}_k = \sum_{j=1}^{n} a_{kj} x_j + b_k \xi, k = 1,\ldots,n \qquad (1)$$

We'll consider that the mechanism or inverse reaction is determine on the output ζ with the rigidity connection on the input ξ :

$$\zeta = k\xi \qquad (2)$$

The acquisition board collects the signals and transmits the input sensors in order to obtain the embedded system:

$$\sigma = \sum_{j=1}^{n} c_j x_j - r\xi \qquad (3)$$

where c_j, r are transfer numbers, r is the transfer coefficient of the inverse rigid connection, $r > 0$ (the regulator characteristics) [13,14,15]. The connection between the output function σ (linear) of the controller and the nonlinear input φ in the case of automatic regulation is express by the relation:

$$\dot{\xi} = \varphi(\sigma) \qquad (4)$$

The characteristic function of the controller $\varphi(\sigma)$, $\sigma \in (-\infty,+\infty)$ is continuous and verify the conditions [14,6,7]:

$$a) \quad \varphi(0) = 0$$
$$b) \quad \sigma \cdot \varphi(\sigma) > 0, \quad \forall \sigma \neq 0 \qquad (5)$$
$$c) \quad \int_0^{\pm\infty} \varphi(\sigma) d\sigma = \infty$$

Observe that $\varphi = \varphi(\sigma)$ is ascending in the quarters I, III where is graphically. The functions $\varphi(\sigma)$ are named admissible, and is verified the sector condition:

$$0 < \frac{\varphi(\sigma)}{\sigma} < k \qquad (6)$$

where k is the amplification coefficient.

Example1.

- $\varphi(\sigma) = sgn(\sigma) \cdot \ln(\sigma^2 + 1), k > 1$
- $\varphi(\sigma) = a(e^{\sigma} - 1), k \leq a$

The equations (1), (3), (4) model the perturbed system with the zeros $x(0,0,\ldots,0)$, $\xi = 0$.

Using the nonsingular square matrix $A = \|a_{kj}\|$ of degree $n > 1$, $B = \begin{pmatrix} b_1 \\ \cdots \\ b_n \end{pmatrix}, C = (c_1 \quad \ldots \quad c_n)$, C' the transpose matrix of C, this system can be:

$$\dot{X} = AX + B\xi, \quad \dot{\xi} = \varphi(\sigma),$$

$$\sigma = C'X - r\xi, \qquad X = \begin{pmatrix} x_1 \\ \cdots \\ x_n \end{pmatrix} \tag{7}$$

Observation. It is known that for the linear system $\dot{X} = AX$, the second method of Liapunov for the null solution stability consists in determine a Liapunov function $V = V(x)$ fulfilled the regularity conditions associated of this system [1,20]. A simple technique is to search V like square form positive defined $V = X'PX$ and $\dot{V} = X'(A'P + PA)X$ associated of the autonomous system where $V(0) = 0, \dot{V}(0) = 0$. For the simple or asymptotic stability in the vicinity of the null solution must have negative sign (or negative defined). It must:

$$A'P + PA = -Q \tag{*}$$

Where the matrix $P, Q \in \mathbf{R}_{n\times n}$ Q are symmetrically and positives. So, practically it is choose Q randomize fixed and is determined the matrix P from the equation (*) with A nonsingular.

Bringing the system (7) to the canonical form and determine the Liapunov function:

Suppose that A with $\det A = \Delta_0 \neq 0$ is Hurwitz, that mean the characteristic polynomial $P(\lambda)$ has simple roots with $Re(\lambda_k) < 0, k = 1, \ldots, n$

$$P(\lambda) = (-1)^n \det(A - \lambda E) = 0 \tag{8}$$

The system (7) is bring to the canonical form if the matrix A is bring to the Jordan form $J = diagA = \begin{pmatrix} \lambda_1 & & 0 \\ & \ddots & \\ 0 & & \lambda_n \end{pmatrix}$. It is determine a non degenerate matrix $T = (t_{kj})$ for the diagonalization of matrix A with the relation:

$$T^{-1}AT = J, \qquad AT = TJ, \qquad \det T \neq 0 \tag{9}$$

We make the linear transform:

$$X = TY, Y = \begin{pmatrix} y_1 \\ \cdots \\ y_n \end{pmatrix} \tag{10}$$

Obtaining from (7):

$$T\dot{Y} = ATY + B\xi, \qquad \dot{\xi} = \varphi(\sigma), \sigma = C'TY - r\xi$$

that mean:

$$\dot{Y} = JY + B_1\xi, \qquad \dot{\xi} = \varphi(\sigma), \qquad \sigma = C_1'Y - r\xi, B_1 = T^{-1}B, C_1' = C'T \tag{11}$$

Reducing the system (1) with the linear transform:

$$Z = JY + B_1\xi, \sigma = C_1'Y - r\xi, Z = \begin{pmatrix} z_1 \\ \cdots \\ z_n \end{pmatrix} \tag{12}$$

$$\begin{cases} \dot{Z} = JZ + B_1\varphi(\sigma) \\ \dot{\sigma} = C_1'Z - r\varphi(\sigma) \end{cases} \tag{13}$$

The disturbed system (13) with the equilibrium solution ($z_k = 0, \sigma = 0$) will be equivalent with the system (7) with the equilibrium solution $(x_k = 0, \xi = 0)$ and the transform (12) will be non degenerate if the determinant of the system (13) is non null.

$$\Delta = \begin{vmatrix} J & B_1 \\ C_1' & -r \end{vmatrix} \neq 0, r + C_1'J^{-1}B_1 \neq 0 \tag{14}$$

Retuning to $J^{-1} = T^{-1}AB, B_1 = T^{-1}B, C_1' = C'T$ transforms we obtain from (14) the final condition:

$$r + C'A^{-1}B \neq 0 \tag{15}$$

The Lurie's problem consists in calculus the asymptotic stability conditions of the (7) equivalent with (13) with the null solution respectively $(x_k = 0, \xi = 0)$, $(z_k = 0, \sigma = 0)$ for the initial perturbations and for any admissible functions $\varphi(\sigma)$ defined in (5), (6). This type of stability where the systems (7), (13) have a

linear part which is the A and a non linear part which is $\varphi(\sigma)$ is named the absolute stability (a.s), [1,16] It is observe that if $\varphi(\sigma)$ is linear, than the systems are linearized being asymptotic stable. The simplicity of system (13) entails immediate techniques for determining the Liapunov function $V = V(z_1,\ldots,z_n,\sigma)$ attach to the system (13). The function $V(z,\sigma)$ of class C^1 is Liapunov from the system (13) if $V(z=0,\sigma=0)=0$ and is positive defined $V(z,\sigma)>0$ radial unlimited to ∞ , with the absolute derivative $\dot{V} = \frac{dV}{dt}$ $\dot{V}(0,0)=0$ and $\dot{V}$ negative defined $\frac{dV}{dt} < 0$ for $(z \neq 0, \sigma \neq 0)$ in vicinity of the equilibrium point for have than absolute stability. Here, for the case of automatic regulation we choose $V, \dot{V}$ have the special form which verify these conditions. So we search the function $V = V(z,\sigma)$ compose by a square form z_k corresponding to the linear block A and an integral term corresponding to the non linear part.

$$V(z,\sigma) = Z'PZ + \int_0^\sigma \varphi(\sigma)d\sigma = \\ = V_1(z,\sigma) + \int_0^\sigma \varphi(\sigma)d\sigma \tag{16}$$

From theory [1,4] $Z'PZ$ is the square form defined strictly positive if the matrix P is symmetric $(P = P')$ and we have $A'P + PA = -Q$ where Q is symmetric and positive (with the eigenvalues positive). The integral term from (16) is strictly positive from the conditions (5) with $\sigma \neq 0$ and $V(z=0,\sigma=0)=0$. Next are verify the regularity conditions with $\dot{V}$ attach to (13) and with (15) will obtain the conditions for parameters c_k, r to obtain (a.r.a.s.). From (16) using (13) and:

$$Q = Q', P = P', B_1'PZ + Z'PB_1 = \\ = B_1'PZ + (PB_1)'Z = 2(PB_1)'Z$$

for:

$$\frac{dV(z,\sigma)}{dt} = Z'(J'P + PJ)Z - r\varphi^2(\sigma) + \\ + \varphi(\sigma)(B_1'PZ + Z'PB_1) + \varphi(\sigma)C_1$$

We obtain:

$$\frac{dV}{dt} = -Z'QZ - r\varphi^2(\sigma) + 2\varphi(\sigma) \\ \left(PB_1 + \frac{1}{2}C_1\right)Z; \dot{V}(z=0,\sigma=0)=0 \tag{17}$$

It can be see the connection from the matrix components $P(p_{ij}), Q(q_{ij})$ from $\lambda_i + \lambda_j \neq 0, i, j = 1,\ldots,n, P = P', J = \text{diag}A$ than from $Q = Q'$ we have $q_{ij} = -\left(\lambda_i p_{ij} + \lambda_j p_{ij}\right)$ that mean:

$$p_{ij} = -\frac{q_{ij}}{\lambda_i + \lambda_j} \tag{18}$$

Observation1. The matrix A is stable with $\lambda_i + \lambda_j \neq 0$ if Q is a square form positive defined.

Example2. If choose $Q = E$ the unit matrix and P obtain from (18) than the below observation is valid. Because $\dot{V} < 0$ we prove that $(-\dot{V})$ is positive defined. Apply in (17) the Silvester criterion demanding that all diagonal minors of (17) to be positive. Because Q is positive like square form, than the first n inequalities are verify; it rest the last inequality from (17) after the square form in z and which is:

$$r > \left(PB_1 + \frac{1}{2}C_1\right)' Q^{-1}\left(PB_1 + \frac{1}{2}C_1\right) \tag{19}$$

For $Q = E, \sqrt{r} > \left\| PB_1 + \frac{1}{2}C_1 \right\|$

If the regulator parameters verify the conditions (15), (19) there are sufficient conditions for the asymptotic stability of the system (1), (3), (4) for the solution $(x=0,\xi=0)$. [13,19,11].

Remark1. A choice technique of the square form $V_1(z)$ for p_{ij} according Lurie is:

$$V_1(z) = \varepsilon\sum_{k=1}^{s} z_{2k-1}z_{2k} + \frac{\varepsilon}{2}\sum_{k=1}^{n-2s} z_{2s+k}^2 - \\ -\sum_{k=1}^{n}\sum_{j=1}^{n}\frac{a_k z_k a_j z_j}{\lambda_k + \lambda_j} \quad , \varepsilon > 0$$

where $a_1, a_2, \ldots, a_{2s}$ are complex conjugated, $a_{2s+1},\ldots,a_n$ are real corresponding to roots λ_k determining the coefficients a_k .

Remark2. The two transforms for the diagonal system (1), (3), (4) to obtain (13) can be replacing directly with the transform [15]:

$$x_k = -\sum_{i=1}^{n} \frac{N_k(\lambda_i)}{D'(\lambda_i)} z_i \qquad (20)$$

where from (7)

$$P(\lambda) = (-1)^n D(\lambda), N_k(\lambda) = \sum_{i=1}^{n} b_i D_{ik}(\lambda) \quad , \quad D_{ik}$$

are the corresponding algebraic complements of (i,k) from $D(\lambda) = A - \lambda E$. In this case the simplified system analogous (13):

$$\dot{z}_k = \lambda_k z_k + \varphi(\sigma), \dot{\sigma} = \sum_{i=1}^{n} f_i z_i - r\varphi(\sigma), \qquad (21)$$

$k = 1,...,n$

for which we will build easier $V(z,\varphi)$.

Determining of $V(z,\varphi)$ with a new efficient method for (13) or (21)

Following the form of $V_1(z)$ we choose the function $V(z,\sigma)$ for (21).

$$V(z,\sigma) = \frac{1}{2}\sum_{j=1}^{n} A_j z_j^2 + F(\alpha_1 z_1, \alpha_2 z_2, ..., \alpha_n z_n) + \qquad (22)$$

$$+ \int_0^{\sigma} \varphi(\sigma) d\sigma$$

$$F(z_1, z_2, ..., z_n) = -\sum_{j.k=1}^{n} \frac{1}{\lambda_j + \lambda_k} z_j z_{k,} \lambda_{k<0} \qquad (23)$$

Where, $A_j > 0, \alpha_j \in \mathbf{R}$ will be determined.

From

$$-\frac{1}{\lambda_j + \lambda_k} = \int_0^{\infty} e^{(\lambda_j + \lambda_k)s} ds > 0$$

$$F(z_1, z_2, ..., z_n) = \int_0^{\infty} \sum_{j,k} z_j z_k e^{(\lambda_j + \lambda_k)s} ds =$$

$$= \int_0^{\infty} \left(\sum_{j=1}^{\infty} z_j e^{\lambda_j s} \right)^2 ds \geq 0$$

Results that F is nullify just for $F(z_1 = 0, z_2 = 0, ..., z_n = 0) = 0$ and $\int_0^{\sigma} \varphi(\sigma) d\sigma > 0$.

So, $V(z,\sigma)$ has the positive sign defined and $V(z=0,\sigma=0)=0$. Compute $\frac{dV}{dt}$ associate to the system (21) and it must be $(-\dot{V})$ of positive sign defined.

$$-\frac{dV}{dt} = -\sum_{j=1}^{n} A_j \lambda_j z_j^2 - 2\sum_{j,k=1}^{n} \frac{\lambda_j \alpha_j \alpha_k}{\lambda_j + \lambda_k} z_j z_k +$$

$$+ r\varphi^2(\sigma) + \sum_{j=1}^{n} z_j \left[A_j + f_j - 2\alpha_j \sum_{k=1}^{n} \frac{\alpha_k}{\lambda_j + \lambda_k} \right] \varphi$$

From

$$2\sum_{j,k=1}^{n} \frac{\lambda_j \alpha_j \alpha_k}{\lambda_j + \lambda_k} z_j z_k = \left(\sum_{k=1}^{n} \alpha_k z_k \right)^2, r > 0, \lambda_j > 0$$

We obtain the first three terms positives and must nullifying the coefficient of φ:

$$A_j + f_j - 2\alpha_j \sum_{k=1}^{n} \frac{\alpha_k}{\lambda_j + \lambda_k} = 0, j = 1..n \qquad (24)$$

In this quadratic algebraic system (24) we can take $A_j = -\frac{1}{\lambda_j}$, and f_j, λ_j known, we determine the coefficients $\alpha_j, j = 1..n$ and other conditions from (19). If in (24) divide with λ_j and summing we obtain $\left(\sum_{j=1}^{n} \frac{\alpha_j}{\lambda_j} \right)^2 = -\sum_{j=1}^{n} \frac{A_j + f_j}{\lambda_j} \equiv \Gamma^2, \sum_{j=1}^{n} \frac{\alpha_j}{\lambda_j} = \pm\Gamma$

(25)

So, must have $\sum_{j=1}^{n} \frac{A_j + f_j}{\lambda_j} < 0$, and the solution of the system (24) $(\alpha_1, \alpha_2, ..., \alpha_n)$ is in this hyper-plane (25).

For the case when a root is null $P(0) = 0$ and the others have $Re(\lambda_k) < 0, k = 1,...,n-1$ than the system (13) with $Z = \begin{pmatrix} \tilde{z} \\ z_n \end{pmatrix}$ becomes:

$$\dot{\tilde{z}} = \tilde{J}\tilde{Z} + \tilde{B}_1\varphi, \dot{z}_n = b_0\varphi, \dot{\varepsilon} = \tilde{C}_1'\tilde{Z} + C_0 z_n - r\varphi \tag{26}$$

where for $\tilde{z}$ we have the matrix $\tilde{Z}$ and $\tilde{J}$ of degree $(n-1)$, $\tilde{B}_1, \tilde{C}_1$ row, column matrix $(n-1,1),(1,n-1)$. In this case the Liapunov function search form:

$$V(\tilde{z}, z_1, \sigma) = az_1^2 + \left\{\tilde{z}' P\tilde{z} + \int_0^\sigma \varphi(\sigma)d\sigma\right\} \tag{27}$$

For proofs and recently applications we recommend the bibliography [2,15,14,11,12].

3. THE FREQUENCY METHOD FOR (A.R.A.S.)

This method obtained by V.M. Popov [18] is applied to the dynamical system with continuous nonlinearity. We present in this section the method with criterions given by Aizerman, Kalman, Jakubovici [19,14]. Let be the dynamical, autonomous, non homogeneous system:

$$\begin{aligned} &\dot{x}_i = \sum_{l=1}^{n} a_{il}x_l + b_i u, i = 1,...,n; \dot{x} = \frac{dx}{dt} \\ &\sigma = \sum_{l=1}^{n} c_l x_l, u = -\varphi(\sigma) \end{aligned} \tag{28}$$

where a_{il}, b_i, c_l are real constants, u is the arbitrary function of input , continuous, nonlinear with $\varphi(\sigma)$ and σ is the output function. Using the Laplace transform, replacing the operator $\frac{d}{dt}$ with s we obtain from (2):

$$sx_i = \sum_{l=1}^{n} a_{il}x_l + b_i u, \sigma = \sum_{l=1}^{n} c_l x_l, i = 1,...,n \tag{29}$$

Eliminating from (21) the characteristic parameters of the regulator is obtained:

$$\sigma = W(s)u, \sigma = W(s)(-\varphi) \tag{30}$$

where $W(s) = \frac{Q_m(s)}{Q_n(s)}$ is the transfer function and $Q(s)$ are polynomials $m < n$. [4,6,16] The transfer function connect σ and φ ; the function φ verify the conditions (5) and the sector condition (6) $0 < \frac{\varphi(\sigma)}{\sigma} < k \le \infty$ - the plot $\varphi = \varphi(\sigma)$ in the plane (σ, φ) will be the sector $0 \le \varphi(\sigma) \le k\sigma$. The sector condition and the nonlinearity of φ determine the system (σ, φ) with closed loop through the impulse function φ . We study the absolute stability of the perturbed system (29) from the null solution $(x = 0, u = 0)$. Because the system is closed and nonlinear we can't applied directly the Nyquist criterion, [4,6,18]. If $\varphi \equiv k\sigma$ then the system is linear and it cab be applied this criterion. It observe that the block $\sum a_{il}x_l$ is linear and $b_i u$ is nonlinear and result that the roots of characteristic polynomial $P(\lambda) = (-1)(A - \lambda E) = 0, P(\lambda_i) = 0,$ the poles of $W(s)$ and k will influence the determination of the absolute stability criteria. From $W(s = j\omega) = U(\omega) + jV(\omega), j = \sqrt{-1}$ we have the hodograph for the axis (U, V) [2,4,6,7,15]:

$$U = U(\omega), V = V(\omega), 0 \le \omega \le \infty \tag{31}$$

If all poles of $W(s)$ have $Re(s_i) < 0$ then the system is uncritically; if through the poles of $W(s)$ are a part null or on the imaginary axis and the rest have $Re(s_i) < 0$ then the system is in the critical case. We enunciate the criteria for absolute stability of automatic control (a.r.a.s.) by the frequency method.

Criterion1.*(the uncritically case). Let be the conditions:*

a) The function $\varphi(\sigma)$ verify (5), (6)

b) All poles of $W(s)$ have $Re(s_i) < 0$

c) If there exists a real number $q \in R$ that $\forall \omega \ge 0$ is satisfied the condition:

$$\frac{1}{k} + Re\left[(1 + j\omega q)W(j\omega)\right] \ge 0 \tag{32}$$

Then the system (20) is automatic regulated and absolute stable for the null solution $(x = 0, u = 0)$.

From (32) is obtained:

$$\frac{1}{k} + U(\omega) - q\omega V(\omega) \ge 0 \tag{33}$$

The criterion (32) geometrically shows that in the plane geometric $U_1 = U, V_1 = \omega V$ exists the line (33) passing through $\left(-\frac{1}{k}, 0\right)$ and the plot of the hodograph is under this line for $\omega \ge 0, k > 0$.

Criterion2. *(the critical case when there are a simple null pole $s_0 = 0$). Let be satisfied the conditions:*
a) The function φ verify (5), (6).
b) $W(s)$ has a simple null pole, and the others poles s_i have $Re(s_i) < 0$.
c) We have $\rho = \lim_{s\to 0} sW(s) > 0$ and exists $q \in R$ for $\forall \omega \geq 0$ verifying the condition (24) Then for the system (20) for the null solution we have (a.r.a.s.).
Criterion3. *(the critical case when $s = 0$ is a double pole). Let be the conditions:*
a) The function $\varphi(\sigma)$ verify (5), (6) and the sector condition for $k = \infty$ in the quarters I, III.
b) $W(s)$ has a double pole in s=0 and the others poles has $Re(s_i) < 0$.
c) Is verifying $\rho = \lim_{s\to 0} s^2 W(s) > 0$,

$$\mu = \lim_{s\to 0} \frac{d}{ds}\left[s^2 W(s)\right] > 0 \quad ,$$

$\pi(\omega) = \omega ImW(j\omega) < 0$ for $\forall \omega \geq 0$ then for the system (20) we have (a.r.a.s.) for the null solution.
Observation2. *The shape of these criteria (I, II, III) has an analytical character and their verification is required for construction of hodograph values of the coefficients by numbers. For special cases the recommended monographs are [2,4,15,19].*

4. THE STUDY OF THE ABSOLUTE STABILITY OF SOME AIRCRAFT COURSE WITH THE AUTOMATIC PILOT

We'll consider the airplane fly in the vertical plane xOy, the longitudinal axis of the aircraft is parallel with the horizontal axis Ox and the vertical plane is symmetry plane for the aircraft. In the longitudinal fly course (horizontal) can appear some perturbations with angular variations for:

- the pitch angle ψ, between the longitudinal axis and Ox
- the speed angle on the trajectory of fly θ, with the axis Ox compared with the considered system $\psi - \theta = \alpha$, represents the attack angle [17].

Considering these 3 angles without yaw and roll, it is written the system of disturbed differential equations compared with the mass center, corresponding to ψ, θ, α, the coefficients are linearized, depend of the gyroscopic momentums created by the stability gyroscopes and the automatic regulations mechanisms for the pitch stability [5,17]. Eliminating θ, α from the system we'll study the equation for ψ in concordance with the regulator characteristics. The object of automatic regulation is the horizontal course of the plane. The important elements of the measurement, control, sensors and with response with inverse reaction to the perturbations that compose the regulator are considered: a gyroscope that measure the pitch speed ψ and a gyrotachometer that measure the angular speed $\dot{\psi}$, [5,17]. With sensors and potentiometers help these values are transmitted on the collector plate and transducers and amplifiers are turned into electrical signals, by summary they are transmitted through the input function φ for the output command function to the server $\sigma = -C_1\psi - C_2\dot{\psi} - r\xi$. By mechanical, electromagnetic, hydroelectric and gyroscopic effects, with the reaction parameter ξ determined, conform with the conditions from §3, it is obtain the stability for the null solution.
The mechanical reactions of replay to the control will be transmitted by the commanded stabilizer to the ailerons, shutters (solid or jet type), horizontal empennage, horizontal rudder, to the pitch momentum around the Oy axis to converge to zero, considering that the perturbations moments by rolling or yaw be very small; in this way it is

obtained the absolute stability of the horizontal course.

A. The method of the Liapunov solution for (a.r.a.s.). We'll write the reduce system of equations dimensionless [17], corresponding to the pitch perturbation $\psi = x$ in concordance with the functions and characteristics of the regulator connections.

$$\dddot{x} + a_1\ddot{x} + a_2\dot{x} = l\dot{y} + lmy$$

$$\sigma = -c_1x - c_2\dot{x} - r\xi; \psi = x; \dot{\psi} = \frac{dx}{dt} \quad (34)$$

Here, in the constants that appear have been included mass moments, moments of inertia, gyroscopic moments $a_1, a_2, l, m > 0, a_1^2 > 4a_2$ and the characteristic parameters of regulator $c_1, c_2, r > 0, b_2 = l, b_3 = l(m - a_1)$. The right side of the equation is actually the expression of server represented by the nonlinear function $\varphi(\sigma)$. Will write the system (34) with (1)-(4) using the next notations: $x_1 = x = \psi$, $x_2 = \dot{x} = \dot{x}_1 = \dot{\psi}$, $x_3 = \dot{x}_2 - ly$, $y = \xi$, $\dot{y} = \dot{\xi} = \varphi(\sigma)$.

$$\dot{x} = Ax + By, \dot{y} = \dot{\xi} = \varphi(\sigma), \sigma = c'x - r\xi \quad (35)$$

The matrix from (35) are:

$$x = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}, A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -a_2 & -a_1 \end{pmatrix},$$

$$B = \begin{pmatrix} 0 \\ b_2 \\ b_3 \end{pmatrix}, C = \begin{pmatrix} -c_1 \\ -c_2 \\ 0 \end{pmatrix} \quad (35')$$

Using the linear transform:

$$u = AX + B\xi, \dot{\sigma} = C'x - r\xi, u = \begin{pmatrix} u_1 \\ u_2 \\ u_3 \end{pmatrix} \quad (36)$$

Obtain the simplify system, by derivation:

$$\dot{U} = AU + B\varphi(\sigma), \dot{\sigma} = C'U - r\varphi(\sigma) \quad (37)$$

The system (35) has the unique solution $(x = 0, \xi = 0)$ and (37) $(U = 0, \sigma = 0)$. The absolute stability will be realize compare with these null solutions. The characteristic polynomial $P(\lambda) = \det(A - \lambda E) = 0$, $\lambda(\lambda^2 + a_1\lambda + a_2) = 0$ with the notations: $a_1 = 2p, a_2 = q$ has the roots:

$$\lambda_1 = -p + \sqrt{p^2 - q}, \lambda_2 = -p - \sqrt{p^2 - q} \quad (38)$$
$$\lambda_1 < 0, \lambda_2 < 0, \lambda_3 = 0$$

After the diagonalization method (9) – (13), will transform the system (37) with $U = Tz$, $T(t_{ij}), i, j = 1,2,3$, determining the matrix T with (9) $AT = TJ, J = diagA$, obtaining :

$$T = \begin{pmatrix} \frac{1}{\lambda_1(\lambda_1 - \lambda_2)} & -\frac{1}{\lambda_2(\lambda_1 - \lambda_2)} & \frac{1}{\lambda_1\lambda_2} \\ \frac{1}{\lambda_1 - \lambda_2} & -\frac{1}{\lambda_1 - \lambda_2} & 0 \\ \frac{\lambda_1}{\lambda_1 - \lambda_2} & -\frac{\lambda_2}{\lambda_1 - \lambda_2} & 0 \end{pmatrix} \quad (39)$$

$$T^{-1} = \begin{pmatrix} 0 & -\lambda_2 & 1 \\ 0 & -\lambda_1 & 1 \\ \lambda_1\lambda_2 & -(\lambda_1 + \lambda_2) & 1 \end{pmatrix}, z = \begin{pmatrix} z_1 \\ z_2 \\ z_3 \end{pmatrix}$$

$$\dot{z} = Jz + T^{-1}B\varphi(\sigma), \dot{\sigma} = C'Tz - r\varphi(\sigma) \quad (40)$$

The system (40) is equivalent with (35) (36) and has the unique solution $(z = 0, \sigma = 0)$ and for this solution we study (a.r.a.s), determining the Liapunov function. To build the Liapunov function corresponding to the transformed system (40) $V = V(z, \varphi(\sigma))$, apply the calculus technique presented in (22) – (25) for the special case $\mathrm{Re}(\lambda_{1,2}) < 0, \lambda_3 = 0$ at (26), (27). The system (40) became:

$$\dot{z}_1 = \lambda_1 z_1 + b_1'\varphi(\sigma); \dot{z}_2 = \lambda_2 z_2 + b_1'\varphi(\sigma), \dot{z}_3 = b_3'\varphi(\sigma)$$
$$\dot{\sigma} = f_1 z_1 + f_2 z_2 + f_3 z_3 - r\varphi(\sigma) \quad (41)$$

$$b_1' = b_3 - \lambda_2 b_2, b_2' = b_3 - \lambda_1 b_2, b_3' = b_3 - (\lambda_1 + \lambda_2)b_2$$

$$f_1 = -\frac{c_1 + \lambda_1 c_2}{\lambda_1(\lambda_1 - \lambda_2)}, f_2 = \frac{c_1 + \lambda_2 c_2}{\lambda_2(\lambda_1 - \lambda_2)}, f_3 = -\frac{c_1}{\lambda_1\lambda_2}.$$

In this case we choose the Liapunov function conform with (22), (27)

$$V(z, \sigma) = \frac{1}{2}A_1 z_1^2 + \frac{1}{2}A_2 z_2^2 + \frac{1}{2}A\, z_3^2 + \int_0^\sigma \varphi(\sigma)d\sigma \quad (42)$$

where $A_1, A_2, A > 0$ are fixed, $V(z = 0, \sigma = 0) = 0$ and $V(z, \sigma)$ is positive defined. Compute the derivative $\dot{V}$ associated to the system (41)

$$\dot{V} = \sum_{j=1}^{2} A_j\lambda_j z_j^2 - r\varphi^2 + \sum_{j=1}^{2}(A_j\lambda_j b_j' + f_j)z_j\varphi + \quad (43)$$
$$+ (Ab_3' + f_3)z_3\varphi(\sigma)$$

We observe that taking $A_j = -\frac{1}{\lambda_j} > 0$ the negativity of this form is ensured from the first terms, forcing the cancellation of the last term: $Ab_3' + f_3 = 0$, that means:

$$A = -\frac{f_3}{b_3'} = \frac{c_1}{a_1(b_3 + a_1 b_2)} = \frac{c_1}{a_1 lm} > 0 .$$

From

$$\dot{V} = -(z_1^2 + z_2^2) - r\varphi^2 + \sum_{j=1}^{2} \varphi z_j \left(\frac{b_j'}{\lambda_j} - f_j \right) \qquad (44)$$

The quadratic form is positive defined for $(-\dot{V})$ in relation with z_1, z_2, φ, with the system (41) or (9). From the Silvester determinant is obtained the necessary and sufficient condition (41) for the rigidity coefficient.

$$r > \left(\frac{b_1'}{\lambda_1} - f_1 \right)^2 + \left(\frac{b_2'}{\lambda_2} - f_2 \right)^2 \qquad (45)$$

In this way the characteristic parameters of the regulator r, c_1, c_2 verify the condition (45), ensure the absolute stability of the horizontal fly course of the aircraft. It is observe that in conditions do not appear the function φ, so the nonlinear control function can be choose arbitrary from the admissible class (5), (6).

B. The frequency method for (a.r.a.s.). For this study will applied the frequency method used in §3. because the system (35) is equivalent with (37) and (41), the function $u = -\varphi(\sigma)$ verify the sector condition. By replacing the operator $\frac{d}{dt}$ with the factors is found the transfer function $W(s)$. For simplicity we choose the system (37) with (35), we deduce the transfer function $W(s)$ that is the same for (35) and (41). Applying the Laplace operator in (37) we have:

$$U_1 s = U_2, U_2 s = U_3 + b_2\varphi, U_3 s = -a_2 U_2 - a_1 U_3 + b_3\varphi$$
$$\sigma s = -c_1 U_1 - c_2 U_2 - r\varphi \qquad (46)$$

Eliminating from these relations U_1, U_2, U_3 it is found the connection $\sigma = W(s)(-\varphi)$:

$$W(s) = \frac{1}{s^2}\left(rs + \frac{[b_2(s + a_1) + b_3](c_2 s + c_1)}{s^2 + a_1 s + a_2} \right) \qquad (47)$$

We observe that $W(s)$ has a double pole in $s_0 = 0$ and $s_1 = \lambda_1 < 0, s_2 = \lambda_2 < 0$, being in the special case of the frequency method, Criterion3 (a.r.a.s) from §3. next, we verify the conditions from Criterion3.

$$\rho = \lim_{s\to 0} s^2 W(s) = \frac{lmc_1}{a_2} > 0, b_2 = l > 0,$$
$$b_3 = l(m - a_1) > 0, a_1 > 0, a_2 > 0, c_1 > 0 \qquad (48)$$

$$\mu = \lim_{s\to 0} \frac{d}{ds}(s^2 W(s)) = r +$$
$$+ \frac{l}{a_2^2}\left[c_1(a_1^2 + a_2) - m(a_1 c_1 - a_2 c_2) \right] > 0 \qquad (49)$$

From (49) we obtain conditions for r, m, c_2

$$r > \frac{l}{a_2^2}\left[m(a_1 c_1 - a_2 c_2) - c_1(a_1^2 + a_2) \right] > 0$$
$$m > \frac{c_1(a_1^2 + a_2)}{a_1 c_1 - a_2 c_2} > 0, \frac{a_1 c_1}{a_2} > c_2 > 0 \qquad (50)$$

$$\pi(\omega) = \omega \operatorname{Im} W(j\omega) =$$
$$- r - l\frac{\omega^2[a_1 c_2 - (c_1 + mc_2)] + [a_2(c_1 + mc_2) - a_1 c_1(m - a_1)]}{(a_2 - \omega^2)^2 + a_1^2\omega^2} =$$
$$= -r + g(\omega) \qquad (51)$$

$$\lim_{\omega\to\infty} \pi(\omega) = -r < 0, \lim_{\omega\to 0} \pi(\omega) = -r + g(0) < 0 \qquad (52)$$

From (52) we observe that $r > g(0)$ is from (50) condition. For the rigidity coefficient r we obtain the equivalence with (45). It is observe that by this qualitative criterion are necessary and numerical data in the space of parameters for regulator.

The condition $\pi(\omega) = -r + g(\omega) < 0, \forall \omega \geq 0$ because $g(0) > 0$ is the right member from (50), $g(\omega)$ is derivable,

$g'(\omega) < 0$, $\lim_{\omega \to \infty} g(\omega) = 0$ ($g = g(\omega)$ is an even function on $(-\infty, \infty)$ with $g(0)$ maximal.

5. CONCLUSIONS

The importance of this paper is evident in the fact that the problem of absolute stability is systematized by the two methods. It is remark that fact that the application regarding (a.r.a.s.) for the horizontal fly course with automatic pilot is studied for the critical difficult cases, when the roots of characteristic polynomial or the pole of transfer function is in origin (on the imaginary axis). For the Liapunov function building we applied an original method. For another studies are recommend the published results of the researchers [1,15,19,20,11].

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INTEGRATING QUANTUM TECHNIQUES INTO SECURE SOCKET LAYER PROTOCOL

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Abstract: *The Secure Sockets Layer protocol is a protocol layer which may be placed between a reliable connection-oriented network layer protocol and the application protocol layer. Secure Sockets Layer provides for secure communication between client and server by allowing mutual authentication, the use of digital signatures for integrity, and encryption for privacy.*
The protocol is designed to support a range of choices for specific algorithms used for cryptography, digests, and signatures. This allows algorithm selection for specific servers to be made based on legal, export or other concerns, and also enables the protocol to take advantage of new algorithms.
This work proposes the replacement of classical techniques of client-server authentication by a quantum one, which is not vulnerable to the cybernetic attacks, and which solves the problem of Secure Sockets Layer protocol security.

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1. INTRODUCTION

In the last years, the Internet is more and ore used in business activities. As it is commonly known, both the users' authentication and the access authorization are realized based on username and password. However, there are two weak points concerning the security:

- The data transmitted between the web server and the client's browser are not protected at interception, and it is possible for a person to be able to intercept confidential information, as the passwords or the data about credit cards, bank accounts etc., which circulate between the client's browser and the web server;

- While the web server presents a reasonable security level reported to the client user, the client has no possibility to establish if the web server is the correct one.

The Secure Sockets Layer (SSL) protocol has the intention to assure a private communication channel between the web server and the client's browser, and in the same time to assure the clients that the server to which they are connected is the real one. For this it is used the SSL certificate, which is a digitally signed certificate.

The Secure Socket Layer protocol is a client/server protocol that provides the following basic security services to the communicating peers:

- Confidentiality - by the use of an encrypting algorithm;
- Authentication - by the use of digital certificates;
- The control of the integrity (without recovery) - by the use of some algorithms for the integrity of the messages.

Secure Socket Layer works by combining public key cryptography and secret key encryption to ensure data confidentiality. In the classical version, the Rivest-Shamir-Adleman public key algorithm is used to generate the certificates and the public and private key used pairs utilized in Secure Socket Layer. When a client connects to a server that is configured for Secure Socket Layer, a Secure Socket Layer handshake process is initiated with the server. The server at this stage has already obtained a server certificate from a Certificate Authority (CA). A Certificate Authority (CA) can be defined as an entity that generates and validates digital certificates. The Certificate Authority adds its own signature to the public key of the client. This essentially indicates that the public key can be considered valid, by those parties that trust the Certificate Authority.

This work proposes the replacement of the existent Secure Socket Layer handshake protocol techniques with quantum versions. The quantum versions proposed substitute the authentication procedure, as well as the method of secret key distribution. The quantum versions use tri-dimensional quantum systems - qutrits, which are not vulnerable to the cybernetic attacks, assure the correct authentication, and determine giving up the long row of authentication certifications used in the classical case for removing any suspicions.

2. AN OVERVIEW OF THE SECURE SOCKET LAYER - HANDSHAKE

The Secure Socket Layer protocol itself is made up from two sub protocols: the Secure Socket Layer - Record protocol defines the method employed to transmit data and the Secure Socket Layer - Handshake protocol uses the record protocol to perform a two-way handshake. The Secure Socket Layer - Handshake Protocol is layered on top of the Secure Socket Layer - Record Protocol. It allows a client and server to authenticate each other and to negotiate items like cipher suites and compression methods.

Each time a Secure Socket Layer session is initiated an exchange of messages, known as the handshake, must be performed. This handshake allows the server to authenticate itself to the client and optionally allows the client to authenticate itself to the server.

In the classical case, after authentication the client and server cooperate to generate symmetrical session keys which will be used for encryption/decryption and tamper detection throughout the session. The handshake may also be initiated at any time during a given session to re authenticate the two hosts and generate new cryptographic settings. The handshake uses public key encryption to communicate securely.

The most important part of the handshake is the authentication of the server. If this is corrupt all further generation of session keys will be corrupt and the entire Secure Socket Layer session will be insecure. The server is authenticated via a digital certificate which it sends to the client and the clients will proceed then to validate the identity of the host that the certificate claims to represent. A digital certificate contains information such as the certificate version, serial number, signature, issuer, and validity period, among other information.

3. QUANTUM VERSION OF THE SECURE SOCKET LAYER - HANDSHAKE

The Secure Socket Layer - handshake process occurs between a client and a server to negotiate the secret key encryption algorithm which the client and the server will utilize to encrypt the data which is transmitted in the Secure Socket Layer session. The most important part of the Secure Socket Layer - handshake is the authentication of the server. If this is corrupt all further generation of session keys will be corrupt and the entire Secure Socket Layer session will be insecure.

The server is authenticated via a digital certificate that it sends the client and the clients will proceed then to validate the identity of the host that the certificate claims to represent. A digital certificate contains information such as the certificate version, serial number, signature, issuer, and validity period, among other information.

The procedure of generation of a quantum certificate by the provider of certificates is based on the method of encoding the state of two non-entangled qubits in a qutrit introduced by Grudka and Wójcik [3]. We start from the idea that the information contained by the digital certificate (the owner's public key; the owner's Distinguished Name; the Distinguished Name of the Certificate Authority (CA) that is issuing the certificate; the date from which the certificate is valid; the expiry date of the certificate; a version number; a serial number) are encoded in elementary units of the quantum information, i.e. qubits. The encoding of two non-entangled qubits in a qutrit is presented as follows.

Suppose there are two qubits with the states:

$$|\Psi\rangle_1 = a_1|0\rangle_1 + b_1|1\rangle_1$$
$$|\Psi\rangle_2 = a_2|0\rangle_2 + b_2|1\rangle_2 \qquad (1)$$

The total state of these two qubits is:

$$|\Psi\rangle = |\Psi\rangle_1|\Psi\rangle_2 = (a_1|0\rangle_1 + b_1|1\rangle_1)$$
$$(a_2|0\rangle_2 + b_2|1\rangle_2) = a_1a_2|0\rangle_1|0\rangle_2 + \qquad (2)$$
$$+ a_1b_2|0\rangle_1|1\rangle_2 + b_1a_2|1\rangle_1|0\rangle_2 + b_1b_2|1\rangle_1|1\rangle_2$$

The encoding operation then consists of the following mapping:

$$|0\rangle = |0\rangle_1|0\rangle_2;\ |1\rangle = |0\rangle_1|1\rangle_2;\ |2\rangle = |1\rangle_1|1\rangle_2$$

The state $|1\rangle_1|0\rangle_2$ is filtered out in the mapping which is necessary in order to accommodate the two qubits into a single qutrit.

The normalized state of a qutrit [5] after encoding is written as state (3):

$$|\Psi\rangle = \frac{1}{\sqrt{1-|b_1|^2|a_2|^2}}\left(a_1a_2|0\rangle + a_1b_2|1\rangle + b_1b_2|2\rangle\right)$$

In the process of generation of a quantum certificate we will use both the qubits belonging to the server, and the qubits belonging to the client, who will be encoded two by two (a server-qubit and a client-qubit) in qutrits which will realize the certificate.

The certificate thus obtained could be used both for the authentication of the server to the client, and for the client's authentication, without the need of further exchange of certificates.

A Secure Socket Layer session always begins with an exchange of messages called the Secure Socket Layer - handshake. The handshake allows the server to authenticate itself to the client using quantum techniques.

The steps which need to be followed in *the client-server authentication* in the quantum version included in the Secure Socket Layer handshake protocol can be resumed as follows:

1. The owner of a site who wishes to use the Secure Socket Layer protocol sends an application for a certificate to a certificate provider.

2. The certificate provider works together with a Certificate Authority to whom he sends the application received from the client. After checking if the certificate application is available and if it comes from the source which he pretends he is representing, he creates a certificate which he then encodes with his private key. It is as though he "signed" the certificate. This signature consists of a row of qutrits placed at the beginning of the row of qutrits composing the certificate.

The certificate is then sent to the site owner who asked for it.

One thing should be mentioned here, which is the fact that each of the qutrits of the "signature" are obtained through encoding the state of two non-entangled qubits, one qubit of every qutrit contributing to the construction of the public key, and the other qubit which was left - to the construction of the private key. In the case when the belonging of the certificate is contested, or when an intruder interposes between the applicant and the authority and tries the interception, the extraction, and the substitution of the "signature", the Certificate Authority can use the qubits of the private key to reconstruct the qutrits of the "signature" demonstrating the validity of the certificate.

The certificate contains qutrits with the state obtained through the encoding of the states of two non-entangled qubits, one belonging to the server (used in the procedure of server-client authentication), the other belonging to the client (used in the procedure of client - server authentication). Using such certificates, the client-server authentication can be realized for both parties without the need of further exchange of certificates.

3. After the server receives the digital certificate from the Certificate Authority (CA), from now on, every time a client browser compatible with Secure Socket Layer is connected to the server, this certificate will be send to the client browser.

In addition, the client receives information related to the bi-dimensional subspace (base vectors) necessary for decoding the qutrits of the certificate, and for the extraction of the qubits that are checking the authenticity of the server.

Similarly, for the client's authentication, the server will receive information related to the bi-dimensional subspace (base vectors) which must be used in the decoding of the qutrits of the certificate, and in the extraction of the client's qubits.

This exchange of information between the two parties is realized after the authenticity of the certificate was checked.

4. The client browser, who trusts the Certificate Authority (CA) emitting the certificate, validates the certificate with the public key of the Certificate Authority. The public key contains information related to the bi-dimensional subspace (base vectors) necessary in the procedure of decoding the qutrits from the "signature" of the Certificate Authority. If the qubits of the "signature" applied by the Certificate Authority were obtained, then the validity of the certificate is certified.

After the client assured himself of the validity of the certificate, we will continue with the procedure of client-server authentication.

The authentication mechanism is based on the study realized by Bartuśková et all [1] according to which from a qutrit with the state (3) one qubit can be perfectly extracted. For the successive extraction of the two qubits it is necessary to project the qutrit on bi-dimensional subspaces, where the projections obtained are:

$$P_{1+} = |1\rangle\langle 1| + |2\rangle\langle 2|; \quad P_{1-} = |0\rangle\langle 0|; \qquad (4)$$

$$P_{2+} = |0\rangle\langle 0| + |1\rangle\langle 1|; \quad P_{2-} = |2\rangle\langle 2|$$

As a result, each of the parties will use the information related to the bi-dimensional subspaces (base vectors) where the qutrits of the certificate must be projected, consequently realizing the client-server authentication.

After finishing the authentication process, the parties will continue with the generation of encrypting keys. For this they will use the H. Bechmann-Pasquinucci and A. Peres protocol [2] which generates a symmetrical key which will be used afterwards in the encryption/decryption of the information exchanged between client and server.

The H. Bechmann-Pasquinucci and A. Peres protocol [2] extended the distribution protocol of the quantum key for systems with three states, the so called qutrits. For the preparation of the states of the qutrits which will be sent to the client, the server chooses between any base vectors $|l\rangle$ and $|m\rangle$ belonging to different bases satisfying the condition: $|\langle l|m\rangle|^2 = 1/3$. As a result, the server will use some bases called mutually unbiased bases [4][6]. Suppose the first base chosen arbitrarily is: $\{|\alpha\rangle, |\beta\rangle, |\gamma\rangle\}$. The other

bases are obtained by the application of the discrete Fourier transformations.

The first base:

$$\begin{cases} |\alpha'\rangle = (|\alpha\rangle + |\beta\rangle + |\gamma\rangle)/\sqrt{3} \\ |\beta'\rangle = (|\alpha\rangle + e^{2\pi i/3}|\beta\rangle + e^{4\pi i/3}|\gamma\rangle)/\sqrt{3} \\ |\gamma'\rangle = (|\alpha\rangle + e^{4\pi i/3}|\beta\rangle + e^{2\pi i/3}|\gamma\rangle)/\sqrt{3} \end{cases} \quad (5)$$

The second base is obtained through cyclical permutations:

$$\begin{cases} |\alpha''\rangle = (e^{2\pi i/3}|\alpha\rangle + |\beta\rangle + |\gamma\rangle)/\sqrt{3} \\ |\beta''\rangle = (|\alpha\rangle + e^{2\pi i/3}|\beta\rangle + |\gamma\rangle)/\sqrt{3} \\ |\gamma''\rangle = (|\alpha\rangle + |\beta\rangle + e^{2\pi i/3}|\gamma\rangle)/\sqrt{3} \end{cases} \quad (6)$$

The third base is obtained through cyclical permutations:

$$\begin{cases} |\alpha'''\rangle = (e^{4\pi i/3}|\alpha\rangle + |\beta\rangle + |\gamma\rangle)/\sqrt{3} \\ |\beta'''\rangle = (|\alpha\rangle + e^{4\pi i/3}|\beta\rangle + |\gamma\rangle)/\sqrt{3} \\ |\gamma'''\rangle = (|\alpha\rangle + e^{4\pi i/3}|\beta\rangle + e^{4\pi i/3}|\gamma\rangle)/\sqrt{3} \end{cases} \quad (7)$$

The server randomly chooses one of the 12 states and sends it to the client. He randomly chooses one of the four bases and measures the state, then announces publicly what base he used, without telling the result he obtained. The server checks if the choice is correct. If it is, then both are in the possession of the same bits of information; if not, they give it up.

The procedure is repeated until the server and the client obtain a sufficiently big number of bits, the following steps being to correct the errors and to remove any residual information which an intruder could have introduced.

At this moment, both parties are in the possession of a symmetrical key, the Secure Socket Layer - handshake protocol ends, thus assuring a secure connection between a client and a server through which any quantity of data could be sent securely.

3. CONCLUSIONS

The use the method of the encoding the state of two non-entangled qubits in a qutrit method in the authentication procedure determines giving up the long row of authentication certifications used in the classical case in order to remove the suspicions existent before starting the communication process. The main purpose of the protocol based on encoding the state of two non-entangled qubits in a qutrit is the fact that it offers a different conceptual way to solve some of the problems related to client-server authentication. The integration of quantum techniques bring an advantage in what concerns the security of the method, the no-cloning theorem, and the principle of irreversibility of quantum systems measurement, guaranteeing for it. The advantages consist in the improvement of the efficiency of the classical protocols, the detection of the intruders implying the comparison of a smaller number of bits as compared to the high probability that the intruder modifies the result expected by the parties involved in communication.

4. ACKNOWLEDGMENT

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NUMERICAL APPROXIMATION OF DIRICHLET PROBLEM IN BOUNDED DOMAINS AND APPLICATIONS

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Abstract: *We consider numerical approximation of Dirichlet problem for the Laplace equation in a domain* $D \in R^d$, *that is we will consider the problem of finding a* C^2 *function* $u = u(z) \in C^2(D) \cap C^0(\overline{D})$ *such that* $\begin{cases} \Delta u = 0, in D \\ u = f, on \partial D \end{cases}$. *Using probabilistic methods we can give explicit reprezentation of solution of Dirichlet problem* $u(z) = E^z f(B_{\tau_D})$, *where* B_t *is a Brownian motion starting at* $B_0 = z$, E^z *denotes the expectation of function in* B_{τ_D}, *and* $\tau_D = \inf\{t \geq 0, B_t \notin D\}$ *is the exit time of Brownian motion from D. We give a Mathematical implementation of function* $u(z)$ *for different choices of* f *and domain D (half-plane, unit disc, rectangle, triangle) and we apply it to obtain some numerical results.*

Mathematics Subject Classifications 2011: *60J65, 35J05, 65C30, 68U20.*
Keywords: *Brownian motion, Dirichlet problem, Laplace equation, stochastic differential equations, simulation.*

1. INTRODUCTION

The Dirichlet Problem is named after German mathematician Gustav Lejeune Dirichlet (1805- 1859) (see [3]).

The Dirichlet problem for harmonic functions always has a solution, and that solution is unique, when the boundary is sufficiently smooth and *f* is continuous.

The goal of the present paper is to present some applications of Brownian motion in solving classical differential equations: the Dirichlet problem.

Brownian motion, named after the Scottish botanist Robert Brown in 1828, is the unique process with the following proprieties:

a) No memory, which means that $B_{t_1} - B_{t_0}, B_{t_2} - B_{t_1}, B_{t_3} - B_{t_2}, \ldots$ are independent;
b) Invariance, which means that the distribution of $B_{s+t} - B_s$ depends only on t;
c) Continuity which means that $t \to B_t$ is continuous a.s. and $t \to B_t$ is nowhere differentiable a.s.
d) $B_0 = 0$, with mean $E(B_t) = 0$ and variance $Var(B_t) = t^2$.

Definition. A *d*-dimenional Brownian motion starting at $x \in R^d$ is a stochastic process B_t with the following proprieties:

a) $B_0 = 0$;

b) For all $0 \le s < t$, $B_t - B_s$ is a normal random variable $N(0, t-s)$;

c) B_t is almost surly continuous.

2. THE DIRICHLET PROBLEM

2.1 The Dirichlet Problem. We will consider the well-known Dirichlet Problem for a domain $D \subset R^d$, this is we will consider the problem of finding a harmonic function in a given domain D, continuous on $\overline{D}$, with fixed boundary values on ∂D, satisfying the following initial value problem: find $u \in C^2(D) \cap C^0(\overline{D})$ which solves

$$\begin{cases} \Delta u = 0 \text{ in D} \\ \mathrm{u}|_{\partial D}(x,y) = f(x,y), \forall \mathrm{z} = \mathrm{x} + \mathrm{iy} \in \partial \mathrm{D} \end{cases} \quad (1)$$

where Δ denote the Laplacian operator, namely the differential operator in the variable $x = (x_1, x_2, ..., x_n \in R^d)$

$$\Delta_x = \sum_{j=1}^{d} \left(\frac{\partial}{\partial x_j} \right)^2$$

and f is a given function, continuous on boundary of the domain D.

In general, the solution of the above boundary value problem may not exist. However the existence of the solution is closely related to the regularity of the boundary of the domain D.

Definition. A point $x \in R^d$ is called regular for the set $A \subset R^d$ if a Brownian motion starting at x enters the set A immediately, that is

$$P^x(T_A = 0) = 1,$$

where $T_A = \inf\{t > 0 : B_t \in A\}$ is the hitting time of the set A by a d-dimensional Brownian motion B_t starting at x.

Example. a) The point $z_0 = 0$ is regular for the ball $B(1,1)$, but is not regular for $B(0,1) \setminus \{0\}$.

b) In the case of unit disk $U = \{x \in R^2 : |x| < 1\}$, all points on the unit circle $\partial U = \{x \in R^2 : |x| = 1\}$ are regular for U^c.

Under minimal regularity conditions on D and f, the main result is the following:

Theorem. Let $D \subset R^d$ be a bounded domain for which every point of ∂D is regular for D^c. If $f : \partial D \to R$ is a continuous function, then there exists a unique solution of the Dirichlet problem (1), explicitly given by

$$u(x) = E^x f(B_{\tau_D}), \quad (2)$$

where

- B_t is a d-dimensional Brownian motion starting at $x \in \overline{D}$;
- $\tau_D = \inf\{t > 0 : B_t \notin D\}$ is the lifetime of the Brownian motion B_t, killed on exiting D;
- E^x denotes the expectation of function f in the exit point B_{τ_D} of the Brownian motion B_t from domain D.

Proof. See [4, p. 111-113].

Example. Consider the domain $D = B(0,r)$ and the function $f(x,y) = x^2 - y^2$. Then the probabilistic solution is the following:

$$u(x) = E^x f(B_{\tau_{B(0,r)}}),$$

and $u(0) = E^0 f(B_{\tau_D}) = \frac{1}{2\pi \mathrm{r}} \int_{\partial \mathrm{B}(0,\mathrm{r})} f(y) dy$.

For $\partial B(0,r)$ we have $z = re^{it}$ and $dy = rdt$.

$$\Rightarrow u(0) = \frac{1}{2\pi \mathrm{r}} \int_0^{2\pi} f(r\cos t, r\sin t) r dt$$

$$= \frac{1}{2\pi} \int_0^{2\pi} (r\cos t)^2 - (r\sin t)^2 dt$$

$$= \frac{1}{2\pi} \int_0^{2\pi} r^2 (\cos^2 t - \sin^2 t) dt$$

$$= \frac{r^2}{2\pi} \int_0^{2\pi} (\cos 2t) dt$$

$$= \frac{r^2}{2\pi\, \mathrm{r}} \left(\frac{\sin 2t}{2} \right) \Bigg|_0^{2\pi} = 0 .$$

2.2 A numerical algorithm. We will consider D to be the closed triangular domain with vertices (-a, 0), (b, 0) and (0, c). We will try to elaborate an algorithm for discretizing the killed Brownian motion in a simply bounded domain, using some recent results (see [1]) and [2]).

First, if $\left(X^k_{2^{-2k} n} \right)_{n \in N}$ is a simple random walk on the lattice $D \cap 2^{-k} Z^2 = D_k$ which jumps to one of its nearest neighbors every 2^{-2k} units of time, we obtain that $X_t^k \xrightarrow[k \to \infty]{} B_t$, $t \geq 0$, for a chosen level of discretisation $k \in N$.

We consider $n = [t 2^{2k}]$ and $X_0 = 0$.

The numerical approximation of the value $f(B_t)$, where B_t is a killed Brownian motion in D starting at the point $x = (x_1, x2) \in D$, is given by

$$f(B_t) \approx f(X_t).$$

Then the numerical approximation of expected value $E^x f(B_t)$ is given by

$$E^x f(B_t) = \frac{f\left(X_t^1\right) + \ldots + f\left(X_t^N\right)}{N}.$$

2.3 Using Mathematica softwere. Using Mathematica (see [5]) source presented below, we obtain the approximating domain D_1 in the Fig. 1 below, in the case of a triangle with vertices at (-4, 0), (2, 0) and (0, 6) (See article).

For an arbitrarily fixed $k \in N^*$, note that $\left(\frac{i}{2^k}, \frac{j}{2^k} \right) \in D_k$ if and only if $i, j \geq 0$ and

$$\begin{cases} -\frac{i}{a2^k} + \frac{j}{c2^k} - 1 \leq 0 \\ \frac{i}{b2^k} + \frac{j}{c2^k} - 1 \leq 0 \end{cases}$$

Which shows that D_k can be written as follows

$$D_k = \bigcup_{j=0}^{[c2^k]} \left\{ \left(\frac{i}{2^k}, \frac{j}{2^k} \right) : -\left[\frac{a}{c} \left(c2^k - j \right) \right] \leq i \leq \left[\frac{b}{c} \left(c2^k - j \right) \right] \right\}$$

```
a=4; b=2; c=6; k=3;
abc={{b,0},{0,c},{-a,0},{b,0}};
triangle={Thickness[.01],RGBColor[1,0,0],Li
ne[abc]};
incr=(1/2^k);
x=Table[i*incr,{i,-IntegerPart[a*2^k],
IntegerPart[b*2^k]}];
y=Table[j*incr,{j,0,IntegerPart[c*2^k]}];
imin=Table[-IntegerPart[a*2^k-a*j/c],
{j,0,IntegerPart[c*2^k]}];
imax=Table[IntegerPart[b*2^k-b*j/c],
{j,0,IntegerPart[c*2^k]}];
points=Table[Disk[{x[[i+1]],y[[j+1]]},0.05],{j
,0,IntegerPart[c*2^k]},{i,imin[[j+1]]+IntegerP
art[a*2^k],imax[[j+1]]+IntegerPart[a*2^k]}];
Graphics[{RGBColor[0,0,1],GraphicsGroup[{
triangle,points}]},GridLines→Automatic,
Axes→Automatic,AspectRatio→Automatic,
PlotRange→{{-a-1,b+1},{-1,c+1}}]
Neighbour:=Function[{i,j},nbs={};
If[i+1≤imax[[j+1]],
nbs=Append[nbs,{i+1,j}]];
If[imin[[j+1]]≤i-1,nbs=Append[nbs,{i-1,j}]];
```

If[(j<IntegerPart[c*2^k]) && (imin[[j+2]] ≤i) &&(i≤imax[[j+2]]),bs=Append[nbs,{i,j+1}]];
If[(j>0) && (imin[[j]] ≤i) && (i≤ imax[[j]]), nbs=Append[nbs,{i,j-1}]];
nbs[[RandomInteger[{1,Length[nbs]}]]];

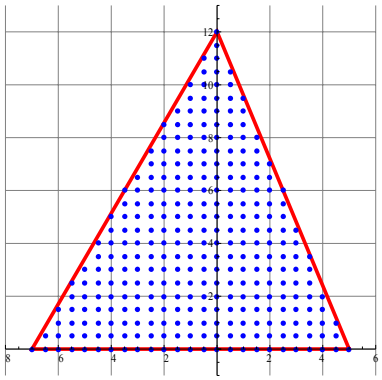

Fig. 1. The approximating domain D_1

Increasing the discretization level to k=4, we obtain more points-neighbors, as in Fig. 2 below.

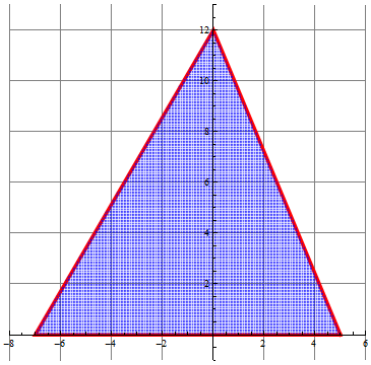

Fig. 2. The approximating domain D_4

For a given function f we will obtain a numerical approximation of the expected value $E^x f(B_t)$ with respect to a Brownian motion in a triangle starting at x of the value of the function f at the point B_t, value that correspondes to the solution of the Dirichlet Problem $u(x) = E^x f(B_{\tau_D})$, in the given triangular region.

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ANALYSIS OF MONTE CARLO SIMULATIONS BASED ON DIFFERENT DISCRETIZATION SCHEMAS OF CONTINOUS STOCHASTIC MODELS FROM FINANCE

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Abstract: *In this paper we will compute with Monte Carlo simulations some derivative values at maturity time in some stochastic models with different discretization schemas (like Euler-Mayurana, Millstein, Runge-Kutta, generic Duffy) and compare results and computing efforts.*

Mathematics Subject Classifications 2010: *65C05, 91G20, 91G60.*
Keywords: *Monte Carlo, financial derivatives, discretization schemas.*

1. BLACK-SCHOLES-MERTON MODEL AND BLACK-SCHOLES PDE

One of popular stochastic equation that models a traded asset (like a stock) is the *Black-Scholes-Merton model* based on *geometric brownian motion* (see [1]):

$$dS(t)=S(t)[\mu dt+\sigma dW(t)] \quad (1)$$

where (S(t), t≥0) is the stochastic process for asset value at timestamp t, (W(t), t≥0) is a *Wiener standard process* (see [2]), μ is the *drift rate of return* and σ is *volatility*.

A derivative based on this asset is an other traded asset that fructify at *maturity time* T, payoff depend on value of support, S(T). *payoff* function is defined as:

$$payoff:R_+\rightarrow R \quad (2)$$

Main problem is pricing of a financial derivative. For this, we build an risk-free portofolio based on some supports and some derivatives. After applying of Ito lemma (see [3]) we obtain Black-Scholes PDE (see [4]):

$$V_t+\tfrac{1}{2}\sigma^2S^2V_{SS}+rSV_S-rV = 0 \quad (3)$$

for pricing derivatives, where:

$$V:R_+x[0,T]\rightarrow R_+ \quad (4)$$

and V(S,t) is value of derivatives at timestamp t if support is valued as S.

Note that for a generalized brownian motion:

$$dS(t)=A(S(t),t)dt+B(S(t),t)dW(t) \quad (5)$$

where A(S,t) and B(S,t) are some algebraic expression, we can build a generalized form of Black-Scholes PDE (see [5]):

$V_t+½B^2V_{SS}+rSV_S–rV = 0$ (6)

Black-Scholes PDE and generalized Black-Scholes PDE can be linked with Dirichlet condition:

$V(0,t)=0$ (7)

$V(S,T)=payoff(S)$ (8)

that means for 0 value of support, derivatives is valued to 0 too, and value at maturity is payoff function.

2. OTHER MODELS

We give some usual stochastic models in table 1 (see [5]):

Name	**Equations**
Bachelier (see [12])	$dS = adt+bdW$
Black-Scholes-Merton	$dS/S = adt+bdW$
CEV (see [13])	$dS = aSdt+bS^{\beta}dW$
Chen (see [11])	$dS = (\theta(t)–\alpha(t))dt+S^{½}\sigma(t)dW$ $d\alpha = (\zeta(t)–\alpha(t))dt+\alpha(t)^{½}\sigma(t)dW$ $d\sigma = (\beta(t)–\sigma(t))dt+\sigma(t)^{½}\eta(t)dW$
Dias-Rocha (see [6], p. 68)	$dS/S = [k_1(\mu–S)–\lambda k_2]dt+\sigma dW(t)+dq$ $Prob(dq = 0) = 1–\lambda dt$ $Prob(dq = \varphi) = \lambda dt$
Double-Heston (see [7], [8])	$dS = \mu Sdt +v_1^{½}SdW_{11}(t)+v_2^{½}SdW_{12}(t)$ $dv_1 = k_1(\theta_1–v_1)dt+ \xi_1v_1^{½}dW_1(t)$ $dv_2 = k_2(\theta_2–v_2)dt+ \xi_2v_2^{½}dW_2(t)$ $dW_1dW_{12} = r_1dt$ $dW_2dW_{22} = r_2dt$
Heston (see [9])	$dS = \mu Sdt+v^{½}SdW_1(t)$ $dv = k(\theta–v)dt+\xi v^{½}dW_2(t)$ $dW_1dW_2 = dt$
Marlim (see [6], p. 68)	$dS = k(\mu–S)dt+\sigma dW(t)+dq$ $Prob(dq = 0) = 1–\lambda dt$ $Prob(dq = \varphi) = \lambda dt$
Merton (diffusion+jumps, see [10], p. 585)	$dS/S = (a–\lambda b)dt+\sigma dW(t)+dq$ $Prob(dq = 0) = 1–\lambda dt$ $Prob(dq = \varphi) = \lambda dt$
SABR (see [14])	$dS = vS^{\beta}dW_1(t)$ $dv = \alpha vdW_2(t)$ $dW_1dW_2 = rdt$
Vasicek	$dS = a(b–S)dt+cdW(t)$

Table 1. Some usual stochastic models.

3. DISCRETIZATION SCHEMAS

For a stochastic process $X(t)_{t\geq 0}$ with next SDE:

$dX(t)=A(X(t),t)dt+B(X(t),t)dW(t)$ (9)

where $W(t)_{t\geq 0}$ is a standard Wiener process, than we can approximate process $X(t)_{t\geq 0}$ with a Markov chain $(Y_n)_{n\geq 0}$, where Y_n is $X(t_n)$. Some usual discretization methods can be found in table 2 (see [5]):

Method name	**Schema**
Explicit Euler-Maruyana (Euler)	$Y_{n+1} = Y_n+A(Y_n,t_n)\Delta+B(Y_n,t_n)N_n\sqrt{\Delta}$

Method name	**Schema**
method (see [15])	
Implicit Euler-Maruyana (Euler) method (see [15])	$Y_{n+1} = Y_n+A(Y_{n+1},t_n)\Delta+B(Y_n,t_n)N_n\sqrt{\Delta}$
θ-stochastic implict Euler-Maruyana method	$Y_{n+1} = Y_n+A(\theta_nY_{n+1}+(1-\theta_n)Y_n,t_n+\theta_n\Delta)\Delta+B(Y_n,t_n)N_n\sqrt{\Delta}$
Implicit median point method (see [15])	$Y_{n+1} = Y_n+A((Y_n+Y_{n+1})/2,(t_n+t_{n+1})/2)\Delta+B(Y_n,t_n)N_n\sqrt{\Delta}$
Implicit trapezoidal method (see [15])	$Y_{n+1} = Y_n+(A(Y_{n+1},t_{n+1})+A(Y_n,t_n))\Delta/2+B(Y_n,t_n)N_n\sqrt{\Delta}$
Millstein method (see [16])	$Y_{n+1} = Y_n+A(Y_n,t_n)\Delta+B(Y_n,t_n)\sqrt{\Delta}N_n$ $+½B(Y_n,t_n)B_X(Y_n,t_n)\Delta(N_n^2-1)$
A method like Runge-Kutta (see [16])	$Y_{n+1} = Y_n+A(Y_n,t_n)\Delta+B(Y_n,t_n)\sqrt{\Delta}N_n+½(B(Y_n+A(Y_n,t_n)\Delta$ $+B(Y_n,t_n)\sqrt{\Delta},t_n)-B(Y_n,t_n)\sqrt{\Delta}(N_n^2-1)$
Generic Duffy method (see [16])	$Y_{n+1} = Y_n+[\alpha C(Y_{n+1},t_{n+1})+(1-\alpha)C(Y_n,t_n)]\Delta$ $+[\eta B(Y_{n+1},t_{n+1})+(1-\eta)B(Y_n,t_n)]\sqrt{\Delta}N_n$ $C(Y,t) = A(Y,t)-\eta B(Y,t)B_X(Y,t)$
Extended Duffy method (see [16])	$Y_{n+1} = Y_n+[\alpha C(Y_{n+1},t_{n+1})+(1-\alpha)C(Y_n,t_n)]\Delta$ $+[\eta B(Y_{n+1},t_{n+1})+(1-\eta)B(Y_n,t_n)]\sqrt{\Delta}N_n$ $+[\xi A(Y_{n+1},t_{n+1})C(Y_{n+1},t_{n+1})+(1+\xi)A(Y_n,t_n)C(Y_n,t_n)]\Delta$ $C(Y,t) = A(Y,t)-\eta B(Y,t)B_X(Y,t)$

Table 2. Some usual discretization schema.

where:

- $\Delta= t_{n+1}-t_n$;
- N_n is ~N(0,1);
- θ_n is a stochastic value in (0,1);
- α is a parameter in (0,1);
- η is a parameter in (0,1);
- ξ is a parameter in (0,1);
- B_X is partial derivative of B on nontemporal dimension.

Note that for a static B (like volatility parameter in Bachelier model) we will have:

$$B_X=0 \qquad (10)$$

Note that for a static A (like drift parameter in Bachelier model) we will have an equivalence between all of explicit and implicit Euler-Maruyana schemas. If A and B are statically, Millstein schema is equivalent too.

If we have a stochastic model with multiple SDEs (like Chen, Heston, double-Heston etc), then we can build a multidimensional Markov Chain: for each SDE we can use any discretization schema like in previous paragraph.

4. NUMERICAL SIMULATIONS

For Bachelier and Black-Scholes-Merton model with:

a = 1
b = 4%
S0 = 9
Payoff(S)=max{0,S-10}
T = 1
Δ =0.01

with Monte Carlo simulation on N=10, 100 and 1000 simulation steps we obtain:

	Pricing value for Bachelier model	Pricing value for Black-Scholes-Merton model	Monte Carlo iterations
Explicit Euler-Maruyana (Euler)	0.00631039	14.1453	10
	0.019516	14.4509	100
	0.0221323	14.5943	1000
Millstein method	0.0287962	14.4454	10
	0.0253927	14.7503	100
	0.0219063	14.6148	1000
Generic Duffy method	0.0168662	13.7366	10
	0.0189815	14.2445	100
	0.0203399	14.2373	1000

Scilab (see [16]) program for this simulation is:

```
function
f=NextValue(CurrentValue,tip,a,b,delta)
    N=rand(0,'normal');
    radical=sqrt(delta);
    patrat=N*N;
    // tip>0 Bachelier
    // Explicit Euler-Maruyana (Euler)
    if tip==1 then
    f=CurrentValue+a*delta+b*N*radical;
    // Millstein method
    elseif tip==2 then
    f=CurrentValue+a*delta+b*radical*N;
    // A method like Runge-Kutta
    elseif tip==3 then
    f=CurrentValue+a*delta+b*radical*N+(b-
b*radical*(patrat-1))/2;
    // Generic Duffy method
    elseif tip==4 then
    f=CurrentValue+a*delta+b*radical*N;
    // tip<0 Black-Scholes-Merton
    // Explicit Euler-Maruyana (Euler)
    elseif tip==-1 then
    f=CurrentValue*(1+a*delta+b*N*radical);
    // Millstein method
    elseif tip==-2 then
    f=CurrentValue*(1+a*delta+b*radical*N+b*
delta*(patrat-1)/2);
    // A method like Runge-Kutta
    elseif tip==-3 then
    f=CurrentValue*(1+a*delta+b*radical*N+(b
*(1+a*delta+b*radical)-b*radical*(patrat-1)))/2;
    // Generic Duffy method Î±=Î·=1/2
    elseif tip==-4 then
    f=CurrentValue*(1+(a-
b/2)*delta/2+b*radical*N/2)/(-b*radical*N/2-(a-
b/2)*delta/2+1);
    end
    endfunction

    function
f=Path(FirstValue,Maturity,Exercise,tip,a,b,delta)
    x=FirstValue;
    for t=0:delta:Maturity,
x=NextValue(x,tip,a,b,delta); end;
    f=max(0,x-Exercise);
    endfunction

    function
f=CompleteSimulation(N,FirstValue,Maturity,Exer
cise,tip,a,b,delta)
    s=0;
    for i=1:N,
    s=s+Path(FirstValue,Maturity,Exercise,tip,a,b
,delta);
    end;
    f=s/N;
    endfunction

    S0=9;
    T=1;
    Ex=10;
    a=1;
    b=0.04;
    delta=0.01;
    for tip=1:4,
    printf("%d %g %g\n",tip, CompleteSimulation(
10, S0, T, Ex, tip, a, b ,
    delta), CompleteSimulation( 10, S0, T, Ex, -tip,
a, b , delta));
    printf("%d %g %g\n",tip, CompleteSimulation(
100, S0, T, Ex, tip, a, b ,
    delta), CompleteSimulation( 100, S0, T, Ex, -
tip, a, b , delta));
```

```
printf("%d %g %g\n",tip, CompleteSimulation(1000, S0, T, Ex, tip, a, b ,
delta), CompleteSimulation(1000, S0, T, Ex, -tip, a, b , delta));
end;
```

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PARALLELIZING BLACK-SCHOLES PDE SOLVING ON AN OPEN DOMAIN WITH SCHUR DECOMPOSITION METHOD

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Abstract: *In this paper we will provide some parallel algorithms for PRAM and BSP architectures for solving Black-Scholes PDE on an open domain (on support, non temporal dimension) and without frontier condition there. We suppose exist an PDE solver (like an implicit method based on algebraic system solver) for a rectangle with conditions only on two adiacent lines from border, after computation we will use computed value for an other rectangle with same PDE solver.*

Mathematics Subject Classifications 2010: *65C99, 65N06, 65Y05.*
Keywords: *parallelization, Black-Scholes PDE, Schur decomposition method.*

1. BLACK-SCHOLES-MERTON MODEL AND BLACK-SCHOLES PDE

One of popular stochastic equation that models a traded asset (like a stock) is the *Black-Scholes-Merton model* based on *geometric brownian motion* (see [1]):

$$dS(t)=S(t)[\mu dt+\sigma dW(t)] \quad (1)$$

where $(S(t), t\geq 0)$ is the stochastic process for asset value at timestamp t, $(W(t), t\geq 0)$ is a *Wiener standard process* (see [2]), μ is the *drift rate of return* and σ is *volatility*.

A derivative based on this asset is an other traded asset that fructify at *maturity time* T, payoff depend on value of support, S(T). *payoff* function is defined as:

$$payoff:R_+\rightarrow R \quad (2)$$

Main problem is pricing of a financial derivative. For this, we build an risk-free portofolio based on some supports and some derivatives. After applying of Ito lemma (see [3]) we obtain Black-Scholes PDE (see [4]):

$$V_t+\tfrac{1}{2}\sigma^2S^2V_{SS}+rSV_S-rV = 0 \quad (3)$$

for pricing derivatives, where:

$$V:R_+x[0,T]\rightarrow R_+ \quad (4)$$

and V(S,t) is value of derivatives at timestamp t if support is valued as S.

Note that for a generalized brownian motion:

$$dS(t)=A(S(t),t)dt+B(S(t),t)dW(t) \quad (5)$$

where A(S,t) and B(S,t) are some algebraic expression, we can build a generalized form of Black-Scholes PDE (see [5]):

$$V_t+\tfrac{1}{2}B^2V_{SS}+rSV_S-rV = 0 \qquad (6)$$

Black-Scholes PDE and generalized Black-Scholes PDE can be linked with Dirichlet condition:

$$V(0,t)=0 \qquad (7)$$
$$V(S,T)=payoff(S) \qquad (8)$$

that means for 0 value of support, derivatives is valued to 0 too, and value at maturity is payoff function.

2. SCHUR DECOMPOSITION METHOD FOR BLACK-SCHOLES PDE ON AN OPEN DOMAIN

Schur method (see [6]) is based on decomposition of an initial domain D of a Dirichlet problem Lu=0 in two or more problems Lu=0 defined on domains D_1, D_2, …, where union of domains cover D:

$$D\subseteq D_1 U D_2 U\ldots \qquad (9)$$

with Dirichlet conditions on some frontiers as subset of $\partial D_i \cap \partial D$

The main idea to solve generalized Black-Scholes PDE (6) is splitting domain D in rectangles ($D_{i,j}$, i=1,N, j≥1)

$$D_{i,j} = \{ (s, t) \mid t\in[(N+1-i)T/N, (N-i)T/N], s\in[(j-1)\Delta, j\Delta] \} \qquad (10)$$

like in figure 1:

9,5	9,4	9,3	9,2	9,1
8,5	8,4	8,3	8,2	8,1
7,5	7,4	7,3	7,2	7,1
6,5	5,4	6,3	6,2	6,1
5,5	5,4	5,3	5,2	5,1
4,5	4,4	4,3	4,2	4,1
3,5	3,4	3,3	3,2	3,1
2,5	2,4	2,3	2,2	2,1
1,5	1,4	1,3	1,2	1,1

Figure 1. Decompozition of D (partial) in $D_{i,j}$

and solving PDE successively on $D_{1,1}$, $D_{1,2}$, $D_{2,1}$, $D_{1,3}$, $D_{2,2}$, $D_{3,1}$, etc like in figure 2.

45 9,5	44 9,4	42 9,3	39 9,2	35 9,1
43 8,5	41 8,4	38 8,3	34 8,2	30 8,1
40 7,5	37 7,4	33 7,3	29 7,2	25 7,1
36 6,5	32 5,4	28 6,3	24 6,2	20 6,1
31 5,5	27 5,4	23 5,3	19 5,2	15 5,1
26 4,5	22 4,4	18 4,3	14 4,2	10 4,1
21 3,5	17 3,4	13 3,3	9 3,2	6 3,1
16 2,5	12 2,4	8 2,3	5 2,2	3 2,1
11 1,5	7 1,4	4 1,3	2 1,2	1 1,1

Figure 2. Succesion on solving PDE on $D_{i,j}$

If suppose that SOLVERECTANGLE(i,j) solve Black-Scholes PDE on $D_{i,j}$ with any method (like an implicit method) in Dirichlet conditions un right and bottom frontiers like in figure 3:

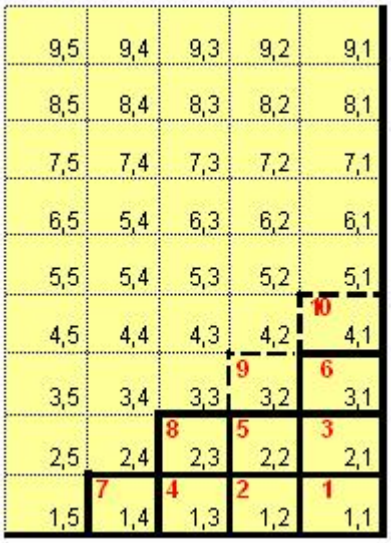

Figure 3. Right and bottom Dirichlet condition is precomputed on previous call of SOLVERECTANGLE(i,j)

Serial algorithm for this method is:

Algorithm SchurSerial
For K=2 to M+N
For I=max(1,K-N) To min(M,K-1)
SOLVERECTANGLE(I,K-I)
End For
End For
End Algorithm

3. PARALLELIZATION OF SCHUR METHOD FOR A PRAM ARCHITECTURE

A good idea for parallelization of previous algorithm on a PRAM architecture (see [7]) is parallel execution of internal FOR that means all $D_{i,j}$ on same diagonal (i+j invariant) can be processed in parallel. Parallel PRAM Algorithm is:

Algorithm SchurPRAM
For K=2 to M+N
// diagonal can be processed
// in parallel
Parallel For I=max(1,K-N) To min(M,K-1)
SOLVERECTANGLE(I,K-I)
End For
End For
End Algorithm

In figure 4 is shown with same colour parallel PRAM steps:

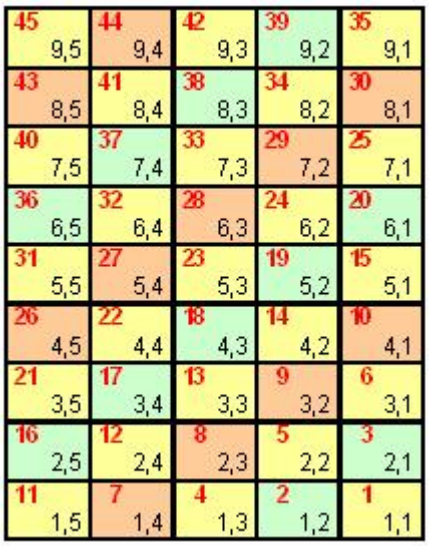

Figure 4. Coloured parallel PRAM steps

Main problem is when min(M,N) mod P is not null, that means some processors will be free at last part of parallel for execution. Is a good ideea to try min(M,N) as a multiply of P, because all calls of *SOLVERECTANGLE* are similar, because problems are similar on each subdomains.

4. PARALLELIZATION OF SCHUR METHOD FOR A BSP ARCHITECTURE

For a BSP architecture (see [8]) that has P=min(M,N) processors, that can process in parallel an entire diagonal of subdomains (i+j = K).

In figure 5, domains coloured with same colour will be processed as same processor:

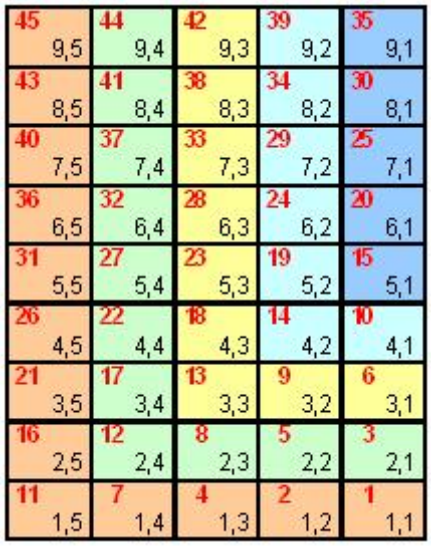

Figure 5. Coloured BSP processor assign

Parallel algorithm for BSP architecture is:

```
Algorithm SchurBSP
For K=2 to M+N
  Macrostep Start
  A= max(1,K-N)
  B= min(M,K-1)
  For I=A To B
    If ProcessorId = I-A+1 Then
      Call SOLVERECTANGLE(I,K-I)
    End If
    // sincronize border data with other
    // processors
    If K<min(M,N) then
      If ProcessorId < min(M,N) then
        SendBorderData(ProcessorId+1)
      End If
    Else
      If ProcessorId > 1 Then
        SendBorderData(ProcessorId-1)
      End If
    End If
  End For
  MacroStep Stop
End For
End Algorithm
```

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MATHEMATICAL ESTIMATION IN FINANCIAL ECONOMICS

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Abstract: *This paper is an application to the euro-leu evolution and a prediction for this evolution. We are testing if that euro-leu exchange rate fluctuations can be approximated by a normal distribution.*

2000MSC: 62?07, 62H12, 62Q05.
Keywords: *estimation theory, prediction interval, standard deviation, trust interval.*

1. Introduction

In this lecture we will derive the formulas for the symmetric two-sided prediction interval for the n + 1-st observation and the upper-tailed prediction interval for the n+1-st observation from a normal distribution when the variance S^2 is unknown. We will need the following theorem from probability theory that gives the distribution of the statistic $X - X_n + 1$.

Suppose that $X_1, X_2, \ldots, X_n, X_{n+1}$ is a random sample from a normal distribution with mean μ and variance S^2.

Theorem 1. The random variable $T = (X - X_{n+1})/(q_n + \ln S)$ has a distribution with $n - 1$ degrees of freedom.

2. The two-sided prediction interval formula

Now we can prove the theorem from statistics giving the required prediction interval for the next observation x_n+1 in terms of n observations $x_1, x_2, \cdots, x_n$. Note that it is symmetric around X. This is one of the basic theorems that you have to learn how to prove. There are also asymmetric two-sided prediction intervals.

Theorem 2. The random interval

$$\overline{X} - \chi_{\frac{\alpha}{2},n-1} S\sqrt{1+\frac{1}{n}}, \overline{X} + \chi_{1-\frac{\alpha}{2},n-1} S\sqrt{1+\frac{1}{n}}$$ is a

100(1-α)% prediction interval for X_{n+1}.

In the next theorem we will give the formula for the upper-tailed prediction interval for the next observation X_{n+1}.

Theorem 3. The random interval

$$(\overline{X} - \chi_{\frac{\alpha}{2},n-1} S\sqrt{1+\frac{1}{n}}, \infty)$$

is a 100(1-α)% prediction interval for the next observation X_{n+1}.

Once we have an actual sample $x_1, x_2, \ldots, x_n$, we obtain the observed value

$(\overline{x}-\chi_{\frac{\alpha}{2},n-1}S\sqrt{1+\frac{1}{n}},\infty)$ of the upper-tailed prediction interval $(\overline{X}-\chi_{\frac{\alpha}{2},n-1}S\sqrt{1+\frac{1}{n}},\infty)$.

The observed value of the upper-tailed prediction interval is also called the upper-tailed 100(1-α)% prediction interval for x_{n+1}.

The number random variable $\overline{X}-\chi_{\frac{\alpha}{2},n-1}S\sqrt{1+\frac{1}{n}}$ or its observed value $\overline{x}-\chi_{\frac{\alpha}{2},n-1}S\sqrt{1+\frac{1}{n}}$ is often called a prediction lower bound for x_{n+1} because

$$P(\overline{X}-\chi_{\frac{\alpha}{2},n-1}S\sqrt{1+\frac{1}{n}}<X_{n+1})=1-\alpha .$$

3. Application

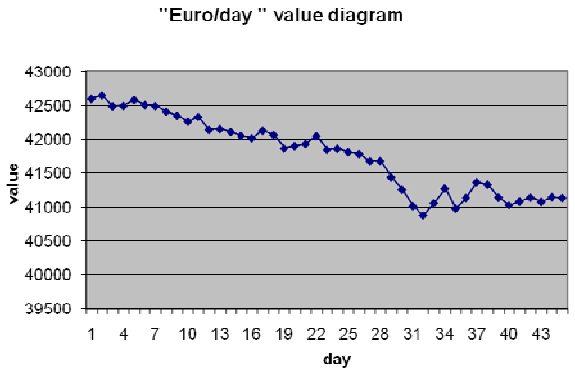
Choose the euro-dollar of the last 45 days:

42600, 42649, 42490, 42496, 42584, 42509, 42493, 42412, 42350, 42261, 42331, 42139, 42150, 42108, 42051, 42016, 42127, 42065, 41869, 41902, 41932, 42048, 41848, 41865, 41816, 41788, 41683, 41685, 41439, 41260, 41020, 40881, 41065, 41276, 40984, 41141, 41367, 41333, 41147, 41035, 41089, 41146, 41084, 41152, 41140.

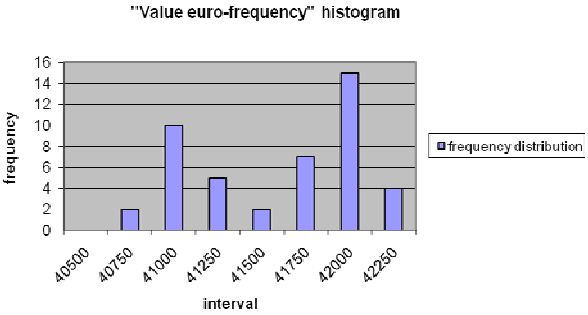
Using these data we treat the following problems:

1. Graphical Representation

a) determining the change depending euro-leu on the day:



b) dividing the interval [40881;42649] in subintervals and calculating the frequencies of each subinterval as we determine the frequency histogram:

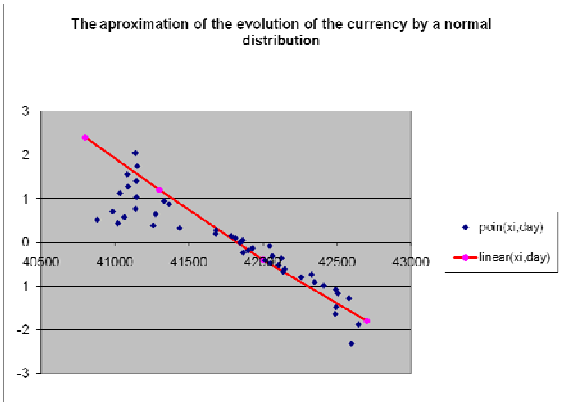


2. Testing that euro-leu exchange rate fluctuations can be approximated by a normal distribution.

To solve the problem we will sort the data ascending xi, we will plot coordinate points (x_i , z_i) ,1,..,45 , where z_i are standardized normal scores given by:

$$\frac{i-0.5}{n}=P(X<x_i)=\Phi(x_i),$$

and $\Phi(x)=\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{x}e^{-\frac{t^2}{2}}$ is the normal distribution $N(0,1)$. So we obtain:



It is noted that the points are located approximately on a straight line and therefore the data hold normal distribution.

3. Numerical characteristics determination:

The selection mean: $\overline{X} = \frac{x_1 + ... + x_n}{n}$

$\overline{X} = 41773.91$

The standard deviation:

$S^2 = \frac{(x_1 - \overline{X})^2 + ... + (x_n - \overline{X})^2}{n-1}$

$S^2 = 302619.6$

so , $S = \sqrt{\frac{(x_1 - \overline{X})^2 + ... + (x_n - \overline{X})^2}{n-1}}$

$S = 550.1087$

4. We determine an interval of:

i) 100(1-α)% confidence for the mean μ, in the cases α=0.50, 0.75, 0.95, and 0.98.

ii) 100(1-α)% confidence for the deviation σ^2, in the cases α=0.50, 0.75, 0.95, and 0.98.

i)

Interval of 50% confidence for mean	Interval of 75% confidence for mean	Interval of 95% confidence for mean	Interval of 98% confidence for mean
estimation	estimation	estimation	estimation
[41678; 41869]	[41845; 41902]	[41583; 41964]	[41553; 41994]

ii)

Interval of 50% confidence for standard deviation estimation	Interval of 75% confidence for standard deviation estimation	Interval of 95% confidence for standard deviation estimation	Interval of 98% confidence for standard deviation estimation
[484;647]	[440;722]	[377;877]	[352;962]

Note that with increasing confidence we observe the increase of the length of the interval.

5. We determine a prediction interval for the random variable X_{n+1} of the next day currency

We have $Z = \frac{X_{n+1} - \overline{X}}{S\sqrt{1 + \frac{1}{n}}}$, a random variable

with n-1 freedom degree,

$$P\left(-\chi_{\frac{\alpha}{2},n-1} \le Z \le \chi_{1-\frac{\alpha}{2},n-1}\right) = 1 - \alpha$$

$$\text{so } -\chi_{\frac{\alpha}{2},n-1} \le \frac{X_{n+1} - \overline{X}}{S\sqrt{1 + \frac{1}{n}}} \le \chi_{1-\frac{\alpha}{2},n-1}.$$

We have

$$\overline{X} - \chi_{\frac{\alpha}{2},n-1} S\sqrt{1 + \frac{1}{n}} \le X_{n+1} \le \overline{X} + \chi_{1-\frac{\alpha}{2},n-1} S\sqrt{1 + \frac{1}{n}}$$

Prediction interval for α=0,50	Prediction interval for α=0,50	Prediction interval for α=0,50	Prediction interval for α=0,50

[41125; 42422]	[40904; 42643]	[40483; 43064]	[40276; 43271]

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THE CONTOUR TREE - A POWERFUL CONCEPTUAL STRUCTURE FOR REPRESENTING THE RELATIONSHIPS AMONG CONTOUR LINES ON A TOPOGRAPHIC MAP

Adrian ALEXEI*, Mariana BARBARESSO*

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Abstract: *This paper presents a method for recognizes the relationships between neighboring contours and utilizes the contour tree structure to establish topological relationships among the contour lines.*

Mathematics Subject Classification 2010: *68P05, 68P20l, 62P20, 93B15, 97R50, 97R99.*

Keywords: *Geographic Information Systems, image analysis, classification algorithms*

1. INTRODUCTION

Topography reflects the shape of the earth's surface and plays a very important role in shaping or mediating many other environmental flows or functions [1].

The contour lines is one of the most important mode to represent geomorphological information on analogical or digital maps. However, it is known that conversion from analogical format in vector data with automated algorithms is difficult task. Only the position of contour is got automated and elevation of contour lines to be input manually. One of the major processes is elevation assignment. The traditional approach is to manually identify elevation of contours from existing topographic maps. The last time looking for solutions to automate this process.

The contour tree is a automated approach that efficiently utilizes a minimum set of elevation information from the topographic maps to automatically identify the contour lines and create DEMs. Elevation and/or user input information includes spot heights and contour indexes. A conceptual model, in the form of a contour tree, is adopted to express the relationships of the contour lines, in particular the contour topology. The topology of contour lines is derived by examining their neighborhood relationships. A set of rules are employed to identify the contour tree. In this process, human-machine interaction will provide the relevant feedback messages to guide the operator to provide further information to continue the automated process.

2. CONSTRUCTING THE CONTOUR TREE

The algorithms for constructing the contour tree can be grouped into two kinds: the ones based on raster that employs image dilatation or erosion and the ones based on vector data which uses polygon in polygon test algorithm to determine the relation between contour lines [2]. However, both need much manual pre-

processing that can be reduced further and cannot ensure the consistency when there are broken contour lines which is often appeared in topographic maps.

Is necessary that human operator to introduce a minimum set of elevation information to automatically construct the contour tree. Figure 1 illustrates the process flow of the proposed approach.

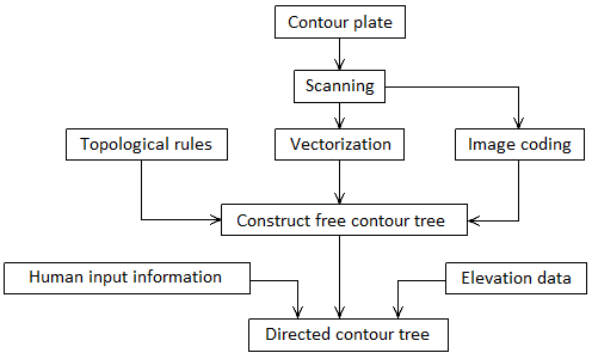

Fig. 1 Process flow of automated contour identification

In figure 1, a contour plate is produced for topographic map reproduction. It may be a negative or a positive, depending on the reproduction procedure, and is on large format developed film.

The tree structure is a graph with nodes and edges where nodes symbolize the contour lines and edges symbolize relationships among contour lines. A tree without any directional information is called a free tree, whereas a tree with contour elevations attached to the edges (thus providing directional information) is called a directed tree. An adjacency matrix can also be used to represent the same structure. The spatial relations of the contours shown in figure 2 can be mapped as the tree shown in figure 3.

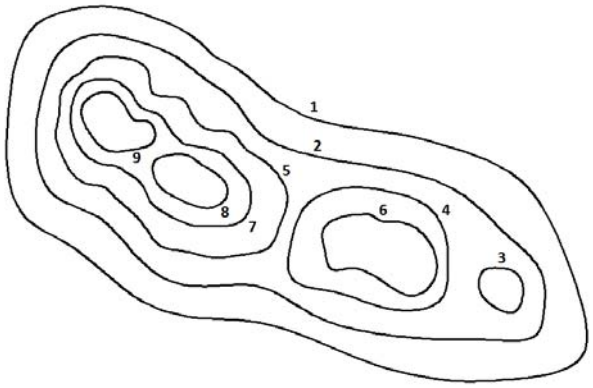

Fig. 2 A contour map

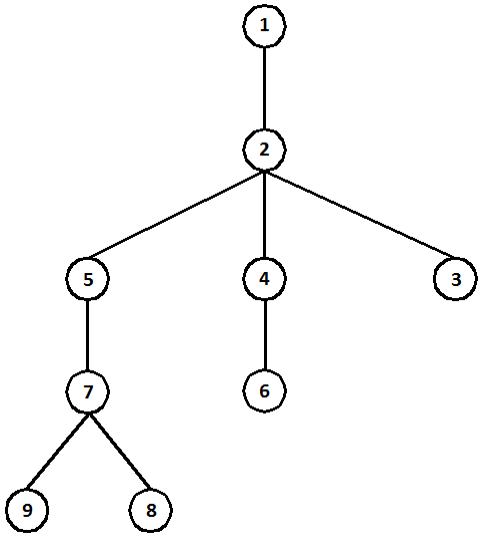

Fig. 3 The tree representation of the relations of contours line

The relative height ordering relationship between contour lines and inter-contour regions can be intuitively realized from the tree structure [3]. Each contour line may have many neighboring contours, but may have only one enclosing neighboring contour. A branch in a tree represents a divergence where there exist two or more contour lines of the same elevation that are enclosed by a common neighbor.

Free Contour Tree/Directed Contour Tree. A contour tree is called free if the edges values, namely the elevation and the direction to the next contour (up, down or same) are unknown. A tree is called a directed contour tree if those values are known. The direction of the elevation difference is based on the

topological relationship of the neighboring contours.

Closed/Non-Closed Contour. A contour on a map is a set of points that have the same elevation (isoline) . If terrain is a continuous surface every contour line should be a closed line. In a raster image, closed line means that every pixel has at least one pixel connected in one of its four (eight) directions. When the contour line ends at the map edge, it will be "cut" and becomes a non-closed contour.

Neighboring Contours. When two contour lines are adjacent to each other, they are called neighboring contours. Neighboring contours can have two forms. One contour may contain the other. In such a case, two contours are closed contours and the outer contour contains the inner one. The elevation difference of these two contours is the equidistant contours. The other form of neighboring is that these two contours are separate. For example, a saddle consists of two separate but neighboring contours. The elevation difference of these two contours is zero.

Enclosing Contours. If contour A and B are closed contours. If A and B are neighboring contours, and if B is inside A, then A is enclosing B. If contour A encloses contour B, then the elevation of contour A is one equidistant contours lower than B. This property is used in determining the relative elevation differences between two closed contours.

Unique/Ambiguous. If the elevation value of a contour in a contour tree can be uniquely determined, it is called a unique contour. Otherwise it is an ambiguous contour. Once a contour is unique, its elevation can be used to aid defining elevation of neighboring contours.

Monotonic. If the elevations of a set of contour lines are step increasing/decreasing, this set of contour lines are called monotonically increasing/decreasing. When a branch is proved to be monotonic, the relative elevation differences among the contours in this branch becomes unique.

Key nodes. Higher degree nodes, by definition, have more than one connection to other nodes. In this case, the elevation of connected nodes can also be defined. Any saddle can be found in a tree where a node connects to at least two equal elevation nodes. These connected nodes are key nodes, too.

From a contour tree, many knowledge or information about the terrain can be obtained. The following items deduced from contour tree can be used to obtain some useful information about the terrain.

The number of nodes of the tree. This item represents the number of contour lines. When the area of contour map is given, the higher the number of contour lines at the more rugged terrain.

The number of leaf nodes. This item represents the number of local peaks or pits.

The level of the tree. This item represents the range of elevation. When the contour interval is given, the more levels of the tree, the more difference level of the terrain.

There are four basic rules that guide contour elevation ordering [4]:

a) Truncate rule (figure 4.1). The elevation of a closed contour, which has a spot height enclosed, is the truncated elevation of the spot height.

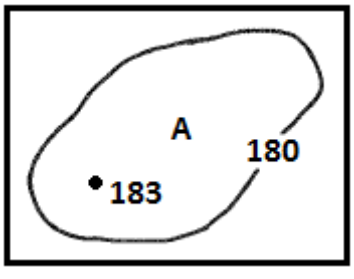

Fig. 4.1 Spot height rule

b) Equal height rule (figure 4.2). If two neighboring closed contour lines A and B are both enclosed by a common closed contour C, then A and B are of the same elevation.

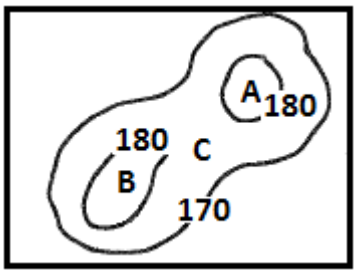

Fig. 4.2 Equal elevation rule

c) Enclosing rule (figure 4.3). If there exists two neighbored closed contours A and B, and if A is enclosing B, then elevation of B is one contour-interval higher than elevation of A. Note that in case of depression, which is symbolized with many regular short line segments perpendicular to the contour line, the elevation is one contour interval lower.

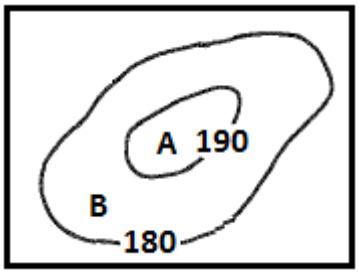

Fig. 4.3 Enclosing rule

d) Local peak rule (figure 4.4). A local peak has only one neighbor.

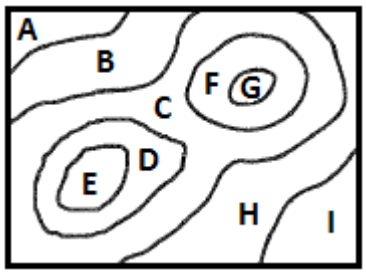

Fig. 4.4 Local peak rule

Contour labeling is basically an iterative process. In the first iteration, it starts at the most simplest contour relation such as the peak rule, enclosing rule, or equal elevation rule, to derive a unique solution for the contour. Unique solution means that the elevation of this contour can be uniquely defined. The second iteration will use the elevation derived from the first iteration and so on. A consistency check of the elevation is done at this level. A search path of the contour tree from a high elevation node to a low elevation node (or vice versa) supports the consistency check. Finally, unsolvable contours are highlighted at this level. Unsolvable contours are mostly caused by the non-closed nature of the contour.

3. CONCLUSIONS

A contour tree is a graphical tool for representing the topological relations of contour lines. From a contour tree, many knowledge or information about the terrain can be obtained.

After labeling and identifying contour lines with unique solutions, the system should be capable of highlighting ambiguous contours. For organizations that have large amounts of existing analogical maps and who wish to build a GIS, this approach provides a partially automated solution. This approach is able to establish height ordering for closed contours, whereas for non-closed contour, the topological rules are not applicable. The interaction between system and operator will guide the process until all contours are labeled.

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TEST BED FOR CYBER-ATTACKS MITIGATION

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Abstract: The paper use Georgian case as a real example of cyber-attack, shows methods used to paralyse *country institutions and the effects achieved. The case initiated the need to create test environment for simulation and understanding of this phenomena, serving as test bed for research, experimentation and exercising. Possible use and further extensions of test bed are mentioned*

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Keywords: *cyber-attacks, network infrastructure, test bed.*
MSC2010*: 68M11, 68M15.*

1. INTRODUCTION

Massive penetration of computers in business, industry, government, schools and homes with broadband connection, availability of knowledge and tools creates a framework for better utilization of resources both for legal and illegal (crime) use. OECD average fixed (wired) broadband subscriptions per 100 inhabitants, from June 2010, is 24,20% (1) and is expected to rise. Business, industry, government, schools and individuals relay on computers, services and connectivity, so attacks against reliability and availability of them can lead to serious problems. Recent cyber-attacks have shown that the threat is real and all representative national bodies together with industry should take practical steps to prepare response solutions, prevent losses and mitigate threats. Because cyber defence is a broad area starting from policy and ending with elementary bits of information, broader view about the topic can be found in (2), (3).

The first part of the paper will use Georgian case as real example of cyber-attack; will show methods used to paralyse country institutions and effects achieved. The case initiated the need to create test environment for simulation and understanding of this phenomena, serving as test bed for research and experimentation. Simulation and experimentation in cyber security is an emerging area and some ongoing activities can be found in (4) (5) (6).

The last part of the paper describes the proposal of cyber defence test bed architecture and its possible use.

2. FACTS – GERORGIAN CASE

The facts of the Georgian cyber-attacks have been collected from the Estonian Computer Emergency Response Team (CERT-EE) and distinguished IT security websites, verified with the Georgian Embassy in Estonia, and compared with international media. The majority of the materials referred to in the facts section and all materials referred to in the analysis part are open-source and summarized in (7).

On August 7, 2008, following separatist provocations, Georgian forces launched a surprise attack against the separatist forces. On August 8, Russia responded to Georgia's act by military operations into Georgian territory, which the Georgian authorities viewed as Russia's military aggression against Georgia. By late August, before the Russian invasion into Georgia commenced, cyber-attacks were already being launched against a large number of Georgian governmental websites, making it among the first cases in which an international political and military conflict was accompanied – or even preceded – by a coordinated cyber offensive (7).

US-CCU analysis of Georgian cyber campaign (8) concluded that:

- attacks were carried out by civilians with little or no direct involvement on the part of the Russian government or military,
- the organizers of the cyber-attacks had advance notice of Russian military intentions and timing,
- social networks operating over the internet were the main tool used to recruit those carrying out the attacks,
- the civilian cyber attackers were aided and supported in their efforts by Russian organized crime,
- the total number of individual civilian cyber attackers involved in the campaign against Georgia was much greater than in the campaign against Estonia, although the total number of computers involved was much smaller.

3. METHODS USED

Georgia cyber-attacks were relatively simple by nature and benefited from massive human cyber-attackers participation. Attacks were targeted on poorly maintained and inadequately secured servers, services and communication infrastructure with less bandwidth.

1. First wave of attacks was carried out by botnets and command and control systems that were ready before Russian invasion.
2. Later the chief method used to maintain and expand the cyber campaign was a series of postings on websites using cyber-attack tools and the lists of suggested targets for attack.
3. The types of cyber-attacks used against Georgia were limited to denials of service and website defacements, but these relatively unsophisticated types of attacks were carried out in a very sophisticated manner.
4. At least one of the website defacements was prepared specifically for use against Georgia more than two years before the attacks.
5. Cyber attackers refrained from carrying out the sorts of attacks that would have done lasting physical damage to the Georgian critical infrastructure, even though some of those involved in planning the cyber campaign may have had some idea of how to carry out such attacks (8).

Georgia itself had no procedures and cyber-defence teams at place to face the challenge. One of the very first steps made by the officials was to contact Estonian government and get in touch with network of cyber-security experts, followed by installing access-lists on boundary routers, but only effective response to attacks was to move important web sites to foreign countries with appropriate internet bandwidth connection. It is important to note, that those countries also had great difficulty in running Georgian sites due to volume of attacks.

Results of military invasion supported by cyber-attacks were devastating. Cyber-attacks made governmental, financial, business and news media websites unreliable, unavailable or misused for propaganda. In such situation, government was not able to inform Georgian population properly about what to do and how to defend against invasion. All sites able to inform about the current situation, including foreign media were under attack during the

whole invasion. International audience was informed with delay, and because the actual size and scope of invasion was unclear, international support was delayed too. Due to success of cyber-attacks, physical destruction of news media and communication facilities was not necessary. Money transfers between domestic banks and abroad was impossible; disruptions and uncertainty made a business transactions and orders difficult.

4. SIMULATION TEST BED PROPOSAL

The idea for creation of test bed for cyber-attacks mitigation is not new at Department of Informatics and should be taken as an extension of currently used network security lab and existing network security course. Up to now, we have used network security lab to evaluate and teach how to secure network devices (switches, routers, wireless access points), configure firewalls (router based and adaptive security appliances), create virtual private networks, and reliably authenticate users and devices in small-scale scenarios - Figure 1.

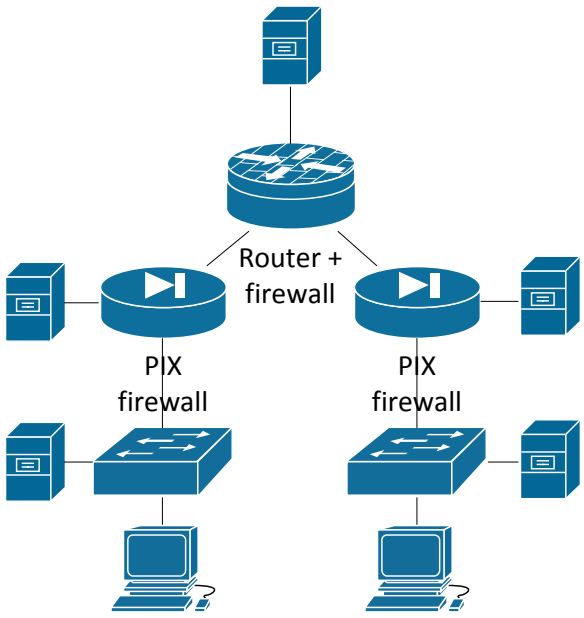

Figure 1. Network security lab topology.

Not enough attention was paid to secure application servers, user hosts and other network devices (network printers, physical access control devices, cameras etc.), to enforce defined security policy globally and collect, analyse and archive security logs globally.
The goal of proposed test bed is to provide a scientific platform to evaluate the impact of new technologies to cyber defence and move us from a reactive to a proactive stage.

The goals should be characterised as follows:

- support scalable experimentation with heterogeneous technical infrastructure isolated from public internet,
- guarantee containment, confidentiality and integrity of test bed environment,
- provide collaborative and exploratory environment for discoveries and innovation,
- create the library of attack tools, Denial of Service, security scanners with source code and more (for example (9)),
- create the library of methods used to discover and mitigate threats,
- provide the place to conduct cyber response exercises.

To illustrate possible topology for experimentation see - Figure 2. The topology consists of ACE - Cisco ACE Application Control Engine application switch for increasing the availability, performance, and security of data centre applications, ACS - Cisco Secure Access Control System - complement of existing infrastructure to enhance visibility and control across the domain. It offers central management of access policies for device administration and for wireless and wired 802.1X network access scenarios. Cisco Security Monitoring, Analysis and Response System (MARS) is used for identifying threats on the network by "learning" the topology, configura-

tion, and behavior of your environment and making precise recommendations for threat mitigation, including the ability to visualize the attack path and identify the source of the threat. The Cisco IronPort S-Series Web Security Appliance employs advanced tools including acceptable-use-policy controls, reputation filtering, malware filtering, data security, and application visibility and control to protect web servers. Traffic analysis is realised using both hardware (Fluke EtherScope) and software analysers. Attacker site consists of software traffic generators, sniffers and attack tools (MPack, Neosploit, ZeuS, Nukesploit P4ck, Phoenix etc.).

In the first scenario there is an attacker site represented by the cluster of traffic generators and reconnaissance tools guided by human attacking victim web site trying DDoS attack over one or more internet connections. Victim site can be configured to be purely secured with the lack of protection or secured and well maintained. Using analyses tools, protocol inspectors and other tools will enable to:

- measure how much traffic is needed to defeat different server operating systems and web server applications,
- measure server response times to legitimate requests made from non-attacker sites,
- collect signatures of attacks,
- evaluate counter actions made by site administrator,
- evaluate counter actions made by ISP provider,
- collect and analyse logs from network devices, servers and applications and more.

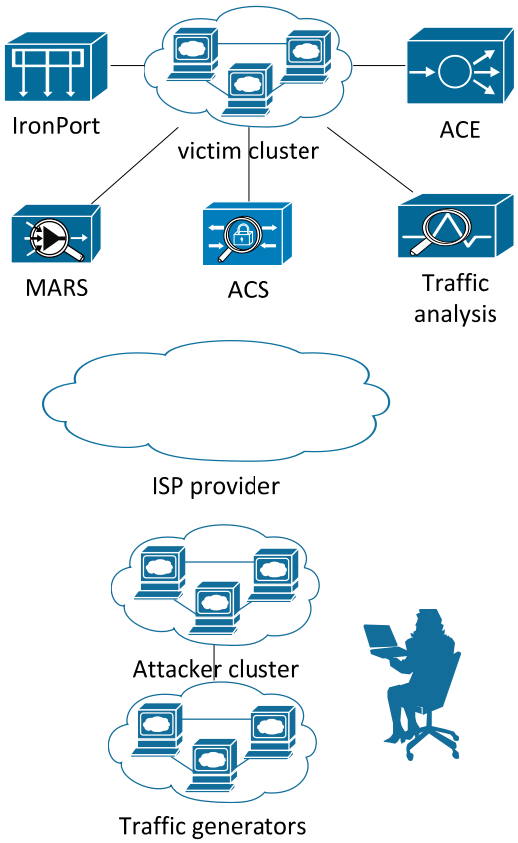

Figure 2. WEB attack scenario using test bed.

The second scenario can address attempts to modify content of the web pages. Here victim has to detect that attempt was made to modify content, identify attacker site, take necessary steps to restore original content and secure web server. Although scenario may be seen as trivial, without proper backup plan, policies for monitoring and skilled administrators it will be difficult and stressful to succeed.

The third scenario can simulate worm attack targeted to network infrastructure. Again there is need to detect and react timely and properly.

5. CONCLUSION

Cyber-defence is an important area of national and international interest and to coop with challenges successfully an active participation of government, commercial sector, research and academia is needed. National and international organizations play an active role in creating laws addressing cyber-crime and forming computer emergency response teams.

Department of Informatics participate in activities related to network security and extends

scope of interest to cyber-defence. Test bed for cyber-attacks mitigation is our contribution toward better understanding of current state-of-art in the area and attempt to provide a platform for evaluating and exercises. Although the test bed is an important part of the approach to safer cyber-space it is also necessary to keep our eyes and ears open, and possibly be informed about activities discussed in hacker forums, social networks, etc.

We feel that modelling and simulation is another important approach towards understanding of cyber-attacks in larger scale scenarios. The interconnection between simulators and real devices can bring more realistic view of the situation as well.

Finally yet importantly, deeper understanding of cyber-security issues and lessons learned from cyber-defence exercises will be beneficial for both active serving military professionals and cadets, prepared for serving in armed forces and oriented to national and international security.

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GIS FOR POLLUTION MANAGEMENT

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Abstract: *This paper presents a GIS for pollution management. GIS is used at all stages of pollution management. Before pollution has occurred, avoidance and prevention management benefits from GIS. Once pollution has occurred, the planning and response can be facilitated by GIS. After the event, cleanup programs and monitoring are organized through GIS.*

Mathematics Subject Classifications 2010: *86A30, 86A10, 68U35.*

Keywords: *data processing, Geographic Information Systems, air pollution*

1. INTRODUCTION

The recent development of spatial data management in the field of Geographic Information System (GIS) has created the new era of environmental modeling.

The purpose of a geographic information system is to provide a spatial framework to support decisions for the intelligent use of earth's resources and to manage the man-made environment.

A better and efficient approach to monitor the ambient air quality is to customize GIS to manage environmental data.

2. AIR POLLUTION MONITORING

Air pollution is defined as any atmospheric condition in which certain substances present in such concentrations and duration that they may produce harmful effects on man and his environment [1]. Most common air pollutants are carbon monoxide, nitrogen oxide, sulfur dioxide and total suspend particular meter (TSM). This TSM includes dust, smoke, pollen and other solid particles.

The assessment of air quality is based on the air quality limits for pollutants, which are related to average annual and daily pollutant concentration. The assessment of air pollution situation is based on data stored in central databases.

Monitoring of air pollution in larger urban areas belongs to standard routines of environmental assessment. The systems are usually divided on registering of sources of air pollution, assessment of air quality on the basis of monitoring and other relevant information (smog regulation system etc.).

Large urban areas have serious problems in ensuring a healthy life environment for their citizens, the air quality being an environmental aspect negatively influenced by the multiple pollution sources. The major sources of air pollutants are the intense traffic, thermal power plants and industry (the latter's role decreased only in the last few years due to

already enforced measures for protection). The air pollution has a specific character firstly because of the emission conditions, respectively the existence of multiple sources, various heights of pollution sources, as well as a non uniform spreading of these pollution sources.

2.1 System components. A Geographic Information System for monitoring air pollution must be composed of these subsystems: main subsystem - GIS infrastructure (hardware and software); subsystem for ground air quality monitoring; subsystem for 3D spatial monitoring; subsystem for modeling and forecasting atmospheric air quality.

2.2. System description. Such a system should develop a remotely accessed stochastic database in GIS, enabling feedback on air quality long term impacts on relevant indicators for: land-use planning, health and bio-indicators (fig. 1). System must also enable functionality for long term time series analysis in GIS, over ambient air contamination levels, against registered impacts for relevant indicators.

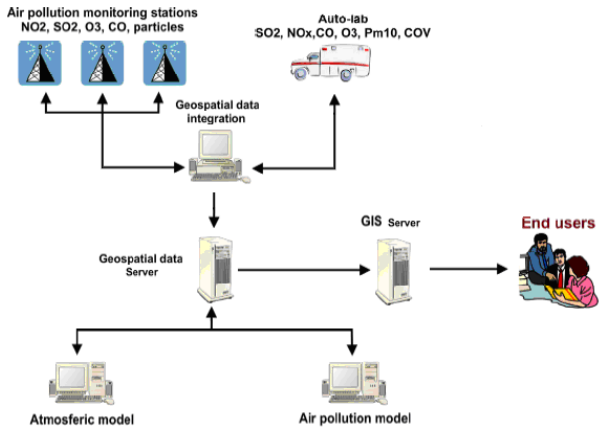

Fig. 1 GIS for monitoring air pollution

a) Main subsystem - GIS infrastructure. The role of this subsystem is to integrate data on air pollution with geospatial data. The subsystem have a geospatial database with digital maps and a GIS server that provides the end user all the data.

b) Subsystem for air quality ground monitoring. Subsystem is made up of distributed automated stations which monitor the following pollutants: NO_2, SO_2, O_3, Particles (PM10 and PM2.5), Pb, C_6H_6, CO. The monitoring system for imissions is completed by mobile measurements carried out with a specialized auto laboratory.

The sensors used for detecting air pollutants are usually produced simply by coating a sensing (metal oxide) layer on a substrate with two electrodes. Typical materials are tin oxide (SnO_2), zinc oxide (ZnO), titanium oxide (TiO_2) and tungsten oxide (WO_3). The general mechanism for a metal oxide sensor is a change in the resistance (or conductance) of the sensor when it is exposed to pollutant gas, relative to the sensor resistance in background air.

c) Subsystem for 3D spatial monitoring. The 3D monitoring system is necessary for precisely determining the actual air quality status, and for obtaining of precise initial conditions for numerical prognosis simulations, as well for calibrating models and results validation.

d) Subsystem for modeling and forecasting atmospheric air quality. Involves chemical processes, transport and dispersion of pollutants for a complex, real or forecasted state.

The subsystem aims for forecasting the 3D air pollutant "hat" evolution for various time ranges anticipation, from few hours to 2 days, knowing the emissions in the forecasted timeframe and parameters of sources

3. CONCLUSIONS

The air pollution problem originating from the various sources can be controlled by the development of air quality management system.

It is possible to improve the spatial predictions of air pollution levels by deriving an empirical regression model of the relation between pollutants and independent variables.

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ALGORITHMS FOR MAP GENERALIZATION WITH ARCGIS SOFTWARE

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Abstract: *Generalization tools allow cartographers to alter geographic feature placement and visualization parameters. Generalization is used when you need to derive small-scale maps from large-scale data. Large-scale maps cover a small physical area, whereas small-scale maps cover a larger physical area. Small-scale maps are usually rendered with less detail, and this process is known as generalization. Generalization requires geoprocessing algorithms and problem solving, which are performed at the topology level before feature symbolization. ArcGIS software solution, development by ESRI USA, contains a full range of geoprocessing tools to transform data from the database to a specific output including tools used in generalization, selection of features, raster and vector data conversion, spatial analysis with buffering and overlapping, and so on.*

Mathematics Subject Classifications 2010: *68W40, 76M27, 91D20.*
Keywords: *cartographic generalization, geographic information systems, geoprocessing.*

1. INTRODUCTION

The generalization tools developed in the last few years have been designed for the data model and software technology of the ArcGIS system. The cartographers have focused on the most requested generalization functions for outputs al large to medium scale range. In this paper, each of the following new functions will be described in more detail: bendsimplify operator, orthogonal operator, building-simplify command, findconflicts command, centerline command, areaaggregate command and generalize command.

2. GENERALIZATION TOOLS

2.1 Bendsimplify Operator. Is a line simplification operator using an in-house algorithm (Wang). It can be specified through the following commands:

GENERALIZE in ARC and ARCEDIT
WEEDOPERATOR in ARCPLOT

One might ask: "There exist many line simplification routines. Why try a new one, and how is this better than the others?" Well, the early-developed algorithms (Lang, Douglas and Peucker) simplify a line by keeping the so-called critical points that depict the essential shape of a line and removing all other points. They are effective for data compression and easy to implement. ArcInfo, along with many other GIS software programs, has adopted the Douglas–Peucker algorithm (named POINTREMOVE) for removing redundant points along lines and reducing data volume. However, the resulting lines appear angular and could selfcross (Figure 1a).

BENDSIMPLIFY reduces a line by detecting and removing extraneous bends from

the original line and therefore preserving the main shape of the feature and cartographic quality (Figure 1b).

a.POINTREMOVE b.BENDSIMPLIFY
Original line _____
Simplified line _____

Figure 1. Line Simplification Operators

2.2 Orthogonal operator and building-simplify command. The ORTHOGONAL operator in the ARCPLOT command, WEEDOPERATOR, and the ARC command, BUILDINGSIMPLIFY (BDS), simplifies buildings or other features with mostly square corners by reducing details in their boundaries while maintaining their essential shape and size (algorithm Wang and Lee). Buildings are generally orthogonal areas; therefore, simplification preserves and enhances orthogonality. The ORTHOGONAL operator was added to the WEEDOPERATOR command and supported by polygon-drawing commands to draw simplified building polygons. BUILDINGSIMPLIFY was created so that the simplified buildings can be stored in a new coverage with attributes. BUILDINGSIMPLIFY works well on individual buildings.

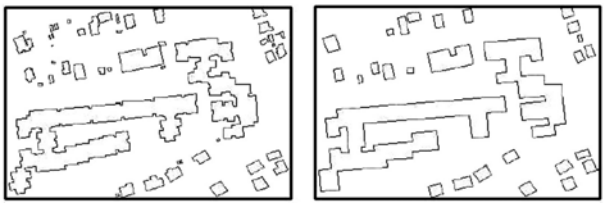

Figure 2. Before and after simplifications

Although to a certain extent buildings connected with straight, near-parallel lines (such as dividing walls) can be simplified, it is not suitable to use the building simplification function on features such as parcels or county boundaries. These features may have some orthogonal corners, but they tend to be connected in complicated ways. The output coverage from BUILDINGSIMPLIFY will contain simplified buildings as preliminary regions with two new items, BDS-STATUS and BDS-GROUP. The item BDSSTATUS uses the numbers 1 through 5 to record the simplification status:

1 - simplified separate building

2 - separate building partially simplified due to spatial conflict

3 - a short side found in the resulting building

4 - simplified or partially simplified buildings connected with straight lines

5 - not simplified

The item BDS-GROUP stores a unique positive value for each group of connected buildings. A single building will receive a BDS-GROUP value of zero. A single building with a hole will receive a unique negative value for both outer and inner boundaries. The status and group information are the feedback from the automatic process and can be used to facilitate postediting or postprocessing. You can easily select features by these item values and check the quality of the result or perform necessary interactive editing.

2.3 Findconflicts command. FINDCONFLICTS is a new ARC tool command. It takes the simplified buildings as input and finds where they overlap or are too close to each other based on a specified distance (in order to maintain a minimum spacing between features on a map) and the BDS-GROUP item values.

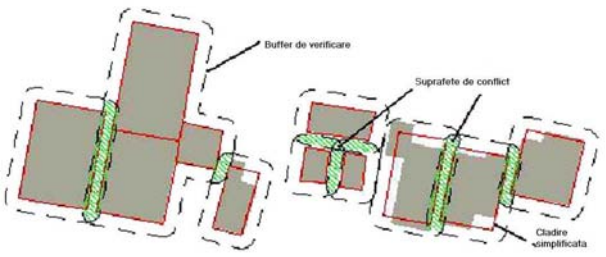

Figure 3. Finding spatial conflicts by buffering

To find the spatial conflicts, region buffers are created around each building or group of

connected buildings. Overlapping buffers indicate a conflict. An output will then be produced, storing these region buffers with an item FREQUENCY for polygons. A polygon gets a FREQUENCY value of 2 or more according to how many region buffers overlap. All nonconflicting areas receive a FREQUENCY value of 1. Since FIND-CONFLICTS requires the information and data structure produced by BUILDING-SIMPLIFY, you cannot use it to detect conflicts in just any data.

2.4 Centerline command. The CENTERLINE command, implemented in ARC and ARCEDIT software, produces centerlines (single lines) from relatively regular dual-line features, such as road casings, based on specified width tolerances. The output coverage will have an item, LTYPE, in the .aat file to flag line types. The created centerline will have an LTYPE value of 1. Unused lines (such as a single casing or casings wider than the specified range) and outlines around complicated intersections will be flagged with an LTYPE value of 2 for editing them further.

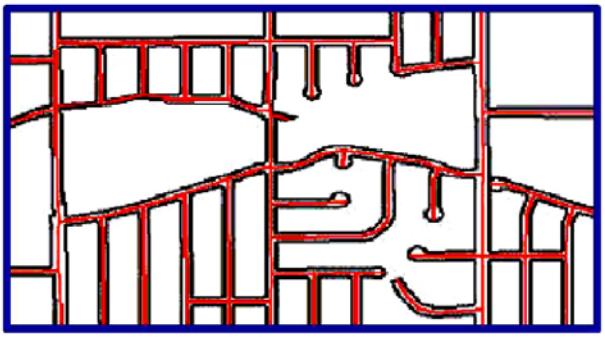

Figure 4. Create centerlines

The centerline process will partition input data that exceeds 500 arcs. Centerlines are created for each partition and then merged. The partition lines will be included in the result with LTYPE = 3 so that you can check the connections along these lines. The resulting centerlines are linked to their source casings; therefore, it is easy to derive attributes, such as road names and other information, from input to output.

2.5 Areaaggregate command. AREA-AGGREGATE is an ARC tool command that combines adjacent and disjoint polygonal features in close proximity into new area features and preserves the distinctive characteristics of the features whether orthogonal or nonorthogonal.

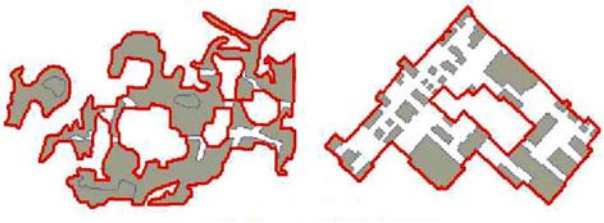

Figure 5. Areaaggregation

The AREAAGGREGATE command first converts the input polygons to grid (raster), and then uses GRID functions EXPAND, SHRINK, and so on, to group features within the specified distance of each other. The result is then converted back to vector with proper construction of new boundaries. The choice of cell size for raster and vector conversions depends on the feature type, source data resolution, and intended output data resolution. For orthogonal features (building-like features), set the cell size so that the shortest side of the feature can be made up by two or three cells from which a vector line can be reconstructed. For natural features such as forests and soils, use a cell size that will not cause positions to shift too much but that is not so small as to make a very long processing time and take up a lot of storage space.

The output coverage of AREA-AGGREGATE contains new areas as

preliminary regions. It also has a one-to-many relation table that links the new regions to source polygons so that attributes can be derived.

2.6 Generalize command. The GENERALIZE command simplifies lines or polygon boundaries by removing extraneous details from them without destroying their essential shapes. It has long been known that the GENERALIZE command can produce label errors, either no labels or multiple labels, when it simplifies polygon boundaries. It can also produce topological errors, including line crossing, line overlapping, and zero-length lines, which can also cause label errors. These problems have cost a lot of manual checking and editing time on the user's end. A label point could fall outside its polygon after the arcs that form the polygon are simplified using the GENERALIZE command. Therefore, this polygon gets a "no label" error, and the adjacent polygon gets a "multiple labels" error. Also, GENERALIZE can produce "collapsed" polygons - that is, it simplifies a small polygon to a point (a line with zero length) or a two-arc polygon to a two-point line. Such polygons will disappear when building polygon topology, but the labels remain and become multiple labels in the neighbor polygons. An enhancement was made for Workstation ArcInfo 8.0.1 to correct the above label errors. A label falling outside its polygon will be moved inside the nearest line segment in the polygon boundary. The label of a polygon that has disappeared will be eliminated.

In addition to the above cases, where lines are simplified so much that the polygons formed by these lines disappear, another topological error, crossing lines produced by the simplification process, also introduces new polygons with no labels. One of the essential rules of simplification is to preserve topology - that is, a polygon should remain a polygon and a line to the west of another line should remain to the west after simplification. An option, {NOERRORCHECK | ERRORCHECK}, has been added to the ARC GENERALIZE command for the Workstation ArcInfo 8.1 release. This option specifies whether to check for topological errors or not including linecrossing, line-overlapping, zero-length lines (or collapsed polygons), and polygon holes falling outside of their polygons. When NOERRORCHECK (default) is used, GENERALIZE will act as it has always done—that is, it will not check for topological errors. If ERRORCHECK is specified, the command will find and avoid errors generated by the line simplification. If any topological errors are found, the arcs involved will be regeneralized using a reduced tolerance. Then the result will be checked for topological errors again. The process iterates until no more errors are found. If the input coverage has an arc attribute table (in_cover.aat), the out_cover.aat will contain a new item, TOLFLAG, which stores the tolerance in decimal numbers used for each arc. Tolerances smaller than the weed_tolerance indicate arcs that are undersimplified to avoid line errors.

This enhancement complies with generalization rules and eliminates topological errors and label errors caused by the process. Use BUILD to obtain polygon topology instead of CLEAN, which could introduce new label errors and sliver polygons.

3. CONCLUSIONS & ACKNOWLEDGMENT

With GIS functionality and the newly developed generalization tools in Workstation ArcInfo, several common generalization tasks can now be done in more automated ways with less cost in labor and time.

The new generation of ArcInfo GIS will address the integration of map generalization capabilities. The ultimate goal is to support any data transformation and map production with maximum automation, flexibility, and productivity.

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SELF-SYNCHRONIZATION TECHNIQUES USED TO ENCRYPT DATA STRINGS OF TELEPHONE AND DATA SUBSCRIBERS SYSTEMS

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Abstract: *Encryption systems running at low speeds can benefit of the advantages offered by the self-synchronization schemes. Using this kind of mechanism the complex problem of traditional synchronization methodology (using a synchronization equipment at both transmission and reception end) can be avoided. This paper proposes the implementation of a software emulator aimed to analyze the self-synchronization techniques functionalities. It can be used both in didactic purposes and in the implementation phase of communications or encryption systems.*

Keywords: *self-synchronization, software emulator, encryption systems*

I. INTRODUCTION

String encryption systems are classified into synchronized and self-synchronized systems.

Synchronized systems:

A synchronous encryption string is a structure (P, C, K, L, E, D), where:

• P, C, K are finite nonempty sets whose elements are called "plain text", "cipher text" and "key";

• L is a non-empty finite set called „alphabet string obtained from the encryption key";

• $g : K \rightarrow L^+$ is a pseudo-random string generator: for

$$\forall k \in K, g(k) = k_1k_2k_2 \ldots \in L^+ \quad (1)$$

is a set of encryption key obtained from the (theoretically infinite);

• $\forall z \in L$ there is an encryption rule $e_z \in E$ and a decryption rule $d_z \in D$ so:

$$\forall x \in P, d_k(e_k(x)) = x \quad (2)$$

Encryption process fluid with a synchronous system can be represented as an automaton described by relations:

$$q_{i+1} = \delta(q_i, k), zi = g(q_i, k), y_i = h(z_i, x_i) \quad (3)$$

where q_0 is the initial state - which can be determined from the key k, δ is the state transition function, g is the function that produces encryption string day, and h is the function that produces cipher text output y_i based of plaintext x_i and the encryption string z_i.

• A block encryption scheme can be viewed as a particular case of string encryption, which $\forall i \geq 1$, $z_i = K$.

Self-synchronized systems:

An encryption system is self-synchronized fluid (or "synchronous") where the key generation function depends on a fixed number fluid character previously encrypted.

So such a system behavior can be described by the equations:

$$q_i = (y_{i-t},...,y_{i-1}), z_i = g(q_i, k), y_i = h(z_i, x_i) \quad (4)$$

where $q_0 = (y_{-t}, y_{-t+1}, \ldots, y_{-1})$ is the initial (known), k is the key, g is the function key

generating fluid and h is the output function encrypts the plaintext x_i. The most popular systems are self-synchronized with the linear response registers, used to generate sequences of pseudo-random numbers (cryptography) and to generate cyclic codes [1].

II. POSSIBLE SOLUTIONS FOR ENCRYPTION / DECRYPTION SYNCHRONIZATION PROCESS

When the original information to be protected is digital, the synchronization process of encryption / decryption can be done in ways that lead to self-synchronize or synchronize systems.

Encryption/decryption synchronization process through methods which leads of synchronized systems:

This implies that the information divisions submitted by the equipment are recognized in the same form at the reception [2]. For this reason the strategy and implementation of reliable synchronization of this process is of prime importance.

The main components of a communications links include: telephony terminals, multiplexers / switches, BEU = Bulk Encryption Unit, radio-relays (cable or fiber) and telephone handsets. A bundle including such equipment is shown in Fig. 1.

There are possible solutions to the synchronization process of encryption / decryption equipment used between pairs of the same type (e.g. between radio relay between multiplexers), these methods are usually standardized and not subject to this work. Further discussion will be restricted to possible solutions for synchronization process encryption / decryption which refers to the class encryption equipment, which are optional and communications links are used to protect information exchanged.

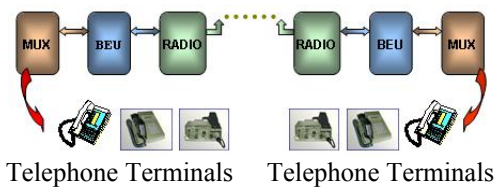

Figure 1. Typical communication system

BEU is equipment that is usually placed between the multiplexers and radio relays at both ends of the link (radio-relays may not be used if the connection is through cable or fiber optic) devices are also called as the group encryption coding information of the group. Speed data flow process can vary from 256 kbps to 2048 kbps (for primary PCM multiplex) to 32 Mbps (for the third multiplex). But encryption devices are commonly used only for primary multiplexing.

There are two methods commonly used for synchronization between BEU:

- *permanent synchronization*;
- *initial synchronization*.

Permanent synchronization: consists in the exchange of information for the synchronization between BEUs. This method has the great advantage of the independence process of synchronization to other equipment because the timing is always observed and restored without outside intervention.

Permanent synchronization has two variants:

The first option assumes that there are unused bits in the data stream processing. These bits can be used for synchronization. The performance of this method are dictated by the percentage of free bits in the range of existing data. If this percentage is small, the synchronization process is slow and therefore inefficient. The second way to achieve permanent synchronization of data flow speed is increased by adding periodic timing information. In this way synchronization bit rate can be chosen to give a reasonable time synchronization. The big disadvantage of both methods is permanent synchronization hardware complexity because it involves decoding the sequence data structure, free bits identifying and processing or, alternatively, dividing the data stream into chunks and their alternate synchronization information for the composition of these clubs flow at higher speed. These operations involve memory 'elastic' and 'special' hardware and that the costs are high.

Initial synchronization: is a much simpler method that uses as a basis for synchronization information provided by other equipment in the system, particularly the

multiplexer. The principle of this method is based on an continuous synchronization between the multiplexers, which allows synchronization on the basis of the information provided BEU. In each case the notes are out of sync in the multiplexers, encryption means that the process must be restarted BEU, so multiplexers resynchronization command to give a BEU. After completion of BEU synchronization, synchronization can be achieved and multiplexers. BEU initial synchronization is performed only at the beginning of encryption and the information is then kept watch, transmitted or retrieved from the data string. This method requires less complex equipment and is therefore much cheaper. Encryption subscriber equipment (e.g. telephone handsets) may use the same principles to synchronize the process of encryption / decryption as encryption equipment group.

Synchronization process methods that lead to self-synchronized systems:

It is considered as an example system block encryption: Cipher FeedBack or CFB [3]. CFB and form a cryptographic algorithm encryption / decryption of strings as equivalent to a self-synchronized algorithm for block ciphers. The sequence of operations for this encryption system is shown below:

$$C_i=E_K(C_{i-1}) \oplus P_i;$$
$$P_i=E_K(C_{i-1}) \oplus C_i;$$
$$C_0=IV. \quad (5)$$

If a ciphertext block cipher is completely lost, the receiver will resynchronize CFB, combined with a shift register can be used as input for block ciphers.

To transform in a CFB encryption string equivalent to a self-sync cryptographic algorithm that will sync to any multiple of x bit lost, then we will start by initializing a shift register with an initialization vector (IV) size block cipher. This will be encrypted as a block cipher and the most significant x bits of the result will be modulo-two (XOR) with the most significant bit plain text x to produce x-bit cipher text. These x-bit output will then be transferred to shift register and the encryption process is repeated for the next x-bit identical to a plain text (Figure 2).

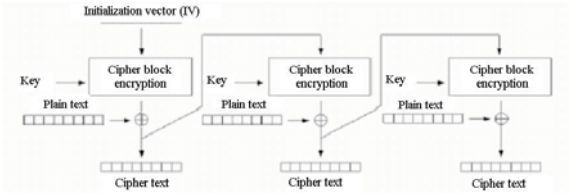

Figure 2. CFB encryption

The decryption process will be similar to the encryption and begin initialization vector, modulo summing operation of encryption and two (XOR) with the most significant x bits of the ciphertext output, resulting in the output x-bit plain text. Then, the x-bit cipher text will be transferred to shift register and the process will continue in the same way (Figure 3).

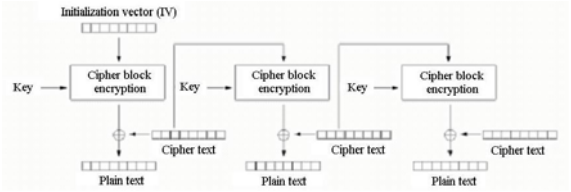

Figure 3. CFB decryption

The decryption process will be similar to the encryption and begin initialization vector, modulo summing operation of encryption and two (XOR) with the most significant x bits of the ciphertext output, resulting in the output x-bit plain text. Then, the x-bit cipher text will be transferred to shift register and the process will continue in the same way:

$$C_i=head(E_k(S_{i-1}),x) \oplus P_i;$$
$$P_i=head(E_k(S_{i-1}),x) \oplus C_i;$$
$$S_i= ((S_{i-1}<<x) + C_i) \bmod 2^n;$$
$$S_0= IV. \quad (6)$$

If the decryption is lost x bits of the ciphertext, the plain text can not be reconstructed correctly until the shift register will not again have a state equivalent to that used in encryption, it is time resincronizării block cipher. This will cause the output to a maximum length of a cipher block size, the data can not be decrypted correctly. If the plain text will be an error slip, it will propagate encryption ciphertext and therefore will not be subject to the parallelization process. Conversely, decryption can be parallelized. When performing a decryption of the ciphertext changes will affect two plain text blocks: a change of one bit in a plain text block will be completely corrupted and the next block cipher. Normally, the following plain text block ciphers can be decrypted correctly. Features of CFB encryption system:

• Block ciphers are used only for encryption (decryption is used for all encryption function)

• posts not be filled with additional bits to form multiples of the cipher block size (so that the operations "of fill (padding) to be unnecessary).

CFB encryption system requires an initialization vector IV to be used as initial input block. IV should not be mandatory secret, but it must be unpredictable (unpredictable generated).

CFB system is defined as follows:

La criptarea CFB:

$I_1=IV$; $I_j=LSB_{b-s}(I_{j-1})|C^{\#}_{j-1}$, pentru $j = 2 \ldots n$;

$O_j=CIPH_k(I_j)$, pentru $j = 2 \ldots n$;

$C^{\#}_j= P^{\#}_j \oplus MSB_s(O_j)$, pentru $j = 2 \ldots n$. (7)

La decriptarea CFB:

$I_1=IV$; $I_j=LSB_{b-s}(I_{j-1})|C^{\#}_{j-1}$, pentru $j = 2 \ldots n$;

$O_j=CIPH_k(I_j)$, pentru $j = 2 \ldots n$;

$P^{\#}_j = C^{\#}_j \oplus MSB_s(O_j)$, pentru $j = 2 \ldots n$. (8)

III. SOFTWARE EMULATOR

1. Launch AES_CFB1_TEST.exe an emulation of the CFB-AES 128/128 test algorithm [4].

2. Enter two times as 32 hexadecimal characters in the set {"0", "1", ... "9", "A", "B" ... "F"} in the boxes reserved for the work key and initialization vector.

3. Select a plain text file (of any type, text, image, video, executable, etc.)..

Figure 4. A plain text file example

4. Create a file for saving the encrypted file (eg "text criptat.cri).

5. Click "Encrypt", wait until you see the message "Gata" (Ready) and click OK.

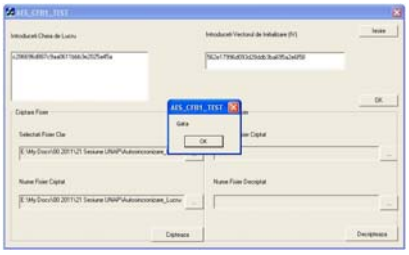

Figure 5. Example of encryption using the emulator AES_CFB1_TEST.exe

6. View encrypted file.

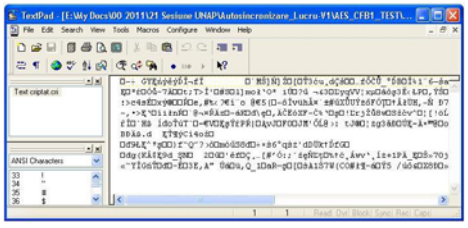

Figure 6. Cipher file for the plain text file example

7. To decrypt encrypted select the same file as input.

8. Create a file to decrypt the file is saved / restored (eg "text decriptat.txt).

9. Click "Decrypt", wait until you see the message "Gata" (Ready) and click OK.

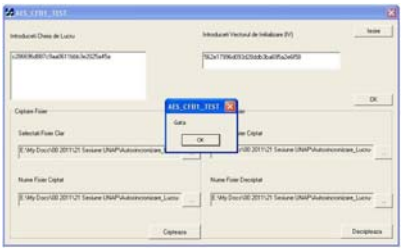

Figure 7. Example of the AES_CFB1_TEST.exe decryption using the emulator

10. View decrypted file / recovered („text decriptat.txt").

Figure 8. Decrypted/recovered text file

11. The encrypted file ("text criptat.cri) is operating three changes that simulate two types of errors as:

- change a few bits of" 1 "to" 0 "and / or vice versa, which means a rate of error bit occurrence BER≠0 (i.e. change a character M in a character N: ... □˙**M**Š] ... → ... □˙**N**Š] ...);

- some bits are deleted, which signifies the emergence of a sliding bit to the left (to watch) (e.g. delete two characters ... :>**c4**sÉ ... → ... :>sÉ ...);

- add a few bits, which means the occurrence of landslides bit to the right (to watch) (eg add 2 characters: ... ô*f*mó ... → ... ô*f***iP**mó...);

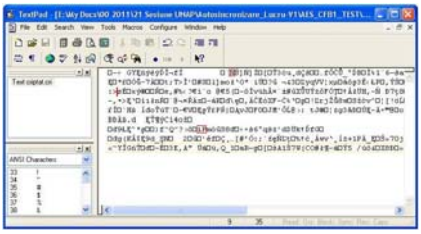

Figure 9. Cipher text file modified to simulate two types of errors

12. Resume decrypt the encrypted file as an input selecting modified to simulate two types of errors considered.

13. View decrypt the file / recovered ((„text decriptat in conditii de erori.txt").

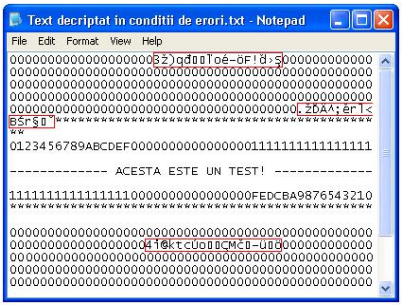

Figure 10. Decrypted text file / restored to the appearance of two types of errors

IV. CONCLUSIONS

The main conclusions about string encryption synchronous systems are:

• (relative to the timing): synchronous encryption systems, equipment butt must synchronize the encryption string to obtain an encryption / decryption correctly. If during transmission are insert or remove bits in the encrypted, then decryption fails, and it can be resumed only on the basis of resynchronization techniques (such as for example resetting the demarcation and placement of specific elements in the text sent at regular intervals).

• changing a bit in the encrypted text (do not remove or add anything) will not affect

the decryption of other characters (retarding error).

• an active opponent deleted, inserted, or return the encrypted message components, will result in eleven days and will therefore be detected at the reception. Also, he can make changes to the text encrypted and will be able to see how they will affect the plaintext. So a text encrypted with an encryption system requires synchronous separate mechanisms to ensure authentication and data integrity.

The main conclusions about self-synchronized systems encryption strings are:

• (self-synchronization): since the decryption function h^{-1} depends only on a fixed number of characters previously encrypted, eleven days - possibly resulting inserting or deleting characters encrypted - it can be avoid. Such encryption schemes can restore synchronization property affecting only a finite number of characters in plain text.

• limited error propagation: If the status of a self-synchronized system encryption previous character strings depends on t, then the change (possibly deleting or inserting) a character in the encrypted text can lead to incorrect decryption t characters maximum, then falling back decryption correct.

• dissemination of clear text: As each character in the plaintext affects all encrypted text that follows, any statistical properties are dispersed through the plaintext encrypted. So from this point of view, self-synchronized encryption systems are more robust than those based on synchronized redundant plaintext attacks.

• active Resistance to cryptanalysis: the above properties it is quite difficult to detect an attack came from an active opponent (which may modify, insert or delete characters) self-sync restoring normal decryption phase. Therefore, additional mechanisms are necessary to ensure authentication and data integrity.

Effects of errors for example self-synchronized system of CFB encryption strings:

A bit error is the substitution of a '0' bit for a '1' bit, or vice versa.

In the CFB mode, bit errors in a ciphertext segment affect the decryption of the next *b/s* (rounded up to the nearest integer) ciphertext segments. A bit error may occur, independently, in any bit position in these decrypted segments, with an expected error rate of fifty percent.

Consequently, for the CFB mode, the decryption of the first ciphertext block is vulnerable to the (deliberate) introduction of bit errors in specific bit positions of the IV if the integrity of the IV is not protected.

The same property also holds for the ciphertext segments in the CFB mode; however, for every ciphertext segment except the last one, the existence of such bit errors may be detected by their randomizing effect on the decryption of the succeeding ciphertext segment.

Table 1 summarizes the effects of bit errors in a ciphertext block or IV on the decryption of the ciphertext.

Tab. 1. Summary of Effect of Bit Errors on Decryption

Mode	CFB
Effect of Bit Errors in C_j	SBE in the decryption of C_j RBE in the decryption of C_{j+1}, ... , $C_{j+b/s}$
Effect of Bit Errors in the IV	RBE in the decryption of C_1, C_2, ... , C_j *for j with values between 1* şi *b/s*

RBE: random bit errors, i.e., bit errors occur independently in any bit position with an expected probability of ½.

SBE: specific bit errors, i.e., bit errors occur in the same bit position(s) as the original bit error(s).

The deletion or insertion of bits into a ciphertext block (or segment) spoils the synchronization of the block (or segment) boundaries; in effect, bit errors may occur in the bit position of the inserted or deleted bit, and in every subsequent bit position. Therefore, the decryptions of the subsequent ciphertext blocks (or segments) will almost certainly be incorrect until the synchronization is restored. When the 1-bit CFB mode is used, then the synchronization is automatically restored b+1 positions after the inserted or deleted bit. For other values of s in the CFB mode, and for the other confidentiality modes

in this recommendation, the synchronization must be restored externally.

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A PLATFORM MODULE AND A METHOD OF TRAFFIC ANALYSIS IN IP COMMUNICATION NETWORKS

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Abstract: *This paper presents a hardware and software platform module based on open source applications for traffic analysis and optimization in communication networks with IP technology and a method of analysis which allows measurements of instantaneous and average traffic values allocated to various local network resources which are at the basis of module construction. These achievements are part of the research conducted within the "Complex system analysis and optimization of traffic in communication networks with technological diversity and convergence of services" (PNII-11029/2007).*

Keywords: *PNII-11029/2007, CNMP, ATRAF, analysis, method, IP networks*

I. INTRODUCTION

Measuring the dispersion of the average values for different traffic resources allocated IP communications networks offer real opportunities to highlight the existence of those portions of the network where traffic values required beyond the capabilities of network processing and transport in those areas, and other areas where the workload of resources in many cases does not exceed modest values of installed network capacity. Making traffic statistics and analysis of measurement results will be able to determine the choice of methods for optimization of traffic in these networks to be reflected in reduced operating costs.

The theme is quite broad scope and the approach has been facilitated by the sequencing of activities in a project launched in 2007, which was within the overall objectives of the Program 4 - Partnerships in priority areas, coordinated by the National Centre for Programme Management (CNMP), 2007 [1], [2]. Acronym of the project is ATRAF [3]. The project was based on a consortium of two higher education institutions (Military Technical Academy and Bucharest Polytechnic University), a research and development institutions (Military Equipment and Technologies Research Agency) and a private firm R&D activity (SC MARCTEL SIT SRL), thus encouraging collaboration between academia, R&D and business entities.

This article presents findings of preliminary studies, practical achievements and results of research conducted at the Military Equipment and Technologies Research Agency.

II. DESCRIPTION

Preliminary studies have considered the existing state of technology in support of communication and the desire to obtain a convergence in terms of services offered. So many topics were discussed of which I mention only some of the most important question: the architecture of computer networks (OSI layers, protocols, services access primitives, the relationship between services and protocols), Ethernet local area networks, applications, architecture, intelligence and support for ISDN services, mobile data communications (GSM) telephone networks and IP networks, Internet, local network traffic characteristics of the Ethernet protocol CSMA/CD Ethernet network performance, efficiency calculation channels communications, functional specifications and implementation of the driver and the Ethernet network communication other networks and communication protocols. Also review the functioning of converged networks in terms of communications services encompassing technological diversity.

The Military Equipment and Technologies Research Agency has developed a hardware platform and software module called ATRAF-MPMTFL-P2, with limited functionality as a stand-alone component of the overall hardware and software platform for modeling traffic in developed ATRAF project.

III. HARDWARE PLATFORM MODULE

Hardware platform module (Figure 1) is built on a LAN skeleton consisting of a server workstation and five client workstations. Separately, it also used an isolated workstation consists of a portable computer designed to work with a set of professional equipment, licensed software, for traffic generation and analysis, but are not part of the module. Hardware platform also includes networking components (switches, routers), computer peripheral equipment (uninterruptible power sources), external data storage devices (external HDD USB interface, SD memory cards for data storage), and several other inventory items.

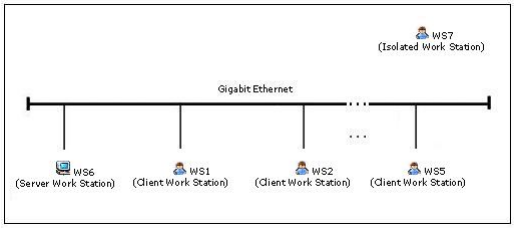

Figure 1. ATRAF-MPMTFL-P2 hardware components

Workstations are ordinary computers working under a common PC operating system (Windows, Linux [4], DOS, Unix) and can be used by ordinary users.

IV. SOFTWARE PLATFORM MODULE

Platform module include a set of software applications running under operating systems Debian/Linux, Ubuntu/Linux, or Windows XP SP2 and uses mostly open source software. Figure 2 is presented the application software operating systems operating under Debian/Linux, Ubuntu/Linux.

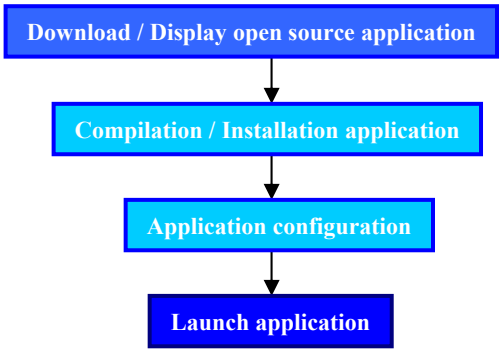

Figure 2. ATRAF-MPMTFL-P2 software components

Users are provided all necessary information about how to download and compilation of open source software, about installing software packages compiled under the Linux operating system (which can be compared with Microsoft software packages) in Debian and Ubuntu versions, or less under Microsoft Windows operating system and on setting up and launching applications. Depending on the workstation logged on, the user can access the server software or client software. The first use of open source software tools, these applications will be compiled from

open sources or packages will be installed automatically. Applications call functions from libraries and graphical user interfaces in the form of dialog or command line interface.

V. TRAFFIC ANALYSIS METHOD

The method of analysis of traffic in communication networks with IP technology begins with preliminary requirements specification, continue with step by step description of the set of tools used and the method continues with the actual steps necessary for analysis.

The set of tools used for applying the method comprising:

- a selection of the best open source software tools;
- representing some professional hardware generators and network analyzers licensed software.

The steps necessary for proper traffic analysis method allows the collection of statistical information IP network technology useful review. They are:

- configuration tools in the set used;
- traffic generation and testing;
- to obtain useful statistics about network traffic.

The method used both open-source software tools, free, which can be download from the Internet, hardware and software licensed professional.

The prerequisites followed in selecting open source software tools in the set were tested:

- Be very powerful even compared to similar commercial tools and already have very good references in benchmarks;
- Be as easy as possible to install;
- Have a good ergonomy and be easy to manage;
- Have an active and large community;
- Have no cost.

Even though some of the tools presented in our tutorials can be used on Microsoft Windows, they run better and increased security on Linux operating system.

Step by step description of open source software tools started from the premise that they can present very different levels of production, which can vary from basic scripts by software tools developed in a professional manner. The descriptions and information are included: hyper terminal application, term therapeutic application, advanced package management tools for Linux operating systems APT, the instrument software installation after compilation CheckInstall, Minicom serial communication program for Linux operating systems , installing the Microsoft fonts used, the use of MySQL commands, use PHP scripts, web browsers used for tests that require an Internet connection, etc.

The actual steps required to implement the method of traffic analysis, we tested a set of these software tools, test and still others will show you the steps necessary for analysis of traffic (including in terms of security) for each instrument in the test kit.

Figure 3 shows the main interfaces of network configuration (ifconfig, dhclient, ethtool, etc.), the instrument used to verify that the computer can be accessed via an IP network (ping), tcpdump [5], netstat , iperf / jperf [6], CDP.

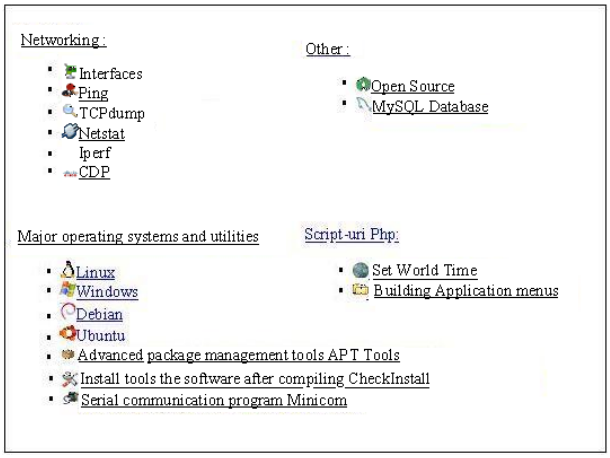

Figure 3. Configuration interfaces, operating systems, utilitaries, open sources, databases, PHP scripts

To generate traffic and testing applications using open source set of tools, shown in Figure 4 are software tools for analyzing traffic in IP networks (Wireshark [7], Ettercap [8], Snort & Base [9], Snort Inline & Base [10], Kismet, traffic monitoring (CACTI [11], PHP Weatermap), logging into the system (Php-syslog-ng, Rancid [12], Ipplan [13]), routing software (Vyatta [14] Quagga [15]), virtual private networking (OpenVPN) [16], software telephony (Trixbox) and emulation of links (WANem) [17].

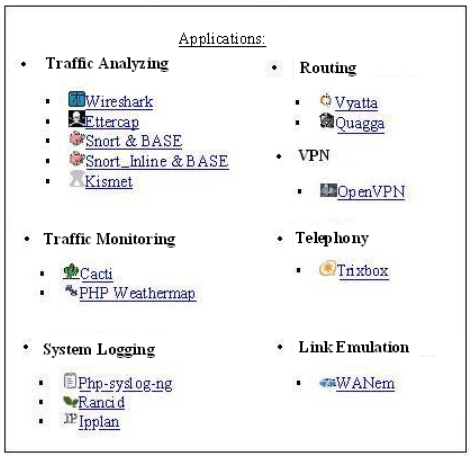

Figure 4. ATRAF-MPMTFL-P2 Software applications

Hardware professional licensed software, which are not part of the module are connected to the remote workstation and used to complete network statistics collected by the proposed method.

The method includes the steps necessary for a separate traffic analysis for the following four types of licensed software professional equipment:

Traffic generator and analyzer Spirent TestCenter SPT-2000A enables multi-user applications, while addressable multiple users of a test mode to increase efficiency of resource use device allows creation and execution of an extremely large number of tests complex and contains sequences of quick suggestions for reducing time to troubleshoot setup problems that may arise during the creation of new tests. SPT-2000A contains a large number of hardware and software, and chassis can be equipped with a variety of interchangeable modules. All chassis family of Spirent TestCenter equipment are compatible. All modules are easily operated remotely manageable via IP networks, to troubleshoot and replace.

Traffic test with Trend Multipro portable equipment is a test platform for Triple Play multiservice: IPTV, VoIP, Data, ADSL2+, VDSL2, QoE, MPEG, IP. This ensures fairness conduct tests for head-to-head operation between networking components that could be found for example in various converged networks, with multiple ways of making test performance and configurable services as required.

Digital pattern generator is PG3ACAB general purpose equipment that contains powerful tools for both work and production engineering. Generator emulation logic can be used as a stimulus for peripheral/ASIC, fixing/checking for confirmatory testing of large-scale production, small-scale testing products, and more generally for many other stimuli. When coupled with a Tektronix logic analyzer and / or a Tektronix digital oscilloscope, performing a complete test system.

TLA5202B logic analyzer is a portable device that combines high-speed timing resolution, fast state acquisition, long record time and sophisticated triggering circuit.

VI. RESULTS

By means of the traffic analysis module based on the proposed method, it was possible

to collect a large number of statistics about the network, such as for example:

- With open source software tools:
- For the traffic analysis:

• providing information about the data captured in the network and in the upper layers protocols, with Wireshark;

• using a software suite for attacks „man in the middle" within a local LAN network, with Ettercap;

• reading network traffic and display it on screen, with Snort, in sniffer mode;

• recording network traffic to a file, with Snort, in packet logger mode;

• recording network traffic according to security rules, with Snort, in IDS mode;

• using an intrusions prevention system, with Snort, in IPS mode;

• traffic analysis and security engine that displays logins generated by Snort IDS and send them into a database, with BASE;

• receiving and filtering of packets transmitted from the Netfilter Firewall, with Snort_Inline;

• detecting wireless networks with Kismet.

- To monitoring traffic:

• tracing the network bandwidth, used by the SNMP engine, using RRDTool, with CACTI;

• generating graphical maps of the load bandwidth network connections with PHP Weathermap.

- To log into the system:

• logins reading generated by a local server or remote workstations with Php-syslog-ng;

• automatic backup of the configuration of network devices and compare different versions of CVS (Concurrent Version System), with Rancid;

• IP address and DNS management via a very friendly Web interface, with Ipplan.

- For routing software:

•Traffic control for a wide range of standard network protocols such as those for: Routing: RIPv2, OSPF, BGP, Frame Relay or PPP encapsulation, network address translation (NAT) Protocol for redundancy (VRRP), DHCP server or relay, troubleshooting tcpdump, Stateful Firewall, with Vyatta;

• routing traffic through a set of "daemons", one for each routing protocol and a separate one called Zebra acting as manager kernel routing, with Quagga.

- To creating of virtual private networks (VPNs):

• building between two sites through SSL / TLS or pre-shared keys with OpenVPN.

- For telephony software:

• using a telephony packet, open source software based, for Asterisk PBX Voice-over-IP, with Trixbox.

- For link emulations:

• specific software to emulate the qualities of a link, to test the behavior of an application such as for example testing the remote possibility that an IP phone located in a low-bandwidth site to call the central site, with sufficient quality, with WANem.

- With some professional hardware equipment representing generators and network analyzers, with software licensed:

- To analyze the traffic performance:

• pentru măsurarea ratei de transfer, a întârzierilor şi a ratei de pierdere de cadre, conform RFC 2544, cu Generatorul şi analizorul de trafic Spirent TestCenter SPT-2000A şi cu echipamentul portabil de testare a traficului Trend MultiPro;

• to measure the transfer rate, latency and frame loss rate, according to RFC 2544, with the traffic generator and analyzer Spirent TestCenter SPT-2000A and the portable equipment for traffic test, Trend MultiPro.

- To analyze the conformance with IPSec standard:

• for ESP protocol layer 3 (IP Protocol 50), according to RFC 2406, with the traffic generator and analyzer Spirent TestCenter SPT-2000A;

• for ISAKMP (Internet Security Association and Key Management Protocol), used to establish security associations, according to RFC 2408, with the traffic generator and analyzer Spirent TestCenter SPT-2000A;

• for IKE protocol (Internet Key Exchange), used for automatic key exchange management through UDP port 500, according to RFC 2409, with the traffic generator and analyzer Spirent TestCenter SPT-2000A.

- That digital pattern generator:

• emulating as a stimulus for peripheral / ASIC, fixing / checking for maintenance, testing, production scale, small scale testing products, and more generally for many other stimuli, with digital pattern generator Moving Pixel Co. PG3ACAB;

- That logic analyzer:

• combining high-speed timing resolution, fast state acquisition, long record time and sophisticated triggering circuit with logic analyzer Tektronix TLA5202B.

The hardware and software platform module and the method of traffic analysis in networks with IP technology form a set of tools and a library of tests for measuring the dispersion of the values assigned to traffic on the various resources of communication networks with IP technology. General block diagram of the module is shown below:

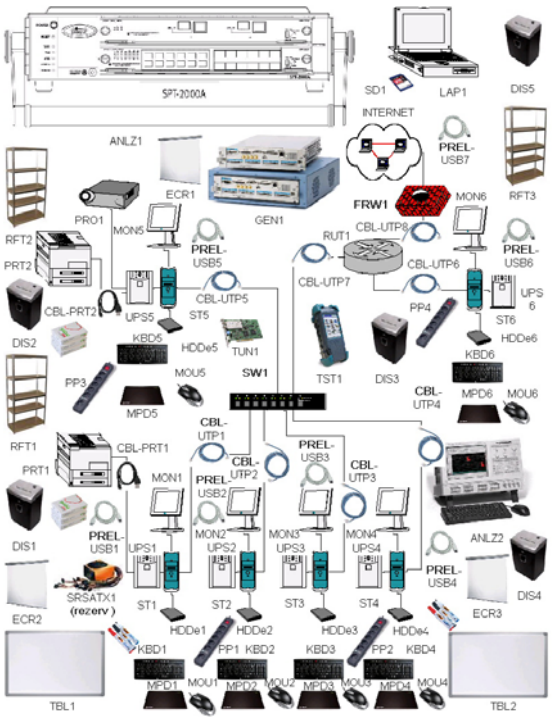

Figure 5. ATRAF -MPMTFL-P2
Hardware and software platform module

Legendă:
ST1 ... ST6 - Workstations 1 ... 6;
MON1 ... MON6 - Monitors 1 ... 6;
KBD1 ... KBD6 - Keyboards 1 ... 6;
MOU1 ... MOU6 - Mouse 1 ... 6;
MPD1 ... MPD6 - MousePad 1 ... 6;
HDDe1 ... HDDe6 - External HDD (USB) for data storage 1 ... 6;
UPS1 ... UPS6 - uninterruptible power supplies 1 ... 6;
TUN1 – Tv-Tuner 1;
SRSATX1 - Workstation Power Supply Unit ATX1 (rezervă)
LAP1 - Laptop 1;
SD1 SD Memory Card 1;
SW1 - Switch 1;
RUT1 - Router 1;
PRT1, PRT2 - Printers 1, 2;
CBL-PRT1, CBL-PRT2 - Printer Extension Cables 1, 2;
CBL-UTP1 ... CBL-UTP8 - UTP cables with RJ-45 connectors 1 ... 8;
PP1 ... PP4 - Multiple protection plugs 1 ... 4;
DIS1, ..., DIS5 - document shredders 1 ... 5;
RFT1 ... RFT3 - Metal racks 1 ... 3;
TBL1, TBL2 - Magnetic Tables 1, 2;
PRO1 - Projector 1;
ECR1 ... ECR3 - Projector screens 1 ... 3;
PREL-USB1 ... PREL-USB7 - USB Extension USB 1- 7;
ANLZ1 - Traffic generator and analyzer Spirent SPT-2000A 1;
TST1 - Portable Traffic Test Trend MultiPro 1;
GEN1 - Digital pattern generator Moving Pixel Co. PG3ACAB;
ANLZ2 - Logic analyzer Tektronix TLA5202B

VI. CONCLUSIONS

Module and method provides concrete opportunities to highlight the existence of those portions of the network where traffic values required beyond the capacity of processing and transportation network and other networks in other areas where the workload of resources in many cases does not exceed the modest values installed capacity of networks.

Method and the module contributes to the development of learning. The main news are made:

- the module allows to analyze adequacy of network management solutions through direct testing;
- the module is designed modular, to allow future development on emerging technologies and services;

the method can make a contribution to the development of new methods of optimizing resource allocation in communication networks with IP technology;

- the method has the ability to analyze network traffic in IP communications technology to extend research to other networks with different communications technology (ISDN / PSTN, GSM, VoIP, Eurocom, etc.).

After collecting network statistics, analysis of results of measurements made on the module based with the method application lead to finding new solutions to optimize network traffic measurement, which is reflected in reduced operating costs.

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DATA ERASURE ON MAGNETIC STORAGE

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Abstract: *User data is left is left on the hard drives removed from computers and storage systems, creating a data security vulnerability that many users are unaware of. This is mostly due the fact that normal "delete" or "format" commands leave data intact on a user computer. The cardinal rule of computer storage design has been to protect user data at all costs. Disk drives supply primary mass storage for computer systems designed to prevent accidental erasure of data. Techniques such as "recycle" folders and "unerase" commands are common ways that operating systems try to prevent accidental sanitization of user data. Deletion of file pointers is standard to speeds data writing, because actual overwriting of file data is far slower. These measures taken to protect and speed access to user data can make that data vulnerable to recovery by unauthorized persons.*

There is an urgent need for a capability to reliably erase data and prevent access to data from retired computer hard disk drives for security and privacy reasons. Data sanitization needs arise differently depending upon user application.

The current work presents standards for data erasure, most important methods of data sanitization of hard disk drives and presents how a customized method of data erasure can be implemented.

Keywords: *recycle, data sanitization, recovery, security vulnerability*

1. INTRODUCTION

When a computer is lost or disposed of, active and discarded data typically remains stored on its hard disk drive. Even if users "delete" all their files, they can be recovered from "recycling" folders or by special utility programs.

Data security has risen to be one of the highest concerns of computer professionals. There is a need for a capability to reliably erase data and prevent access to data from retired computer hard disk drives for security and privacy reasons. Data sanitization needs arise differently depending upon the user application.

2. COMPLETE ERASURE OF USER DATA

2.1 Known methods of "deleting" data. When you format or reformat a hard drive it doesn't erase the data on the drive – only the address tables. In a case where you have accidentally completed a format hard drive, a computer specialist may be able to recover most or all of the data that was on the drive.

Contrary to popular belief when a file is deleted from the computer or in Windows operating system when the recycle bin folder is emptied the actual data is not deleted. The default Recycle bin configuration for a Windows computer is to move the deleted files

to a folder named \Recycler\%SID%\, where %SID% is the SID(security identifier) of the currently logged on user. Every user on the system will have such a directory created the first time Recycle bin is used. As well, each user will have a hidden file called INFO2 created the first time the Recycle bin is used – its purpose is to keep track of the deleted file(s) /folder(s) original location, as well as file size and deletion time. When the Recycle bin is emptied, the INFO2 file is "deleted" for the logged on user along with the file(s) / folder(s) it referenced. These "deleted" INFO2 files can be recovered by conducting a search for the INFO2 file header.

2.2 Approved methods for data sanitization. There are several approved methods for data sanitization that satisfy legal requirements or meet stringent corporate or government secrecy requirements. Many of them physically destroy disk drives to prevent any further use. Another data security measure is encryption of user data. According to newly released data sanitization document NIST 800-88 4, acceptable methods include executing the in-drive Secure Erase command, and degaussing. These data sanitization methods erase data against recovery even using exotic laboratory techniques. Such sophisticated techniques involve signal processing equipment and personnel with knowledge of specific drive engineering details, and can even involve removing the components from the hard disk drive for spin stand testing.

Secure erase is recognized by NIST 800-88 as an effective and secure way to meet legal data sanitization requirements against attacks up to laboratory level.

Four basic sanitization security levels can be defined: weak erase(deleting files), block erase(overwrite by external software), normal secure erase(current drives), and enhanced secure erase. The CMRR(Central of Magnetic Recording Research) has established test protocols for software secure erase.

Block erase is most commonly used. While is significantly better than no erase, or file deletion, or drive formatting, it is vulnerable to malware and incomplete erasure of all data blocks. Example are data blocks reassigned by drives, multiple drive partitions, host protected areas, device configuration, device configuration overlays, and drive faults.

Normal secure erase is approved by NIST 800-88 for legal sanitization of user data up to Confidential, and enhanced secure erase for higher levels. Enhanced level has only recently been implemented, initially in Seagate drives, and these drives are under evaluation by CMRR.

In order to erase data using secure erase and enhanced secure erase methods NIST approved hdderase.exe, a DOS-based application developed by a team at CMRR that uses the secure erase command implemented in the firmware of ATA and SATA drives manufactured after 2001. The internal firmware secure erase command can access data that is no longer accessible through software, such as bad blocks.

2.3 Implementing a data erasure software. In order to make an application to erase data under an operating system you need to implement a block erase method. An important issue to take in account is the characteristics of the operating system the application is going to run under. The most secure operating system from this point of view are the Dos-based systems that allow the implementation of secure erase and enhanced secure erase standards. For an external software that runs under an operating systems the most obvious choices are Windows and Linux operating systems. Linux has an built-in command hdparm that reports if the hard disk has hpa and dco zones and offers the option to erase these zone on disk. Also you can erase the mbr sector using this command. Windows offers the fewest option for a secure erase of hard drive because the access to the ATA registries, which permits mbr erasure and dco and hpa removal, is restricted under Microsoft based operating systems. To compensate this problem a software written under windows can be used complementary with the DOS utility hdderase in order to first remove the hpa and dco zones before proceeding to a block erase of data under windows.

Another issue to take in account when choosing the operating system is the programming environment to work in. Linux offers gcc as a compiler and builder of a project. In Windows we can work with visual studio suite. In most of the cases sources written in one medium can be recompiled in the other medium.

After electing the programming environment, you have to decide how the application will manipulate the hard disk. One option is to erase the hard disk as one logical partition one time and another option is to allow the user the possibility to select a logical partition and erase data only on that partition.

Another issue to decide is the overwriting method to be used. The central part for this type of data erasure is the standard DoD 5220. Many commercial software packages are available using variations of DoD 5220, making as many as 35 overwrite passes. But in today's drives, multiple overwrites are no more effective than a single overwrite. Off-track overwrites could be effective in some drives, but there is no such drive external command for a software utility to use. And even three overwrites can take more than a day to erase a large capacity hard disk drive. DoD 5220 overwriting has other vulnerabilities, such as erasing only to a drive's Maximum Address which can be set lower than its native capacity; not erasing reallocated(error) blocks; or miss extra partitions.

The Gutmann method is an algorithm for securely erasing the contents of computer hard drives. It does so by writing a series of 35 patterns over the region to be erased. The selection of patterns assumes that the user doesn't know the encoding mechanism used by the drive, and so includes patterns designed specifically for three different types of drives. An overwrite session consists of a lead-in of four random write patterns, followed by specific patterns 5 to 31 executed in a random order, and a lead-out of four more random patterns. Each of the patterns 5 to 31 was designed with a specific magnetic media encoding scheme in mind, which each pattern targets.

Compared to other overwriting algorithms the Gutmann method offers the best security but is the slowest and in the light of the fact that one-pass overwriting is considered enough, it it less and less preferred. Instead programmers choose to implement a one to three pass method by overwriting the disk with random bit patterns or predefined bit patterns. It usually preferred to use a defined bit pattern as the last overwriting pattern in order to be able to verify that the overwriting rendered the expected results. The most simple bit pattern would a one-pass zeroize of the entire hard disk.

Another aspect of the security of the application is the possibility to modify to method file and the jurnal file. The method file contains all the overwriting methods that the user can choose from. The jurnal file contains all the events that the application registered from the moment the user prompted the overwriting. It is crucial to impede an attacker to modify this files, so the best way to protect them is to encrypt the files with a password known only to the user.

Lastly, the application could permit a learning mode in which the overwriting doesn't really modify the data on the disk but merely shows the user how the sectors of the drive would actually look if the overwriting would be real.

3. CONCLUSIONS

Data sanitization of hard disk drives has become an important matter from the aspect of security and privacy of user data. Regulations and standard are in place to ensure and enforce proper erasure of data user . Secure erase and

enhanced secure erase built-n commands in hard drives provide the most secure methods for data sanitization but are difficult to customize. An external application implemented to run under a chosen operating system can provide a very good level of security regarding the data erasure if used complementary with standardized tools such as hdderase.

Even though the overwriting standards targeted mainly the hard disk drives they could very well be implemented for usb mass storage drives, card memory devices and tokens.

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DESIGN OPTIMIZATION OF INDUSTRIAL WIRELESS NETWORK USING GENETIC ALGORITHMS

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Abstract:

Transferring information over long distance using wireless communication has become a topic of great interest in our days and is widely used in all areas, from educational to military or from medical to industrial. The quality of information is influenced by several factors and they differ according to the environment of the domain of interests.

In this paper will be shows how to optimize the design of an industrial wireless network using genetic algorithms theory. In this case, the authors discuss about a wireless system sensor located into an industrial furnaces used for monitoring and controlling of temperature and transmitting data to a server through an access point. Using genetic algorithms we want to find the optimal way for placement of access point so that data is transmitted without any problems occur. Is desirable for us to find, using genetic algorithms, and the best place for any equipment so the effect of interferences to be minimal. Interferences that can affect the quality of information transmitted through wireless communication can be internal noise (the equipment itself) and also external noise and other fields. The authors are using genetic algorithms in solving the main problems caused by external noise on the signal.

The advantage of using genetic algorithms in this kind of application, for optimizations of parameters, refers to the fact that they are modular, they are good for noisy environment, and there is always solution that gets better with time.

Mathematics Subject Classifications 2010: *11Y16, 68Q25, 68T01.*
Keywords: *genetic algorithms, indoor radio communication, optimization, wireless sensor network.*

1. INTRODUCTION

In this paper is presented an optimization problem, using genetic algorithms, regarding the distance in wireless communications network so that the path loss to be minimal. This way we want to identify the maximum distance that can be fixed between an access point and a wireless sensor installed on industrial equipment so that data transmitted to the server to reach the optimal conditions.

In this case, the parameters are encoded by the genetic algorithm problem in a number of "chromosomes". In practice the usual case of several parameters, the string contains multiple substrings called "gene". Each chromosome represents one possible solution proposed to solve the problem.

Genetic algorithms perform specific operations on functions within the criteria of a reproduction process governed by the following genetic operators: selection, crossing and mutation to optimize.

In this way, starting from a random population of chromosomes, each new population generated by reproduction and function replaces the previous generation, moving towards optimum criterion, it also provides solutions to the problem originating in getting better.

For a better understanding of how this genetic algorithms used for optimization are working and which is the order of processes we can look to next figure.

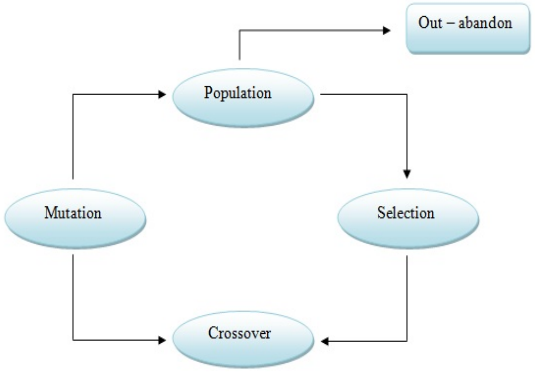

Fig. 1. Genetic algorithm cycle

These steps will repeat until we can see that the population there is a new format that highlights the chromosome. For a chromosome to be considered the dominant one the winner of the cycle, its representability should be greater than 70%, the best value is around 95%.

2. GENETIC ALGORITHM IMPLEMENTATION

As it was said before, the problem of optimization refers to the distance between two points. Those two points represents the industrial equipment, industrial furnace, and a router which helps us communicate to the end user. It also should be mentioned that the industrial furnace has a wireless sensor that measure the temperature and can send data to the server; such a design can be observed below.

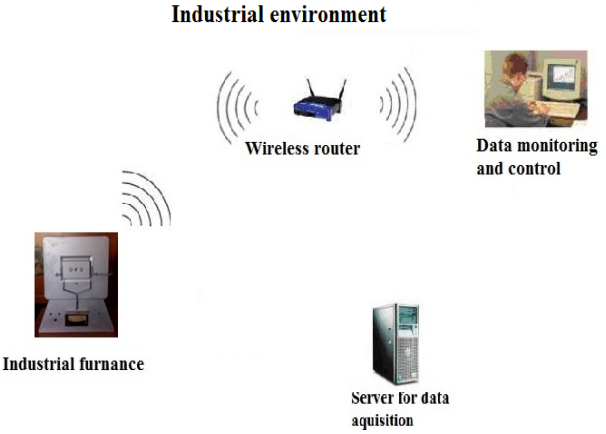

Fig. 2. Design of the industrial network

The reason that the authors of this paper decided to develop this algorithm for optimization of distance represents the interferences that are in industrial environment. It is desirable that the path loss to be minimal and the distance to be maxim. The function that represents this hypothesis is:

$$P_L = \frac{\lambda^2}{(4\pi)^2 d^2} \quad (1)$$

where P_L – represents the path loss in indoor data transfer, λ – represents broadband and d – is the distance that we want to optimize.

To implement the genetic algorithm to explain the way that solve our function we chose a population of 8 chromosomes that will be represented in 4-bit of data.

The first steps, after representing the chromosomes, the value of the function should be calculated, we have this value in table 1

Tabel 1.

Simbol	String	Value	Function $F(S_i)$
S_1	0001	1	63,3900
S_2	0010	2	31,6950
S_3	0100	4	15,8475
S_4	0110	6	10,5650
S_5	1000	8	7,9237
S_6	1010	10	6,3390
S_7	1100	12	5,2825
S_8	1110	14	4,5279

After this, we have to determine the probability of selection (p_i) and also the cumulative probability (C_{pj}). The formulas for this are:

$$p_i = \frac{F(s_i)}{\sum_1^8 F(s_i)} \quad (2)$$

$$C_{pj} - C_{pj-1} + p_j \quad (3)$$

For making this calculation the sum value is needed, and this is 145,5706. And also for making the selection we need to generate 8 random numbers, in the interval [0, 1]. For this a LabVIEW program was done, so that the numbers to be generated automatically, and to ensure uniform coverage of the interval and variety. All the calculated values till now are in table 2.

Tabel 2.

	p_i	C_{pj}	Random number
C_1	0,435459	0,435459	0,5375
C_2	0,217729	0,653188	0,3628
C_3	0,108865	0,762053	0,7981
C_4	0,072576	0,834629	0,5728
C_5	0,054432	0,889062	0,4831
C_6	0,043546	0,932608	0,8136
C_7	0,036288	0,968896	0,9975
C_8	0,031104	1	0,4502

Now we will compare the value for C_{pj} with the random numbers (tabel 3) and after that we gone have a new list of chromosomes. The new list is presented in tabel 4 also with the relation between the new chromosomes and the initial value. Those chromosomes are going to poarticipate to the next process, crossover.

Tabel 3

C2=0,3627	< 0,4355 >	C8=0,4502	C'_1
C4=0,5727	< 0,6532 >	C3=0,7980	C'_2
C4=0,5727	< 0,7621 >	C3=0,7980	C'_3
C6=0,8135	< 0,8346 >	C7=0,9975	C'_4
C6=0,8135	< 0,8891 >	C7=0,9975	C'_5
C6=0,8135	< 0,9326 >	C7=0,9975	C'_6
C6=0,8135	< 0,9689 >	C7=0,9975	C'_7
C7=0,9975	< 1,0000 >		C'_8

As is shown in the table before C_1 and C_7 appear ones, C_4 two times and the dominant is C_6 with four representations. So, this way is visible that we start to have some strong representant.

The dominant accents appear each step, but things can change any moment because of the diversity of the model.

Tabel 4.

C'_1	C2	**0,0467**
C'_2	C4	**0,1859**
C'_3	C4	0,4062
C'_4	C6	0,4216
C'_5	C6	**0,2436**
C'_6	C6	0,3761
C'_7	C6	0,4812
C'_8	C7	**0,1804**

The condition that those chromosomes should satisfies is that their probability to be smaller than the probability of the process, p_c=0,25. Those probabilities are going to be generated randomly, as the ones before. This step is also shown in table 4, the bold numbers

are the value for the chromosomes that are going to participate to crossover.

For this operation we are going to have two pairs of chromosomes, C'_1 and C'_2 the first one and C'_5 and C'_8 the second. For each pair we need a number for the bit where the cross is goin to take place. So for the firs pair the crossover point was 2 and for the second was 3 the modification is going to be illustrated in figure 3.

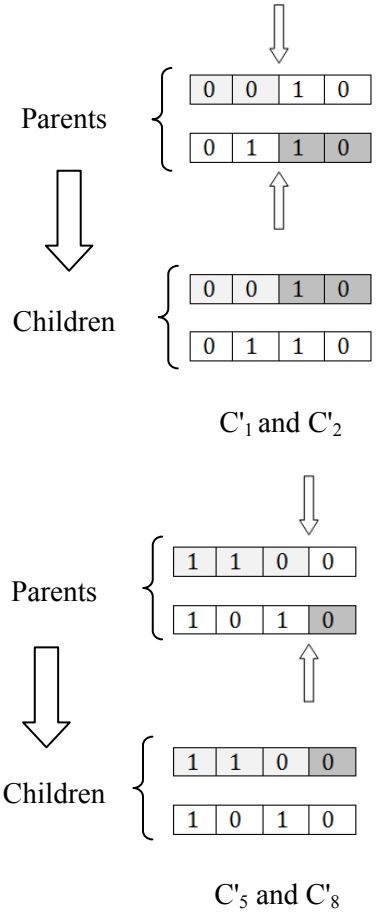

Fig. 3. Crossover process

Finishing this we have the new chromosomes that are going to go to the next level. We can see that we have somehow a dominant chromosome C_6, but we have to see what happened next.

In table 5 we have the new list of chromosomes, and the probability of selection calculated for current values. The number colored in red, represents the chromosomes that fulfill the condition for mutation. This means that their probability is smaller then the process probability, p_m=0,06.

Tabel 5.

C4	10,5650	0,111111
C2	31,6950	0,333333
C4	10,5650	0,111111
C6	10,5650	0,111111
C7	5,2825	**0,055556**
C6	10,5650	0,111111
C6	10,5650	0,111111
C7	5,2825	**0,055556**

Chromosome C_7 is going to participate to the mutation process. Is the only one that has the probability smaller then p_m.

For finishing this process we should know the number of the bit position for mutation. This number is going to be generated also randomly, and is 2 so the second bit is going to change. The scheme for this is illustrate in figure 4.

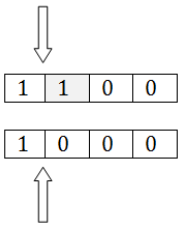

Fig. 4. Mutation process

Because after one cycle no chromosome is dominant the procedure should be repeated. The percentage of C_6 the most representative is only 60% that is not good enough.

After performing one more time the new result determine that C_7 is the most dominant chromosome, the percentage being 87,5. This is a representative value having the fact that the population that we discussed about is not to large.

After making the same two chromosome cycles as the one descried before, starting with a population of 50 chromosomes of 7 bits of data each, it can really see a dominant, its share being 75%. Chromosome that correspond to the value of 74 meters of

distance. This value is good considering that the maximum is 98 meters.

To verify the results, the calculations were redone for the same population only the random numbers that have influenced evolution were changed, using the same program. After conducting 10 different experiments could be observed that the distance is approximately the same for several cases or around the same values. So the best distance that produced lest loss is around 74 – 78 meters.

To ensure the accuracy of the information obtained we went to solve the algorithm through programming languages. Given that the most popular programming language that is used to solve genetic algorithms is Matlab, I went to developing such a program. For the beginning the program created can analyzes only six chromosomes, each having three bits. In this way is desired to see if the accuracy of the assessment process is ensured, but also the evolution of the results.

3. FUTURE WORK

The first thing that the authors of this paper want to develop is an automat program that can be used to solve this kind of algorithm.

As soon as possible the complete form of the model will be test in Matlab. This representing the whole population of 50 chromosomes that correspond to distances considered of interest. And also we have the idea to try to develop a program that can read the chromosomes from another sheet, a list of predefined values. This way is going to be much easier to modify the characteristics of any kind of population.

Also the genetic algorithm model is going to be test using the graphical programming environment LabVIEW.

After verifying the model through this two programming languages there is any doubt about its accuracy. This way we can say that the optimal value that we have is the best in this case.

4. CONCLUSIONS

Genetic algorithms represent a simplistic way that some parameters can be optimized and is also a way that each time gives a better value for the problem that you want to solve using them.

Optimization of mathematical functions that can describe various physical quantities, using genetic algorithms leads to more efficient systems. The achievement of equipment that can work at full capacity is one of the most important criteria that are used by clients for the analysis of a product in our current market conditions.

ACKNOWLEDGMENT

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THE APPRAISAL OF OIL PRODUCTION USING THE METHOD OF REGRESSION

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Abstract: *The present work presents the identification of the temporal series character of the dataset of production after an analysis of these recorded and stored data in the oil scaffolds from Romania.The exploitation development of these data regarding the production, stored in a database have the main purpose the appraisal of the moment of deposits' economic production.*

Mathematics Subject Classifications 2010: *62P30, 65Y04, 68P15, 68U35, 74G15, 93A30, 97R50.*
Keywords: *database, deposit, production, scaffold.*

1. INTRODUCTION

Data warehouse technology is a new way to use large data collections, collections that can accumulate in the activity of a firm over a longer period of time.

Formed initially as a technique for obtaining economic information useful in conducting market analysis, marketing and business development forecasts of different markets and in different contexts, data warehousing technology with other technologies developed specific (OLAP, Data Minig).

Today there are tendencies to introduce this technique and analysis of data obtained in industrial processes.

2. PRODUCTION DATA PROCESSING

The activity of oil extraction and/or natural gas is a data warehouse using their natural application because the process itself involves regular collection and storage of data which can be used not only for understanding the status of a probe at a given time but also to predict its growth and to prevent further failures or problems of maintenance.

The advantages of such an approach are given strong integration of data from points located, in terms of geographic location, distance and manually processed to obtain the additional information from the information production can be a cumbersome process and, practically imposible.

As a solution for production data analysis, we had chosen a long time, so tend to judge the well/reservoir and can be expected to achieve economic production or when production ceases.

To do this, first it was necessary to develop a data mining methods of production are stored in the data store in order to estimate the time of deposit to achieve economic production.

This method is based on the following elements: a reservoir quickly reach the point of maximum production, and most of the deposit operation is achieved by pumping the deep, while the deposit is the contraction of production; production variance analysis over a long period of time may give an indication of the trend of evolution of the probe or deposit at that time, a trend that can be extrapolated to estimate when production ceases or the probe of the probe to achieve economic production.

Of course, these estimates are much closer to reality as the period under review is higher and the current work such estimates must be corrected periodically to take into account the analysis of all factors of influence on production.

Production data in the data store have taken the character of time-series affected by "noise" because it has a sensor that produces periods and periods when it is stopped for various reasons: accidents, instrumentation, interventions, etc.

The data stored over a relatively large periods of time (5 10 years or more) they will contain information on developments in the probe and the reservoir over time.

It is known that any oil deposit in full production for a limited period of time, followed by a decline in production becoming more intensive extraction of oil from the deposit until it becomes uneconomic.

This time corresponds to achieve final recuperare. Factorul final factor determining recovery of the deposit based on estimated production, amounting to not always correspond with reality because they made assertions based on the deposit that are not verified.

Based on these aspects, we intend to develop a model for production data processing to extract new information.

If you represent a production wells over time, it will have on the interval considered as a cloud of points that may suggest a particular function of distribution (fig.1.).

Because we do not know a priori law of development of production while (size may depend on many factors), we try to apply polynomial regression.

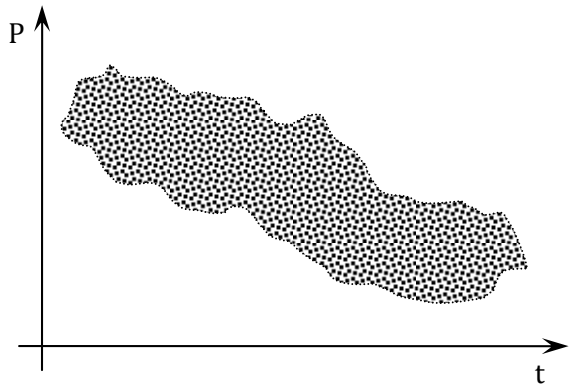

Fig.1. Distribution function for the time evolution of the production.

It will approximate the cloud of points with three regression functions: linear, quadratic, respectively, cubic.

Whether in the form of daily production P=F(t), expressed as discrete pairs (Pi, ti).

We consider three possible functions for the approximation, namely:

$$F_1 = a_1 \cdot t + b_1 \quad (1)$$

$$F_2 = a_2 \cdot t^2 + b_2 \cdot t + c_2 \quad (2)$$

$$F_3 = a_3 \cdot t^3 + b_3 \cdot t^2 + c_3 \cdot t + d_3 \quad (3)$$

those coefficients which are determined by the method of least squares.

Knowing the three functions for a probe, we calculate the correlation coefficient between the known values and the values *Pi* and the values *Fk (ti)* and is chosen as a model for defining such a function to probe the correlation coefficient is maximum.

$$r = \frac{n \cdot \sum_{i=1}^{n} F_i^k P_i - \left(\sum F_i^k\right) \cdot \left(\sum P_i\right)}{\sqrt{\left[\sum F_i^k - \left(\sum F_i^k\right)^2\right] \cdot \left[\sum P_i^2 - \left(\sum P_i\right)^2\right]}} \quad (4)$$

where : F_i^k - is the production in the moment ***i***, estimated with the regression function *k* (k=1,2 sau 3) P_i – is the production realized by the derrick in the moment ***i***.

Knowing the function F characterizing the production of crude oil for a longer period of

time we can make predictions on how future development of the probe (Fig. 2).

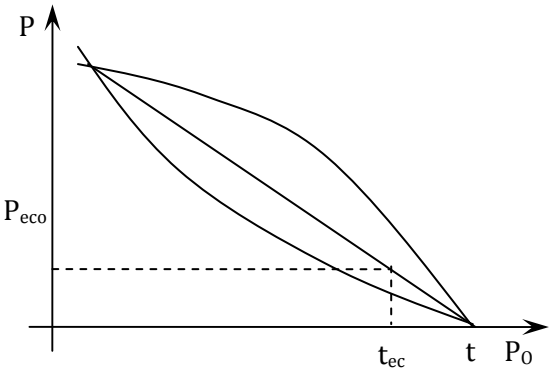

Fig. 2. The trend of development of deposit.

Extrapolating outside the range of known function will initially be able to estimate when the economic threshold is reached by operating the probe (Pec) or the point where he can no longer extract oil from the well (P0), regardless of the funds invested in it. If we look where F (t) = Pec, we obtain $t_{ec} = \frac{P_{ec} - b_1}{a_1}$ for the case with a linear function approximation. For the case $F(t) = 0$ we obtain $t_0 = -\frac{b_1}{a_1}$ all valid relation to the use of linear regression function. If we analyze the case of an aproximation parabolic function for the equasion $F(t) = P_{ec}$

we obtain :

$$t_{ec} = \min\left(\frac{-b_2 \pm \sqrt{b_2{}^2 - 4 \cdot a_2 \cdot (c_2 - P_{ec})}}{2 \cdot a_2}\right)$$

and for the case
$F(t) = 0$
we obtain :

$$t_0 = \min\left(\frac{-b_2 \pm \sqrt{b_2^2 - 4 \cdot a_2 \cdot c_2}}{2 \cdot a_2}\right),$$

where: P_{ec} - represents the economic output of the probe, that threshold level of production that ensure production and delivery costs;

t_{ec} –is the appropriate time is to achieve economic production. Since the elapsed time measurement begins at a time considered time zero, teak is the amount estimated to achieve economic production level;

t_0 - is the estimated time until all of the probe, ie until the probe does not allow any costs associated with oil extraction operation.

That prediction, made for a probe, has its importance, but is not relevant to assess the deposit progress.For the whole trend of the deposit, in terms of production, production will have to examine all of the deposit period under review. Practically, considering that the deposit is exploited through the hole and I have records of production of these wells M in the period analyzed, we generate a cumulative time series.

$$P_i = \sum_{j=1}^{M} P_j^i \qquad (5)$$

where, P_j^i j is the probe output for the period *i* (in this case the period and may be a day or a longer period of time: one month or one year). Subsequently, these data are processed in a similar way, by determining a function F(t) to approximate the time evolution of the deposit (Fig. 3).

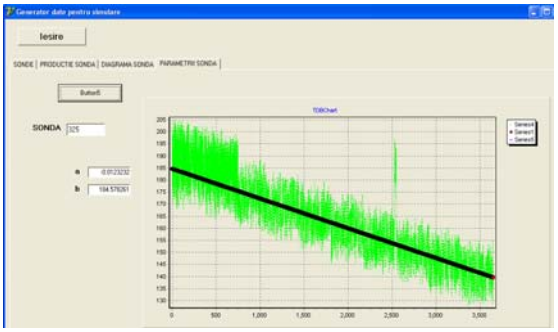

Fig.3. Evolution in time of the deposit.

The proposed analytical method is valid for wells and reservoirs in exploiting deep-sea pumping system as a reservoir from which most wells produce free rash has not entered the phase of decline.

In this case, the daily production wells depends on technical parameters and economic factors affecting production (maintenance of high oil prices may lead to limitation of production, even if the deposit could produce more).

To check the accuracy of the method noted above, a simulation was done because there were actual production data for a long enough period.

Thus, the corresponding data structure data warehouse was implemented using MS Access DBMS's, and to generate test data and analysis was done using an application development environment of Delphi.

MS Access DBMS's choice was dictated by the necessity of obtaining an application to run on machines with average performance.

Initially we tried using the Oracle DBMS, which, however, for the purposes of this work, has proved ineffective because they require special high-performance hardware to function properly in terms of speed of response to user needs.

It was taken account of the fact that in this work to implement a data warehouse itself but is developed and tested data structures characteristic of a data warehouse for demurrage and specific data processing methods.

Simulation was done by generating fictitious production database for more probes, data generated in such a way as to simulate a linear distribution, a parabolic, ie a cube.

Production data were generated as random data that falls within a given range of values.

Specified range of values was determined by analyzing the production values obtained at OMV Petrom, Buzau branch for small intervals of time (three months).

Algorithms for generating test data are presented in the sequence of Pascal code below:

```
{procedure for generating test data according to a linear variation}
procedure TForm1.Button3Click(Sender: TObject);
var sonda,an,luna,zi,zile,cod:integer;
    Pbrutmax,Pbrutmin,Pbrut,Pnet,Apa:real;
    Rmax,Rmin:integer;
    data,s:string;
begin
  val(edit1.Text,sonda,cod);
  val(edit2.Text,Pbrutmax,cod);
  val(edit3.Text,Pbrutmin,cod);
  val(edit4.Text,Rmax,cod);
  val(edit5.Text,Rmin,cod);

ADOTable2.TableName:='PRODSONDA_'+edit1.Text; ADOTable2.Active:=true;
   Randomize;
   for an:=2000 to 2009 do
    begin
      for luna:=1 to 12 do
       begin
         case luna of
           1:zile:=31;
           2:zile:=28;
           3:zile:=31;
           4:zile:=30;
           5:zile:=31;
           ..............................
  .....................................................
  end;
```

Interface application using the above procedures is shown in Figure4.

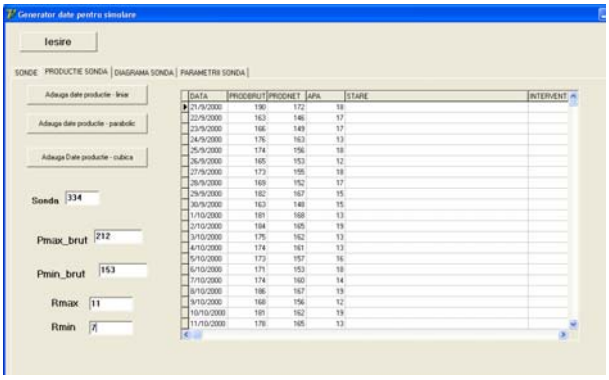

Fig. 4. Application interface for generating test data.

To generate test data for a probe should be specified as input the maximum gross production, ie respectively the minimum and maximum oil and minimum water ration.

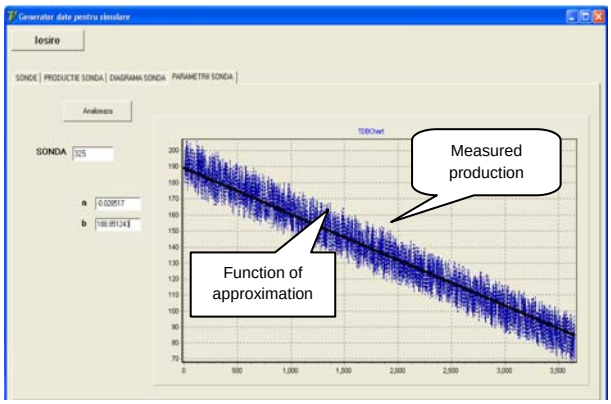

Fig. 5. The result of data analysis.

Fig.5 presents the result of production of a probe analysis using linear regression.

We note that production data distribution leading to a linear function approximation.

Obviously, the results are only a small part of what can be achieved by processing the data, but the workload involved exceeds the possibilities of a single person.

3. CONCLUSIONS & ACKNOWLEDGMENT

In conclusion, I believe that the results represent only a small part of what can be achieved by studying the problem of applying data warehouse technology in the oil industry.

Analysis of technical data can be correlated with economic analysis thus yielding new information on the efficient operation, so a certain wells and the entire deposit, or other information of interest for the decision management in the institution that exploits the deposit.

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THE SECURITY CONTROL OF THE INFORMATIONAL SYSTEMS

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Abstract: *In the present work there are presented the elements connected to the logical control, the identification, authentication and logical access to the informatics resources regarding the assurance of the informatics systems' security as well as the access to the systems, programes, and data only for the authorised users from the institution given as example.*

Mathematics Subject Classifications 2010: *68M12, 68M14, 90B20, 94C12.*
Keywords: *informatics system, control, procedure, access, information.*

1. INTRODUCTION

Security of information of any kind on the Internet and the first business information, is one of the barriers to electronic commerce development.

Processes to ensure the security of information systems function to protect systems against the use, publication or unauthorized alteration, destruction or loss of stored information.

Information systems security is ensured by logical access controls, which provide access to systems, programs and data only to authorized users.

2. CONTROL OBJECTIVES

Logical control elements that provide security systems are:

- data confidentiality requirements,
- the control authorization, authentication and access,
- user identification and authorization profiles,
- setting information required for each user profile,
- the control of encryption keys,
- incident management, futher measurements raport
- protection against virus attacks and prevention,
- firewalls,
- centralized security management systems, software,
- user training,
- methods of monitoring compliance with IT procedures, intrusion testing and reporting.

The organization must have an information security policy that covers:

- staff responsibilities,
- powers of security,
- clarification of data and security levels,
- control (audit) of national security.

Security policy relates to all employees, ie:

- internal standards and principles on security and, at the coarse level, by group (functions, departments) work,
- the code of ethics for employees and their preparation.

Ensuring security of information systems through the control provides security measures:

- including information about risk assessment at the organizational level of information security design,
- implementation and updating IT security plan to reflect changes in organizational structure;
- assessing the impact of changes IT security plans, and monitoring of security procedures,
- alignment of IT security procedures of the organization's general procedures**.**

Identification, authentication and access

- Logical access to computer resources should be restricted by the implementation of adequate identification, authentication and access by creating a link between users and resources based on access rights.

Secure online access to data

- In an online IT environment procedures to be implemented in accordance with the security policy, which requires security access control access based on individual needs, addition, alteration or deletion of information.

Managing user accounts

- Management organization must establish procedures to allow quick action on the creation, assignment, suspension and cancellation of user accounts.
- A formal procedure in relation to the management of user accounts must be included in the security plan.

Checking user accounts by management

- Management should have a monitoring procedure to check and confirm access rights periodically.

Checking user accounts to users

- Users must perform regular checks on their own accounts in order to detect unusual activities.

Security surveillance system

- Computer system administrators should ensure that all security-related activities are recorded in a diary system, and any indication of a potential security breach must be reported immediately to the persons responsible.

Data Classification

Management should ensure that all data are classified in terms of degree of privacy, a formal decision by the data holder.

Even data that does not require protection should be classified in this category by a formal decision.

Data should be reclassified in terms of modifying the degree of confidentiality.

Centralize user identification and access rights

Identification and control of access rights must be made centrally to ensure consistency and efficiency of global access control.

Reports on violations of system security

System administrators must ensure that activities that may affect the security of the system are recorded, reported and reviewed regularly, and incidents involving unauthorized access to data are resolved Force.

Logical access to information should be granted based on stringent needs of the user (it must have access only to information which is necessary).

Incident Management

Management should implement procedures for managing system security incidents so that the response to these incidents to be efficient, quick and adequate**.**

Confidence in third party

The organization shall implement procedures to ensure control and authentication of third parties with whom they come into contact with the electronic media.

Authorization of transactions

Organization's policy should ensure implementation of controls to verify the authenticity of transactions, and user ID that initiated the transaction.

The system must allow transactions can not later be denied by any one participant.

This involves implementing a system of confirmation of the transaction. Sensitive information should be submitted only considered secure communication channel between the parties, that does not allow interception of data.

Protection of security functions

All functions of the organization for security must be protected in particular, to maintain their integrity. Organisations must be kept secret for security procedures.

Encryption key management

The leadership must define and implement procedures and protocols for the generation, modification, cancellation, destruction, certification, encryption keys used to protect against unauthorized access.

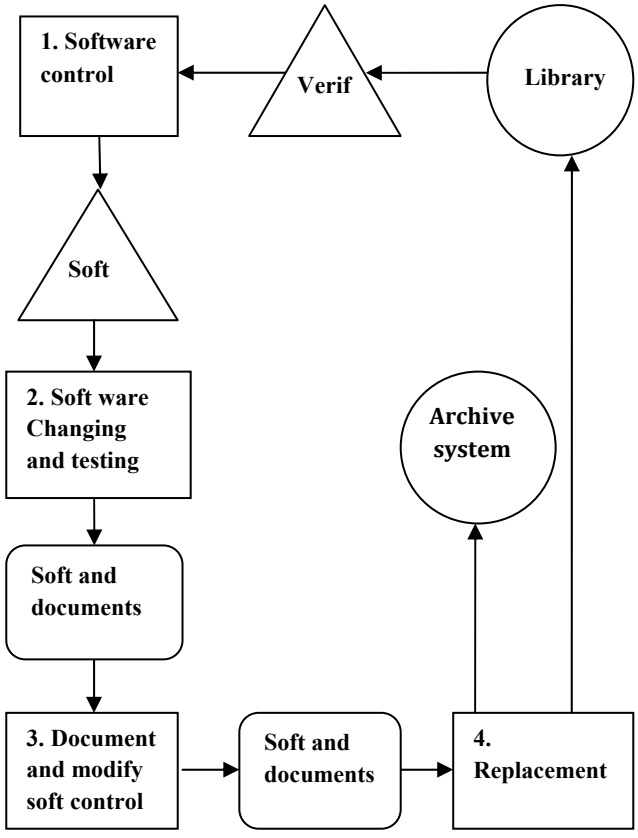

Fig.1. Protecting a system against viruses

Prevention, detection and correction of destructive programs

In order to protect the system against destructive software (viruses), have implemented a procedure that includes prevention, detection, action, correction and reporting of incidents of this kind.

Limits of a firewall

- restricts access to some services block external low protection for attacks from inside
- low protection against viruses,
- reduces the speed of communication with the outside,
- poor reliability due to centralization

Users' Authorization

a. Identification: PC to recognize a potential user of the system,

b. Authentication: establishing the validity of the identity function claimed ;

c. Authorization: user recognized and permitted access to system resources.

Access control

The risk of an unauthorized access refers to:

- reducing privacy,
- data theft,
- unauthorized disclosure of information,
- reducing data integrity,
- interruption of the system.

Control access to public environments using firewalls require access control policy between two networks and we show that:

- the whole data traffic passing through it,
- passing is allowed only as authorized by local security policy,
- the system itself is immune to penetration;
- communications monitoring TCP / IP,
- can record all communications,
- may be used for encryption.

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THE PROTOCOL MODEL FOR THE CONGESTION CONTROL

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Abstract: *The current Internet allows applications to use the network with arbitrary data rates and congestion response, potentially in a harmful way. Protection of the public network may not be a practically important problem when the majority of Internet applications uses TCP. However, it becomes serious with the growth of delay sensitive applications such as streaming media, which often prefer UDP over TCP as their transport protocol choice. A non-TCP protocol is called TCP-friendly when it yields the same throughput as traditional TCP. TCP-friendly protocols are generally used for multimedia/real-time applications. This paper proposes a TCP-friendly protocol model for the streaming media based on Additive Increase / Multiplicative Decrease Control algorithm (AIMD) .*

Key words: Internet, *TCP, congestion, protocol, network.*
MSC 2010: *68M10.*

1. Introduction

Network congestion is characterized by presence of a large number of packets (load) being routed in all or portions of the subnet that exceeds its link and router capacities (resources) resulting in a performance slowdown

A network is considered congested when too many packets try to access the same router's buffer, resulting in an amount of packets being dropped. In this state, the load exceeds the network capacity. During congestion, actions need to be taken by both the transmission protocols and the network routers in order to avoid a congestion collapse and furthermore to ensure network stability, throughput efficiency and fair resource allocation to network users. Indeed, during a collapse, only a fraction of the existing bandwidth is utilized by traffic useful for the receiver. Congestion collapse is considered, in general, as a catastrophic event. However, congestion itself is associated with different properties, depending on the characteristics of the underlying networks, the mechanisms of the transmission protocols, the traffic characteristics of the contenting flows, the level of flow contention, and the functionality of network routers. Therefore, the impact of congestion may be temporary and easily controllable; or it may be catastrophic. Consider, for example, a high speed network which hosts a number o competing flows that increases or decreases. The window of each flow also increases and decreases. However, unlike the traditional networks, the time it takes for the flows to exploit the available bandwidth is certainly longer; the amount of loss upon congestion is certainly higher; and the duration of congestion itself throughout the overall communication time may be relatively smaller. Since the nature of acceptable congestion cannot be prescribed or even accurately defined in general, congestion control becomes a complex task. Furthermore,

complexity increases due to the multipurpose-task of congestion control algorithms. They need to control congestion and avoid collapses, maximize bandwidth utilization, guarantee network stability, and ensure fair resource allocation. Considering the network as a black box that only provides a binary feedback to network flows upon congestion, shifts all the burden to end users and calls for solutions that are more generic and perhaps less responsive. That is, a binary congestion signal does not reflect the particular network state. Each sender operates independently and goals to adjust its rate (or window) in a manner that the total bandwidth of the network will be expended fairly and effectively.

For congestion detection we can utilize two technique:

- Notification from packet switches (routers).
- Infer congestion from packet loss:
    - Packet loss can be used to detect congestion because packet loss due hardware failure is very rare.
    - Sender can infer congestion from packet loss through missing acknowledgments.
    - Rate or percentage of lost packets can be used to gauge degree of congestion.

Congestion control methods:

- Traffic Shaping:
    - Heavily used in VC subnets including ATM networks.
    - Avoid bursty traffic by producing more uniform output at the hosts.
    - Representative examples:Leaky Bucket, Token Bucket.
- Admission Control:
    - Used in VC subnets.
    - Once congestion has been detected in part of the subnet, no additional VCs are created until the congestion level is reduced.
- Choke Packets:
    - Used in both datagram and VC subnets.
    - When a high level of line traffic is detected, a choke packet is
    - Sent to source host to reduce traffic.
    - Variation Hop-by-Hop choke packets.
- Load Shedding:
    - Used only when other congestion control methods in place fail.
    - When capacity is reached, routers or switches may discard a number of incoming packets to reduce their load.

2. Goals and metrics

The congestion window determines the number of packets that can be outstanding at any time. That is, the number of packets that can be sent without having received the corresponding ACK packets. It is incorporated into the transport layer and controls the number of packets put into the network. The rate describes packets per second or bits per second. The window or rate can be dynamically adjusted as the total load on the system changes, however, the former is strictly based on ACKs. A cycle is the phase between two seriate feedbacks of 1 (indicating congestion). Hence, a cycle consists of one decrease step triggered by congestion and a number of additive increase steps. A step describes a single window adjustment in response to a single feedback (either 0 or 1). The system is in an equilibrium state, when resource usage of all flows in a bottleneck is balanced. AIMD-based congestion control algorithms guarantee convergence to equilibrium [2]. In congestion avoidance algorithms this is not always guaranteed. A non-TCP protocol is called TCP-friendly when it yields the same throughput as traditional TCP. TCP-friendly protocols are generally used for multimedia/real-time applications. Although the sources might discover their fair-

share early on, the dynamics of real systems in practice prohibit a straightforward adjustment, but instead, they call for continuous oscillations as a means of discovering the available bandwidth. The metrics for the system performance are as follows:

• **Efficiency**: Efficiency is the average flows throughput per step (or per RTT- round-trip time), when the system is in equilibrium.

• **Fairness**: Fairness characterizes the fair distribution of resources between flows in a shared bottleneck link. A well-known metric is: $F(x) = \frac{\sum (x_i)^2}{\sum (x_i^2)}$. This index is bounded between 0 and 1.

• **Convergence Speed**: Convergence speed describes time passed till the equilibrium state.

• **Smoothness**: Smoothness is reflected by the magnitude of the oscillations during multiplicative decrease. It depends on the oscillations size.

• **Responsiveness**: Responsiveness is measured by the number of steps (or RTTs-round-trip time) to reach an equilibrium (i.e., to equate the windows in order to be in a fair state).

The difference between Responsiveness and Convergence Speed is that the former is related to a single flow and the latter to the System.

Goals in the evaluation process of a congestion avoidance/control algorithm are:

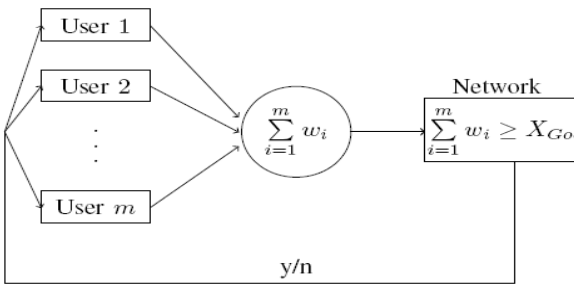
• To achieve high bandwidth utilization.
• To converge to fairness quickly.
• To minimize the amplitude of oscillations.
• To maintain high responsiveness.
• To coexist fairly and be compatible with traditional widely-used (AIMD based) protocols.

3. TCP Congestion Control

TCP uses a form of end-to-end flow control. In TCP, when a sender send a packet, the receiver acknowledges receipt of the packet. A sending source can use the acknowledgement arrival rate as a measure of network congestion. When it successfully receives an acknowledgment, a sender knows that the packet reached its destination. The sender can then send new packets on the network. Both the sender and the receiver agree on a common window size for packet flow . The window size represents the number of bytes that the source can send at a time. The window size varies according to the condition of traffic in the network to avoid congestion . Generally, a file of size f with a total transfer time of Δ on a TCP connection results in a TCP transfer throughput denoted by **r** and obtained from equation $r = f / \Delta$.

We can also derive the bandwidth utilization**,** P_u, assuming that the link bandwidth is B, by equation $P_u = r / B$.

TCP has three congestion-control methods: **additive increase, slow start,** and **retransmit.** Chiu and Jain [2] have formulated the congestion avoidance problem as a resource management problem and proposed a distributed congestion avoidance mechanism named 'additive increase/multiplicative decrease' (AIMD). In their work, as a network model they use a "binary feedback" scheme with one bottleneck router.



Synchronous control system model of m users sharing a network.

It consists of a set of m users each of which send data in the network at a rate $2w_i$. The data send by each user are aggregated in a single bottleneck and the network checks whether the total amount of data send by users exceeds some network or bandwidth threshold *goal X* (we can assume that *goal X* is a value between the knee and the cliff and is a characteristic of the network). The system sends a binary feedback to each user telling whether the flows exceed the network threshold. The system response is 1 when bandwidth is available and 0 when bandwidth is exhausted. The feedback sent by the network arrives at the same time to all users. The signal is the same to all users and they take the same action when the signal arrives. The next signal is not send until the users have responded to the previous signal. Such a system is called synchronous feedback system or simply synchronous system. The time elapsed between the arrival of two consecutive signals is discrete and the same after every signal arrival. This time is referred also as RTT. The system behavior can be defined the following time units: a step (or round-trip time – RTT) is the time elapsed between the arrival of two consecutive signals. A cycle or epoch is the time elapsed between two consecutive congestion events (i.e., the time immediately after a system response 0 and ending at the next event of congestion when the system response is again 0). This network model is quite simple and its assumptions have been evaluated in the Internet for several years. In practice the parameter *goal X* is the network capacity (i.e. the number of packets that the link and the routers' buffer can hold – or in-the-fly packets). When the aggregate flows' rate exceeds the network capacity the flows start to lose packets. If the transport protocol provides reliability mechanisms (e.g. as in TCP) it can detect the packet loss or congestion event. Since the majority of the applications use reliable transport protocols (e.g. TCP), the binary feedback mechanism has an implicit presence: a successful data transmissionis interpreted as available bandwidth, and a packet loss is interpreted as congestion event . Although the system had a strong impact on the evaluation of congestion avoidance mechanisms (e.g. AIMD), there are some limitations. First, the system considers the responses to be synchronous, which, in terms of real networks means that all flows have the same RTT. This assumption is not real. A second assumption and limitation is that the network response arrives at the same time to all users, even when they have the same RTT. The above assumption is supported by Jacobson experimentally in a low bandwidth network with congestion avoidance mechanisms (TCP-Tahoe) and where flows have the same RTT . Whatever the argument, this assumption is not true for a reason which is the third limitation of the system. The system has only one bottleneck. In reality a connection might go through none, one, or more than one router or bottlenecks. If a flow traverses more than one bottleneck, then it is not guaranteed that at each bottleneck congestion will happen at the same time. Nevertheless, these limitations do not prevent the mechanisms from controlling flows' data rate and avoid congestion which was the major concern in the early stages of the Internet .

4. Additive Increase / Multiplicative Decrease Control algorithm (AIMD) and TCP-friendly protocol for the streaming media

The basic idea of the algorithms to reduce the sending rate/window of the flows when the system bandwidth is exhausted and to increase the sending rates/windows when bandwidth is available. As mentioned in the previous section, when bandwidth is available (i.e. the aggregate rates of the flows do not exceed the network threshold: $\sum_i w_i < goal\ X$) the system attaches the signal 1 to the acknowledgment of each packet. In response, flows increase by one (packet) their windows. A continuous series of positive signals will cause a linear increase in the flows' rate. Obviously, the increase is not unlimited because the bandwidth is fixed. When flows' rate exceed the bandwidth limit (i.e. $\sum_i w_i \geq goal\ X$) the system attaches the 0 signal to the

acknowledgment of each packet and flows respond to congestion by a decrease in their sending rates/windows. A. Lahanas and V. Tsaoussidis prove that a linear increase/exponential decrease policy is a condition for the increase/decrease algorithms to set (or converge) quickly the system in a fair state where the load oscillates around some equilibrium. The equilibrium state determines also the fairness and efficiency of the mechanism.

The TCP congestion control is classified as Additive- Increase Multiplicative-decrease (AIMD) mechanism. Following the notation AIMD(a, b), TCP is AIMD(1, 1/2). The parameter a represents the factor to be added to the congestion window each round trip time in absence of congestion, that is congestion_window + a. On the other hand, the parameter b represents the complement to 1 that should be multiplied to the congestion window when congestion is detected, that is (1-b) congestion window.

An AIMD control algorithm may be expressed as:

Increase: $W_{t+R} \leftarrow W_t + a\,, a > 0$

Decrease: $W_{t+\delta t} \leftarrow (1-\beta)W_t\,, 0 < \beta < 1$

A generalizations of AIMD is binomial control:

Increase: $W_{t+R} \leftarrow W_t + \frac{a}{W_t^k}\,, a > 0$

Decrease: $W_{t+\delta t} \leftarrow W_t - \beta W_t^l\,, 0 < \beta < 1$

where "Increase" refers to the increase in window as a result of the receipt of one window of ACKs within a single RTT, "Decrease" refers to the decrease in window upon detection of congestion by the sender, Wt the window size at time t, R the flow's RTT, and a, b, k, l are constants. For example, for k=0, l=1 we get AIMD.

AIMD and binomial controls are memoryless since the increase and decrease rules use only the current window size w_t and constants (α, β, k *and* l). The window size at the end of the last congestion epoch is useful, not only as an indicator of the current congestion level of the network, but also as a good predictor of the congestion state for the next sequence. Thus, our proposed scheme maintains such a state variable $w_{\max}$, which is updated at the end of *each* congestion sequence. In addition, let w_0 denote the window size after the decrease. Given a decrease rule, w_0 can be obtained from w_t, and *vice versa*. For example, for AIMD, $w_0 = (1-\beta)w_{\max}$. Henceforth, for clarity, we use both $w_{\max}$ and w_0 .

We propose to adopt the following window increase function:

$$w(t) = w_0 + c * t^u\,, u, c > 0 \qquad (1)$$

where $w(t)$ is the continuous approximation of the window size at time t (in RTTs- round-trip time) elapsed since the window started to increase. By definition, $w(0) = w_0$. This window increase function is equivalent to the following window increase rule:

$$w_{t+1} \leftarrow w_t + \alpha / (w_t - w_0)^k\,, \alpha > 0 \qquad (2)$$

where $k > -1$ and α is independent of t. In particular, $u = 1/(k+1)$ and $c = ((k+1)\alpha)^u$. We are interested in congestion control schemes that have various window size increase patterns (different $u's$, or equivalently, different $k's$). Consider three cases. First, if $-1 < k < 0$, the congestion window increases super-linearly. The window is increased cautiously just after the detection of packet loss, and the increase becomes more and more aggressive when no more loss occurs. Second, if $k = 0$, the window increases linearly, i.e., additive increase. The aggressiveness does not change with time. Third, if $k > 0$, the

window increases sublinearly. The connection approaches the previously probed window size fast, but it becomes less aggressive beyond that. These various schemes possess different degrees of aggressiveness, and may satisfy different applications. For example, super-linear increase can support applications that need to quickly acquire bandwidth as it becomes available.

Therefore, we consider the following control rules:

$$\text{Increase: } w_{t+1} \leftarrow w_t + \alpha(w_{\max})/(w_t - w_0)^k, \quad \alpha(w_{\max}) > 0 \quad (3)$$

$$\text{Decrease: } w_t \leftarrow w_t - \beta w_t^l, \; 0 < \beta < 1$$

Note that we write α as a function of $w_{\max}$ since this is required in the derivation of TCP-friendliness. In the remainder of this paper, we simply write α for clarity. We use the same decrease rule as binomial controls. For the increase rule, we consider $k > -1$, since otherwise the window size increases exponentially or faster and we consider it unstable. For the decrease rule, we consider $l \le 1$, since otherwise $(w_t - \beta w_t^l)$ can be negative when w_t is large enough.

We show that this control can be TCP-friendly by appropriately defining α as a function of the constant β and the state variable $w_{\max}$. This control is radically different from binomial controls, because binomial controls generalize AIMD, but they are still in the memoryless space.

We show that this control scheme using the control rules in (3) can be TCP-friendly. The notion of TCP-friendliness refers to the relationship between throughput and packet loss rate. We consider a random loss model, where the losses are Bernoulli trials; packets are dropped uniformly with a fixed probability, and following definition of α to make congestion control scheme TCP-friendly:

When the window size variation is small, i.e., the window decrease is small, $\beta w_{\max}^l \le w_{\max}$, we can simplify α and c as

$$\alpha \approx \frac{3}{2(k+1)} \left(\frac{\beta}{\Gamma\left(\frac{1}{k+1}+1\right)} \right)^{k+1} w_{\max}^{kl+l-1} \quad (4)$$

$$c \approx \left(\frac{3}{2}\right)^{\frac{1}{k+1}} \frac{\beta}{\Gamma\left(\frac{1}{k+1}+1\right)} w_{\max}^{l-\frac{1}{k+1}} \quad (5)$$

where the Gamma function $\Gamma(.)$ is a constant, α is a constant factor of $w_{\max}^{kl+l-1}$ and c is a constant factor of $w_{\max}^{l-(l/k+1)}$. When $k = 0$ and $l = 1$, from (4) we have $\alpha_{AIMD} = 3\beta(2-\beta)$. If $\beta \le 1$, $\alpha_{AIMD} \approx 3\beta/2$ it degenerates to the memoryless TCP-friendly AIMD control.

5. Conclusion

We proposed a TCP-friendly protocol model for congestion controls. They are TCP-friendly and TCP-compatible under queue management. They possess different smoothness, aggressiveness, and responsiveness tradeoffs. Thus, instances from this applications can be chosen as the transport schemes of various applications, for example, streaming applications on the Internet which are required to be TCP-friendly.

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DESIGNING A DATA WAREHOUSE. CASE STUDY: SC "AMBIENT" SA

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Abstract: *The current paper approaches the concept of data warehouse and includes the design of the data warehouse in SC "AMBIENT" SA . The core of a data warehouse is a data base of large dimensions containing information used by end-users: clients, suppliers, advertising companies etc. In order to build the warehouse, the following steps have been made: extracting the data in operational data bases/external sources and copying them into the warehouse; cleaning the data and in order to be secure, the data should be correct when making decisions; loading the correct data into the warehouse; creating the data aggregates such as pre-calculated totals, subtotals, average values etc. Designing a data warehouse is a suggestion to obtain the warehouse needed by managers, analysts and specialists involved in strategic decision making regarding the development and future of an organization.*

Mathematics Subject Classification 2010: *68P05, 68P20l, 62P20, 93B15, 97R50, 97R99.*

Keywords: *Databases, Data analysis, Data Warehouses.*

1. INTRODUCTION

In the economic field, the decision-making process is based upon superior capitalization of data by synthesizing, analysis and interpreting which leads to transforming the information gathered into knowledge. This data synthesizing process implies data centralization using different criteria with the help of: specific and dedicated programs; interrogations that offer the possibility of grouping data following established criteria for the created domains; total and subtotal functions offered by the report generators which allow indication of grouping criteria hierarchies.

The immediate problem is that the volume of information is great, which leads to the failure of conventional methods and resort to the use of modern technologies like Data Warehousing and OLAP (On-Line Analytical Processing) for specific data transaction systems.

The data analysis consists of finding connections between synthesized data like: associations, structural correlations. The Data Warehousing represents a special data set which contains historic and present data of potential interest, produced in order to aid the managers through the decision-making process.

There are three different types of Data Warehouses in terms of area coverage of information: Enterprise Warehouses, Data Mart and Virtual Data Warehouses.

The Enterprise Warehouse collects all the information regarding matters that directly influence the well being of the company. The

Data Mart contains a subset regarding the volume of information of the company about a group of users. The Virtual Warehouse represents a number of views regarding the operational data bases.

Designing a Data Warehouse implies understanding and analysis of the economic processes and the construction of an economic analysis scheme. Designing a Data Warehouse implies engineering the following components: identification of the data sources; extracting, transforming and uploading the information in the operational data base (ETL – Extraction, Transformation, Load); Designing the Enterprise Data Warehouse; Designing metadata (general rules of organization of the information); use of middleware type instruments to insure access to the Data Warehouse (OLAP, Data Mining, software instruments used for data visualization and information feedback).

2. DATA WAREHOUSE CREATION

In order to design and create the Data Warehouses, two steps must be completed: the economic analysis (analysis of the economic processes and creating an economical analysis blueprint), designing method (implies the following procedures: top-down view, data source view, data warehouse and business query view) and the actual design of the Data Warehouse.

For example, in order to design a Data Warehouse using the top-down approach you start with the design and complete planning and it is used when the technology is fully matured and well-known and the economic aspects that must be undertaken are fully understood. The bottom-up approach implies a series of experiments and prototypes and it is utilized at the first stages of technological development and modeling. A combined approach of the two methods blends the planned and strategic aspect of the top-down method as long as it is kept in mind the advantage of a fast implementation.

Thus the designing and creating a Data Warehouse consists of: planning; requirements study, problem analysis, Data Warehouse designing, data compiling and testing and finally the use of the Data Warehouse.

The used methodologies are Cascade method, Spiral method. The Cascade method consists of executing a thorough structural analysis every step of the way before moving on to the next phase. The Spiral method generates functional systems which are progressively more complex, at short intervals, between two successive versions.

The actual designing process of the Data Warehouse consists of the following steps:

- Choose the economic process that needs to be modeled (stocks, sales, etc.). If the economic process is organizational and implies complex and multiple object collections there must be created a Data Warehouse. If the process is department based and focused on a single domain there must be created a Data Mart.
- Choose the level of granularity, the fundamental data, which is used to represent atomic data table for each work process.
- Choose the dimension (time, article, client, vendor, deposit, transaction type and state) applied to each registration of the data table.
- Choose the value (values, i.e.: sales_currency or sold quantity) which populates every registered line of the Data Table.

The Data Warehouses are based upon the multidimensional data model where data is seen as a data cube. This allows modeling and visualization of data in multiple dimensions and it is defined by dimensions (i.e.: perspectives and entities needed to store recorded information needed by the company) and facts (collections of quantified activities and dimensions which identify the mode in which they took place).

The dimension has a table associated which is called Dimension Table. The definition of a Data Cube is as follows: It is a data set organized and summarized in a multidimensional structure via a set of dimensions and measurements which represent

a easy-to-use mechanism in order to access information in a short amount of time. The cube has a blueprint represented by the set of information tables. The central information table is the fact table and it is the source of the cube's measurements.

For example, if the granularity level indicates the detail level of the data found in the table, the granularity level is directly proportional with the level of detail of the hierarchy in the dimension table. The granularity is determined by the level of detail of the "Time" dimension. The hierarchy of the "Time" dimension in a decision-making dedicated system in the financial-bookkeeping domain is limited to the level of monthly reports. A more detailed data retrieving process can cause additional difficulties in data collection. If requested by the user, a daily data report can be considered.

That is why an important concept is data aggregation (pre-calculated values established upon the data on the analytic level of the deposit), which determine an important raise in terms of performance when it comes to response time of the informational request. With the help of aggregation information with a synthetic character can be obtained via analyzing the aggregated values without further intermediary calculus. Due to the fact that there are certain technical products that have similar fabrication procedures, the Product dimension details the production steps involved. Data is acquired from multiple data sources, then they are uploaded in the Data Warehouse, after which, based upon OLAP and Data Mining, the data is transformed in information and is directed to the beneficiary as a report.

3. CASE STUDY – BUILDING DATA WAREHOUSE FOR SC "AMBIENT" SA

SC "AMBIENT" SA has as a specific trade material and products for house construction and improving. Since the Data Cube allows modeling and viewing of the data in multiple dimensions being defined by dimensions and facts, in our case, SC "AMBIENT" SA, we can create a Data Warehouse for sales that contain registration based upon the following dimensions: time, article, branch and zone. With the help of these dimensions we will store the monthly sales on articles, branches and zones. Each dimension has a specific table associated with it named Dimension Table, which describes the dimensions. In the case of the dimension table for articles the following features will appear: article name, brand and type. The multidimensional data model is organized around a certain central theme, in our case, sales. Therefore we have a table full of facts, and the fact has a numeric measure and indicated the measurements thru which we want to analyze the relationships between certain dimensions.

Thus, the facts from the Data Warehouse include: sales in lei (sales-currency), quantity sold (number of units sold), total sales planed, and the facts table contains the names of the facts or measurements as well as the keys for each and every table form the dimensions table that are connected to it.

Figure 1 - Highlights how a Data Deposit works and the multidimensional schemes.

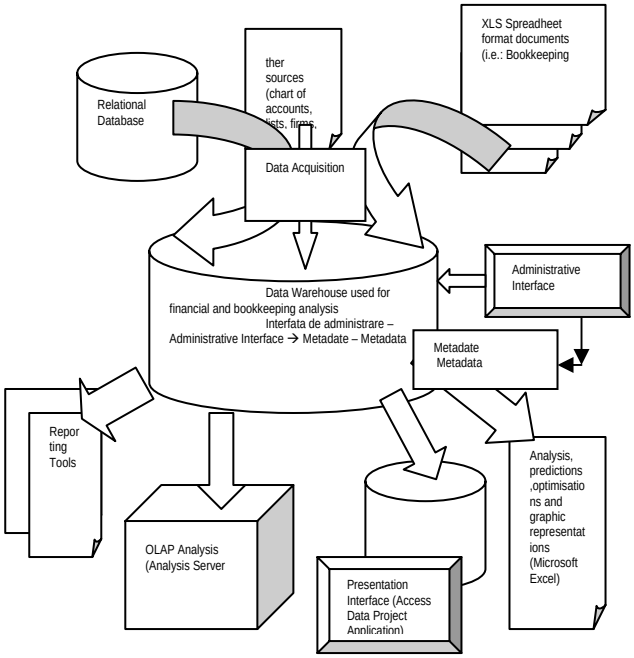

Figure 1. The architecture of the system proposed for implementation

Even though the given deposits in the cube are n-dimensional, usually, we use 3D cubes. The 4D cube built as a series of 3D cubes represented in Figure 2, we can continue to display any n-D data as a series of (n-1) D cubes.

For example, a sales scheme which is considered to have 4 dimensions (Time, item, branch, zone) is represented in the picture above. It contains a central table for sales which also contains keys for the other 4 dimensions.Before the two measures: sales-currency and quantity-sold. The "Zone" table contains the Key-Zone, City, County, Postal Code, Country. This definition could create a certain redundancy (i.e.: The cities Medias and Sibiu are both in the Sibiu County).

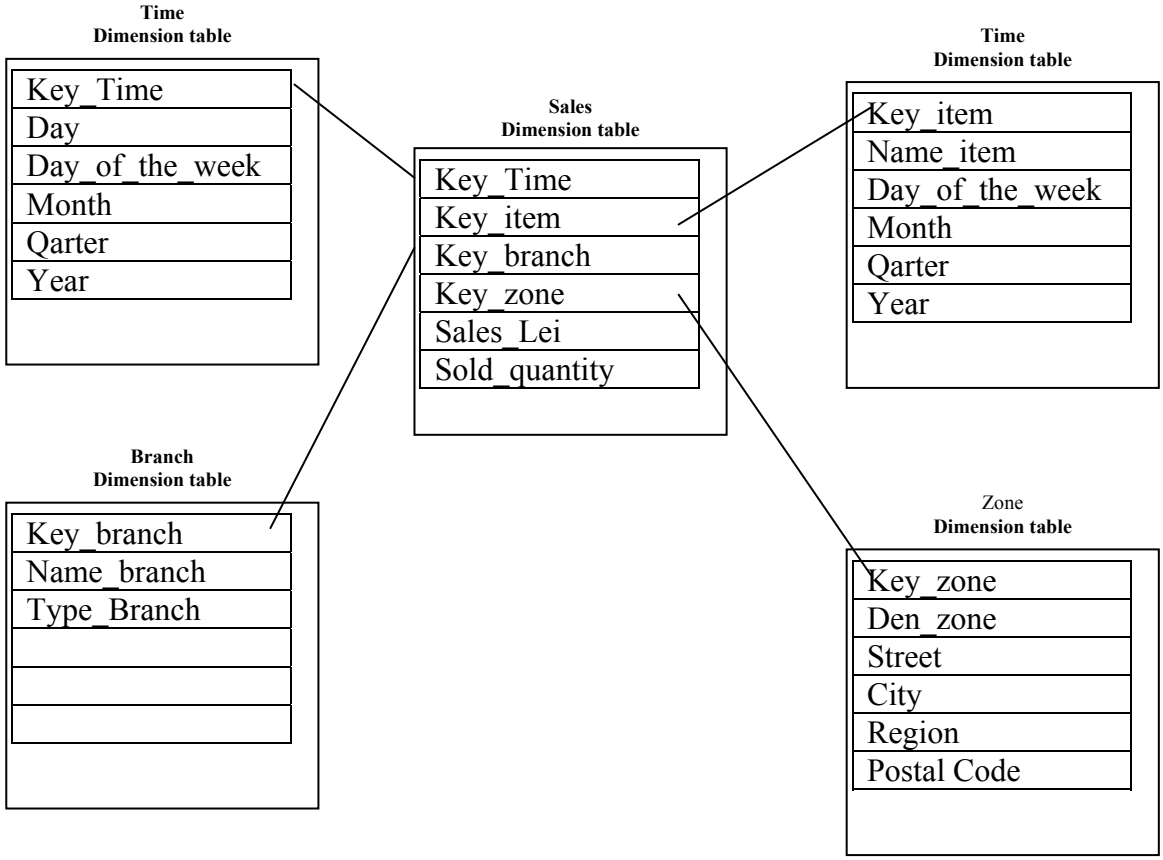

Figure 2. Star based blueprint of a sales data deposit

The multidimensional model requires that the data is organized in multiple dimensions, where each dimension contains multiple levels of abstraction defined my hierarchy. OLAP

operations upon the data cube offers different views allowing interactive interrogation and analysis (Drill-up (roll-up); Drill-down; Dice; Slice; Pivot; Rotate). Of course the scientific demarche will continue with the data extracting process and transformation, for which extraction instruments are used, transform, integrated, cleanup and uploading data form Source Systems to one more data bases of the Data Warehouse.

4. CONCLUSIONS

For adequate decision making we need historical facts that, normally, data bases do not contain. Operational data, although very large, are far from adequate for complete decision-making. However Decision-making needs data from different sources, resulting high quality data, clean and integrated by the imperious necessity of Data Warehouse use, because operational data bases only contain detailed unprocessed data(primary data), such as transactions that need to be consolidate before analysis.

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IMPACT OF CLOUD COMPUTING SOLUTIONS TO NETWORK ENABLED CAPABILITIES

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Abstract: *The paper deals with important topic of nowadays - Cloud computing. Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). The name cloud computing was inspired by the cloud symbol that's often used to represent the Internet in flowcharts and diagrams.*

MSC2010: *68M14.*
Keywords: *distributed information systems, distributed computing, cloud computing, network enabled capabilities.*

1. INTRODUCTION

A cloud service has three distinct characteristics that differentiate it from traditional hosting. It is sold on demand, typically by the minute or the hour; it is elastic - a user can have as much or as little of a service as they want at any given time; and the service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access). Significant innovations in virtualization and distributed computing, as well as improved access to high-speed Internet and a weak economy, have accelerated interest in cloud computing.

A cloud can be private or public. A public cloud sells services to anyone on the Internet. (Currently, Amazon Web Services is the largest public cloud provider.) A private cloud is a proprietary network or a data center that supplies hosted services to a limited number of people. When a service provider uses public cloud resources to create their private cloud, the result is called a virtual private cloud. Private or public, the goal of cloud computing is to provide easy, scalable access to computing resources and IT services (1).

Because cloud-based services use the Internet, storing data in the cloud can be risky and can mean less control over your data. How do IT manager decide which kinds of data to store in the cloud, stay compliant with government regulations, and maintain control and protect data in a cloud-based model?

2. IMPACT OF CLOUD COMPUTING SOLUTIONS TO NEC

Cloud computing is a new option in information technology. Brings a change in the way of storage and retention and also in the way how applications operate. The company does not own it at individual computers, everything is instead located in the so-called "cloud" - that is in computers and servers that are physically located at the service provider

and to the customer is available via the Internet. Cloud computing is the solution passing from products to services. In the implementation of cloud computing environment in NEC's are new proposed technological solution deeply analyzed and assessed primarily in economic and security terms. Philosophy to shift to cloud computing model is economically advantageous but raises particular safety issues regarding the protection of and access to sensitive data. For the operating environment of warfare in the concept of NEC is discussed in particular the immediate accessibility of services and data that is critical (AFCEA TechNet, 2010).

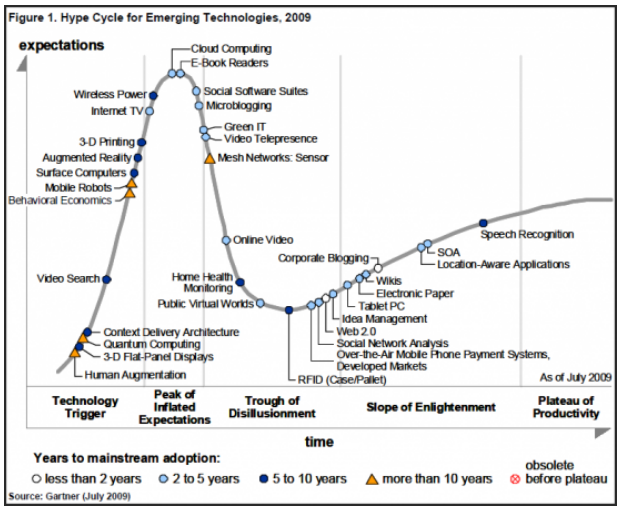

Fig. 1. Analysis of the Gartner 2009 Technology Hype Curve

2.1 The emergence of cloud computing solutions. Cloud computing is emerging as a new phase in connection with the introduction of computer technologies, grid, cluster, virtualization and service-oriented architecture (SOA). The turning point for the onset of cloud computing, according to Gartner's analysis was year 2009 as documented in Figure 1. Distributed information processing technologies are being reviewed and a new model of information processing leads to processing in shared computing centers represented by the powerful server that allows dynamic scalability and virtualization resources (Hoffa, 2008).

Cloud computing is mainly a new economic model for IT, which provides convenient access to a request (on demand) to the network, shared memory, configurable computing resources (eg networks of servers, storage, applications, services) that can be quickly and with minimal modifications prepared to provide security services. This model is based on five main characteristics:

- on-demand self-service,
- ubiquitous network access,
- pooling of resources,
- area of sources - independent of location and homogeneity,
- rapid flexibility resources (services only when they are needed),
- measurable service.

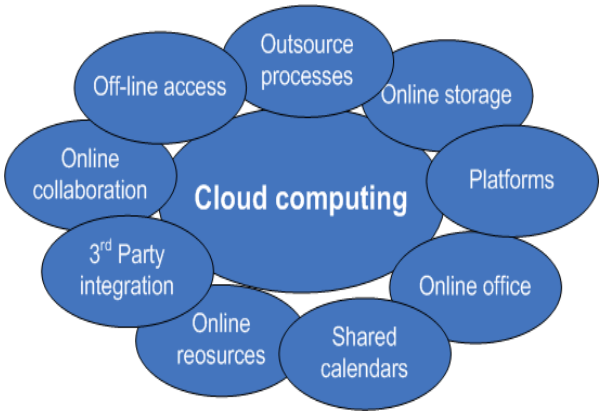

Fig. 2. Integration of IT services in the cloud computing

2.2 Models of Cloud computing. There are currently provided in terms of types of services defined under the three models of Cloud computing:

1. **SaaS** (*Software as a Service*) - software as a service environment where users can start pre-defined applications directly from a Web browser,
2. **PaaS** (*Platform as a Service*) - platform as a service environment, which is available for a rich environment in which they can be processed his application if they are programmed in one of the languages supported platform (eg Java, Python or. Net) ,
3. **IaaS** (*Infrastructure as a Service*) - infrastructure as a service environment that provides the user with computing power, networking, storage and other

necessary resources to enable it to start the software and applications.

In terms of the infrastructures and access to data-existence of 4 types of implementation of Cloud computing:

- *private* - in the report of the organization or business,
- *community* - a common infrastructure for specific communities (eg. telecom operators),
- *public* - open to any community,
- *hybrid* - consisting of at least two previous models.

Cloud computing solution can be compared to the use of common business applications online, that are accessible through a Web browser, another web service, or used by application software, while software and data are stored on the server. The actual application in the **cloud** is processed virtually in a "cloud" and therefore the processing location (and related data) is not known. This is a fundamental difference about the model client - server, where processing takes place in one or more specific servers that are known. Generally, in dealing with cloud computing customers do not own the physical infrastructure and resources in the form of applications used as a "service", only the for the equipment used.

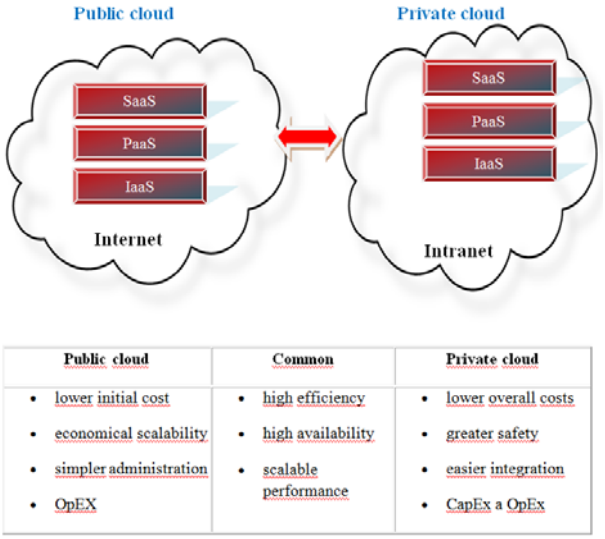

Fig. 3. Comparison of public and private cloud computing solutions

The idea of cloud computing solutions leads mainly to the economic benefits of saving and spending in connection with the purchase and operation of demanding financial solutions to hardware and software. In the area of communication and information infrastructure is likely that the life of the installation and use of the solution is relatively short and return efficiency rapidly decreases with time. Cloud computing solutions philosophy is based on paying only for services computing power of transmission capacity, and application programs for data storage. The critical factors for the use and deployment of incoming solutions of Cloud computing is now: unresolved legislation, protection of sensitive data security and data access.

2.3 Features of Cloud computing Solutions. Importance and benefits of cloud computing solutions can be characterized in several areas:

Reduce costs and total financial impact

- no capital expenditure, all expenditures are operational in nature,

- lower costs to deploy the service are the efficiency and economy expanded massively scalable and services,
- no expenditure on maintenance, administration and ensure high availability.

Elasticity and Scaling

- payment only for the capacity at the time of actual need,
- the ability to scale capacity very quickly (but also move to add),
- increase agility to provide new services.

Faster introduction of services on the market

- reduction in time to pilot and test phases,
- faster adaptability to customer requirements and that adequate services,
- new forms of interaction with customers.

"Infinite" capacity available immediately

- is not limited to the current physical infrastructure,
- may not be available reserve capacity for peak periods,
- all categories of computing resources required are available immediately.

2.4 Data centers and migration to cloud computing solutions. Data Center (DC), respectively data farms provide data services to its historical justification, its own model of governance, management, but also use. In terms of incoming solutions Cloud computing will continue to be possible the existence of data centers under certain assumptions. It will be critical protection and data security. Some elements respectively technology will be replaced by emerging technologies, primarily defined by cloud. Comparison of DC and Cloud computing solutions in terms of philosophy, infrastructure, data and services is shown in Fig. 4.

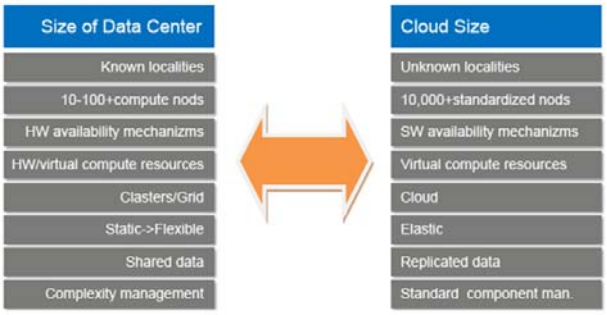

Fig. 4. Comparison of data centers and cloud computing solutions

In the area of data centers and their infrastructure it have been invested enormous resources and therefore it will need to systematically assess which primary services are possible to transform, integrate and indulging in Cloud computing solutions. Primary feature should be elastic services as one of the ideas and making use of cloud computing. Possible migration of services provided to the DC system solutions Cloud computing is shown in Fig. 5. Not all services will be (or not interested) in terms of meaning and security pass to Cloud computing solutions. It is expected that the management of human resources and sensitive data from HR (Human Resources) and also the development environment of their own products on the principle of "know how" to remain in the environment and management of the original owners. Other services eg. CRM (Customer Relationship Management), ERP (Enterprise Resource Planning) will be possible to migrate into the cloud computing environment (Marshall, 2011).

When you migrate from data centers to cloud computing solutions arise fundamental issues determining the success of the transition. The view is from several parties, but concentrated data security issues remain:

1. We guarantee the security of information?
2. We have enough reliable standards?
3. We comply with the requirements for inspection and audit?
4. The basic question - where is our data?

a. Data is replicated between data center - as it should be destroyed?
b. Where are the replicas, and backups? What are the processes?
c. We do not have tools to locate our data!
d. How to get data back (after termination or cancellation of service)?

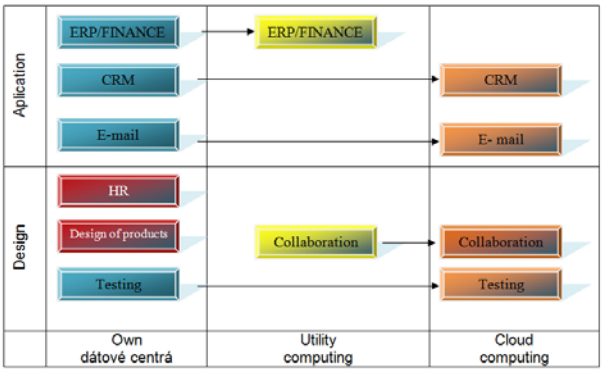

Fig. 5. Migration services from data centers to cloud computing solutions

Based on the answers to those questions is choosen the adequate model. Practicable at this time for DC migration from a solution to Cloud computing is considered particularly advantageous model, private clouds, which offers existing solutions. An important dimension is the organization and scope of services. Private Cloud computing solution model, providing services, that are in principle dealt with the application of existing technologies currently in building data centers and service:

- Cloud uses the principles of solution services in data centers to maximize the total utilization,
- creation of the conditions for running applications in a virtualized environment,
- reengineering of the applications on SOA principles,
- standardization and virtualization of IT infrastructure in order to create a coherent environment,
- the introduction of ITIL (Information Technology Infrastructure Library) principles in the management and administration,
- introduction of SLM (Service Lifecycle Management).

Before the actual deployment of the Cloud computing solutions is necessary to analyze the state of organization, efficiency and the transition mainly safety aspects (Padmanabhuni, 2009).

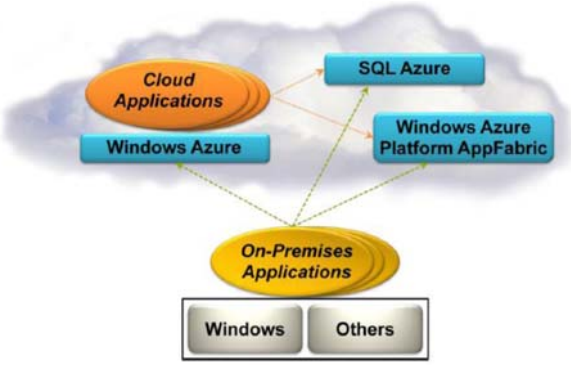

Fig. 6. Microsoft Azure Platform Cloud comuping

3. CLOUD COMPUTING SOLUTION IN PRACTICE

Microsoft as a provider and supplier of software no longer works for the establishment of the Microsoft Azure. Azure platform consists of Windows Azure, which is essential

to the host and development platform. Azure is SQL relational database in the cloud (of course with similar functionality as MS SQL Server) and Azure Services, which provides additional services necessary for running user applications and deployment. Azure fills principled strategy - a concept Microsoft titled "Software + Services (S + S) as the next paradigm in the IT industry. Concept S + S is Microsoft's perspective on the design of applications in the near future.

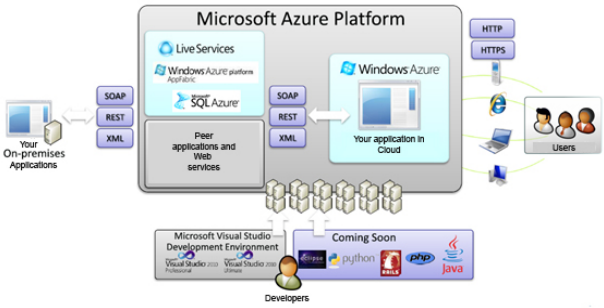

Fig. 7. The interoperability of the Microsoft Azure Cloud comuping solutions for other technologies (eg PHP, Java, Python, ...)

Microsoft Azure platform for Cloud comuping solution consists of three components:

- **Windows Azure** – the data center staffed by servers (eg Microsoft servers) prepared for virtual environment, enabling Web services start, store information in the data storage and manage applications. A typical feature of the center is the scalability of computing power, depending on the requirements for application performance.

- **SQL Azure** –the functionality of SQL Server that provides services and expansion of storage capacity.

- **Windows Azure Platform AppFabric** – development environment for building the system, the possibility to implement SOA architecture.

Microsoft's strategy with regard to the emerging requirement for interoperability tends to support the entry of other technology platforms and environments. Example private cloud computing solutions provided by VM Ware can also be seen in Fig. 8 (Drobný, 2011).

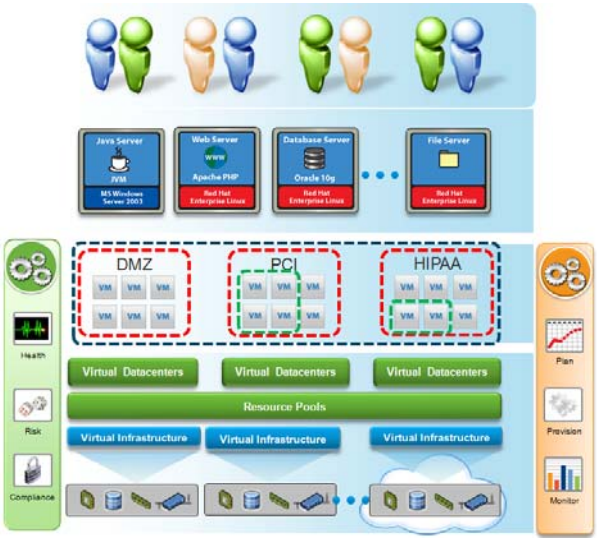

Figure 8 - Example of Private Cloud computing solutions based on technologies VM Ware

4. NEC - SAFETY ASPECTS OF THE TRANSITION TO CLOUD COMPUTING SOLUTION

International conference "TechNet International - Integrating into Cyberspace Battlespace" was held on the 27th to 29th October 2010 in London. This conference is held annually at changing venue throughout Europe and contents dynamically monitor the most current issues of NATO and the armed forces. This year held in London and in the organization participated the AFCEA Europe. The conference program was prepared and managed by an international committee with the support of NATO C3 Agency and NCAS. The main theme of the conference was the integration of cyberspace in the process of struggle. The conference gathered some 90 participants from 12 NATO member states, who presented the latest findings and pointed to key problems of cyber war. In speeches experts raised contributions and aimed at

addressing key Cloud Computing, cyberspace and cyber defense.

In addressing the issue of cloud computing has expressed the opinion that it is primarily an **economic model of savings funds** for infrastructure development and use of the information a communication systems. Despite the solutions offered by IT firms NATO position is that in this area, the deployment of cloud computing will be necessary to strictly distinguish between public and private level. **Private level** in terms of security procedures and protection of information remains **permanently preserve by armed forces.** The civilian companies will be able to enter the public level of this process.

4.CONCLUSIONS

Cloud computing solution is invisible to users (we can not determine dislocation of services and also do not know who operates it). Anonymity gives the impression of loss of security. The solution is a declaration that the processing takes place according to precise rules and standards.

Physical presence of firms in a particular legislative environment and geographically unlimited existence of Cloud computing solutions raises the problem of personal data respectively sensitive data regulated requirements and regulations of each country.

The problem now is the different standards and consistent procedures that would accept the legal aspects of the country.

Content importance of data and access to them is not a single assessment at the organization, but also higher state clusters States (eg NATO).

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DECISION SUPPORT WITH KNOWLEDGE DATABASE IN ASYMMETRIC OPERATION AREA

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Abstract: *The article deals with a possibility of creating a Knowledge Database in asymmetric operation area for Decision Support System. This system can be very useful for mission planning, mission execution and mission training. The core of the system is a Knowledge Database, serving as a comprehensive source of historical information, and components supporting the assessment of risk for future missions. The knowledge database must store the following content mission, staff recommendations, asymmetric threats and assets in general and other dates. To achieve decision superiority is the development and implementation of concepts of operations, based on information network. These concepts allow leading operations through a comprehensive, common and purposeful use of the systems of command, control (C2) by means of digitization and thematic networking of deployed forces to maximize the effect of operations in real time up to the level of weapon platforms and soldiers.*

Keywords: *knowledge database, decision support system, mission, operation*

INTRODUCTION

Peacekeeping operations represent a wide range of political, diplomatic, economic and military activities. Each peacekeeping mission is unique with its political framework, mandate, conditions under which it is lead and with the type of tasks to be fulfilled. Political framework of peacekeeping missions is determined mainly by the participants of the process of political decision making about executing the missions, while the participants are the national states, international and regional organizations, military alliances, nongovernmental organizations, or other subjects in the system of international affairs and politics.

Besides the standard security threats there are threats that are difficult to be identified and predicted in advance and even more when we talk about the extent of their impact. Characteristic feature of these new security threats is the dynamics of their rise and effect. The current world is exposed to the confrontation with the enemy that is scattered around the world and substitutes the lack of conventional military means with ruthless terrorism. Readiness of terrorist groups to go ahead, die of the impact of their own operations, kill the most people possible using most spectacular means, cause panic and break down the infrastructure, all these are good reasons to find solutions for this phenomenon of the present day.

1 ASYMMETRIC THREATS

Definition of word asymmetric embraces various forms of disproportion, the differentiation and the disharmony between two or more parties in the conflict. Asymmetry is an inherent feature of crises and wars first of all terrorist activities. The growing importance of asymmetry in present conflicts (military, terrorist and others) led to considering asymmetric threats as separate, specific area of armed operations. Typically, this area is characterized by: complications, ambiguous and uncertain situation, lack of complete and reliable information on their own and enemy forces.

Asymmetric warfare can be described, in general, as a conflict between two belligerents involving significantly different strengths and weaknesses.

Asymmetric threats in NATO perspective usually arise in relations: strong-weak or large-small. Asymmetric threats are most often posed by the party which seeking the confrontation is unable to resist the enemy in a symmetrical manner. The weaker, poorer armed party of the conflict tries to choose the means of confrontation in a way which minimizes the possibility to exploit the overwhelming combat potential by the opposing party. The case of asymmetric actions is having a place also when one party made a breakthrough in some technology or achieved technological revolution which increases its possibilities and the combat ability of the armed forces.

NATO must be prepared to act effectively against the use of asymmetric means by its enemies. At the same time, it is assumed that potential opponents of NATO will be increasingly using the asymmetric methods of fighting, including an unconventional strategy and tactics, and perhaps especially technique.

By USA view the following phenomena are considered as asymmetric threats: terrorism, the use of Weapons of Mass Destruction and fighting with information. The primary weapon of asymmetric war is terrorism i.e. the threat of using force or violence against persons or property, in order to intimidate a government or society to achieve political, ideological or religious goals.

By British view it is important not to ignore the fact that potential adversaries have access to modern commercial technological means which, if used effectively, can allow them to become a difficult opponent to defeat, in particular concerning the areas of: technology, communications, biotechnology and information.

2 ASYMMETRIC THREATS IN PEACEKEEPING MISSIONS

From the mission in which members of AF of SR participated, we can draw conclusions. Participants of the missions considered the biggest threats the mortar and missile attacks, handgun shooting and explosions around the camp, terrorist suicide attacks, traps with the improvised explosive devices, terrorist activities against the public or private property, against the traffic and communication infrastructure, kidnapping and captivity of soldiers and civilians by terrorist groups and various radical groups, deadly attacks against civilians, attacks against the forming up and national police or national army forces, murdering, kidnapping, crippling of civilians and various provocation and incidents in order to violate the public order.

The fundamentals of identifying the threats that the members of the Armed Forces of Slovak Republic had to face have become the final reports of commanders of individual rotations and the exchange of experience of the members of missions etc. Part of the threats has occurred in Iraq as well as in Afghanistan, but both countries have certain specifics in this area.

The biggest threats can be considered:

- mortar and missile attacks on the camp and on places where soldiers performed demining activities,
- shooting from handguns and explosions in the vicinity of the camp in the evening and night hours,

- mortar and missile attacks during transfers and pauses with the machinery,
- small guns attacks and sniper attacks when repairing vehicles during transfers and in case of car accidents,
- using explosive devices during transfers

Coalition units were mostly threatened when fulfilling tasks in the field, outside of bases, in convoys, patrols and at the checkpoints. For the attacks mostly explosive devices were used, placed on the main and side roads used by coalition units, on the urban roads and facilities of the infrastructure of Iraqi, in parked vehicles, in vehicles driven by suicide killers, in some cases even several suicide killers, even with their families.

The main threats that the allied forces had to face include:

- snipers attack during the activities in the built-up area, especially when building bridges, checkpoints, passages, control posts and other,
- terrorists suicide attacks using vehicles loaded with explosives,
- possible usage of guns and explosives of various types in case of contact with our soldiers and local civilians and in case of civilians moving, traveling and in the vicinity of machinery and during breaks,
- improvised explosive devices, explosively formed penetrates, attacks using handguns, creating traps and other,
- traumatic experience resulting from witnessing torn human bodies (fore mostly children) as a result of terrorists attacks,
- threat of using chemical weapons by terrorist groups,
- possible capturing of our soldiers by terrorist groups and various radical groups operating in the area of operation of our soldiers (kidnapping, captivity),
- kidnapping of foreigners, motivated by ransom that the kidnappers demanded from the families of their victims. Another reason of kidnapping was the requirements of kidnappers that they demanded from the governments of countries their victims came from – they required that the armed forces leave Iraq.
- terrorists´ and radical groups revenge (former members of special forces, police, army, Islamic extremists) against the civilians because of their cooperation with allied forces, including recruits showing interest in this profession,
- higher number of people moving around all Iraq with guns caused the growth of terrorism and criminality,
- sunnit extremism along with fanatic foreign warriors of the so called holy war against the western world from Islamic countries, from Syria, Saudi Arabia, Iran, Jordan and Lebanon.
- a negative influence on the security environment was caused also by the activities of foreign secret services (fore mostly Iran secret service and Syrian secret service).

Experiences gained from peacekeeping missions can become an important source of knowledge to improve the planning of operations, leading operations and training the armies for peacekeeping missions.

3 DECISION SUPPORT SYSTEM WITH KNOWLEDGE DATABASE IN ASYMMETRIC OPERATIONS

Slovak Armed Forces Academy participates in the Multinational Project "Smart Information for Mission Success (SIMS)", with can be used for mission planning, execution and training. The goal of the SIMS project is to demonstrate a tool which supports management of information and can be used in order to improve process of planning and executing daily missions in asymmetric warfare. The core of the system is a Knowledge Database, serving as a comprehensive source of historical information, and components supporting the assessment of risk for future missions.

Managing information in military applications is currently not performed in an optimal way. Military planning still focuses on scheduling of operations and deployment of forces, mostly due to the decreased appreciation of supplying adequate information required for mission execution. The Decision Support System (DSS) with Knowledge Database can offer a solution to that problem by providing methods and tools which extend the results of planning by using information schemes for mission execution. The goal of the DSS project is to create the DSS prototype, a tool to support information processing (acquisition, processing and distribution). The DSS project aims to develop a set of new mission supporting tools that aid force protection in an asymmetric warfare context, both in urban and non-urban environment.

Knowledge Database creates basis of Decision Support in Asymmetric Operations System. The knowledge database must store the following content:

- Mission (mission environment and terrain, mission purpose, tasks and specific purpose of the tasks, mission plan, mission unit, mission time, mission location mission Procedures, etc.).
- Staff recommendations (units, systems, weapons, munitions capabilities, limitations, employment, resource allocation and employment synchronisation of organic and supporting assets, arrangements for combat, allocation, etc.).
- Asymmetric threats (preferred area of asymmetric activities, preferred action mode, preferred targets, objective, force protection measures and assets to counter the threat, etc.).
- Assets in general (equipment, transport, individual and unit force protection, other, etc.).

The knowledge database must allow updating data from the structured process of gathering lessons learned and must allow the data update based on mission status reports during and after mission, as well as mission result assessment. The knowledge database must allow automatic data update from sensors detections reporting on mission environment.

On the basis of previous experiences, the following information related to asymmetric threats will be collected from existing experience and past mission's data. The information are related to the documents on enemy goals, capabilities, methods and opportunities, information on incidents and assets to be protected.

In the final part of the project the own forces perspective is represented by incidents and the enemy forces perspective is represented by the whole processes of mission planning and mission execution with the specific focus on force protection aspect. Data derived from real, historical missions are used to update the knowledge base and then in the future mission planning and execution by own forces and also to generate specific situation for training and analytical purposes. This concept is presented in the Fig. 1.

Decision Support in Asymmetric Operations is to be used to support:

- Operational planning (at e.g. the Brigade level) – especially in monitoring the risk in the Area of Responsibility, managing allocation of Force Protection (air, land, navy) and pre-deployment of Force Protection,
- Mission planning (at e.g. Battalion, Battle group level) in intelligence management and threat analysis – by risk assessment of the mission plan,

- Mission rehearsal (Battalion and sub units level) – by mission review and simulation of potential events during the mission (short briefing based on map and potential risk),
- Mission Execution (at e.g. Companies, Platoon level) – by terrain data collection and status reporting.

Planning is given by exact and logical principles and it is important part of employed troops in the operation. It needs especial interest, with is stressed by necessity to understand each other in working process, often in short time. Planning is conducted in accordance with doctrinal principles, in order to create the effects that will support and build to operational objectives and end-states within a campaign. Planning is conducted to ensure that there is a direct supporting link between tactical activities and operational objectives. This is articulated in a concept of operations.

Military Planning can be implemented at the strategic level (campaign), the operational level (operation), the tactical level (battle). A strategic level plan is more general than an operational level plan, and an operational level plan is more general than a tactical level plan. Depending on military unit, a plan is prepared with different resolution.

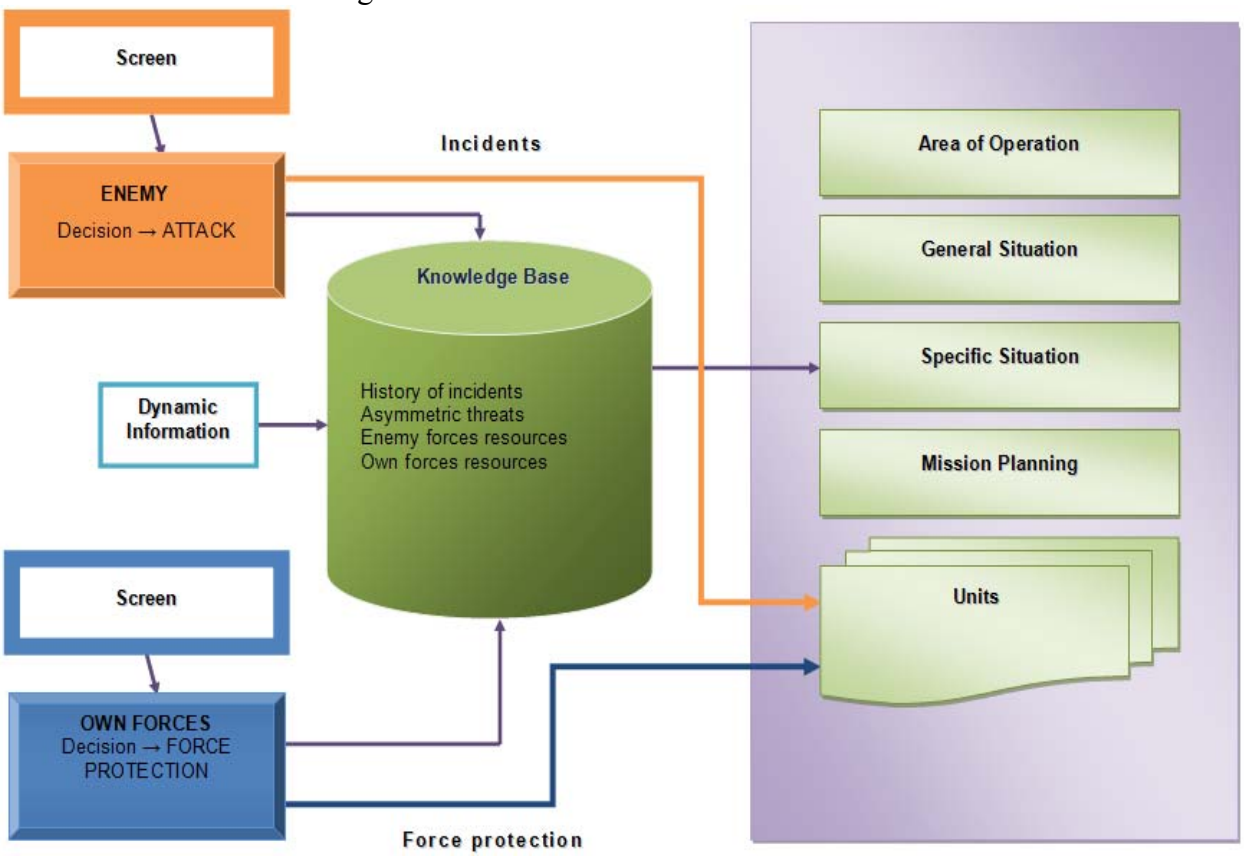

Fig. 1: Knowledge Database position in the system SIMS

Most of the advanced armies in the world have formal mission support concepts, command computerization and well developed databases with algorithms for these kinds of systems. The features of these systems were defined on the basis of factual and deductive databases with generalized knowledge, expressed in the procedural layer at the operational – tactical layers (forces ratios, saturation, feasibility and needs assessment, limits, etc.).

Using the traditional theory of knowledge terminology, the inference processes used by the analyzed tools are deductive.

CONCLUSION

Knowledge Database and system development for decision making support are important elements of international crises management. It can be very useful for mission planning, mission execution and mission training. The core of the system is a Knowledge Database, serving as a comprehensive source of historical information, and components supporting the assessment of risk for future missions. Knowledge base will be fully full of real data and models of asymmetric threats. The knowledge base will allow automatic data update from sensors detections reporting on mission environment. The Decision Support System with Knowledge Database in Asymmetric Threat is to be used to support Mission planning in intelligence management and threat analysis – by risk assessment of the mission plan, Mission rehearsal – by mission review and simulation of potential events during the mission and Mission Execution – by terrain data collection and status reporting. The system will also support the analysis of asymmetric threat history and models, the exploration of information related to the specific type of mission and threat. The system will provide effective access to all data stored in the knowledge base, which will update data from the structured process of gathering lessons learnt

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4. ENGINEERING SCIENCES

4.1 *ELECTRICAL AND ELECTRONICAL ENGINEERING*

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USE OF PRESELECTED MESSAGES IN AIR-GROUND RADIO COMMUNICATIONS

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Abstract: *The increase of aircrafts that are involved in the air traffic, as a consequence of increasing air operators and aircrafts that they operate on daily basis, has lead to the intensification of air-ground communications.*

There were no few situations when because of the misunderstandings of radio messages, the airborne flight safety was severely damaged, fact that lead to the flight accidents that had as a result the loss of human lives, the aircrafts destruction and damage other goods situated on the ground.

A solution for the improvement of air-ground radio communication is the usage of preselected messages, which combine their eloquence with the shortest duration of presentation.

The messages will be reproduced in a phonic and graphic mode (voice & text message).

This can be relatively easily realised, by using, within a "combined system" the existing equipment.

a. on board:

- Radio-connection stations

- IFF (identification friend or foe)

- GPS (global position system)

- TCAS (traffic collision avoidance system)

b. on ground:

- Radio-connection stations

- ground radars

By using this solution the air space will become more and more safe.

Keywords: *communication, misunderstanding, message, preselected.*

1. INTRODUCTION

To ensure flight safety, aircraft will maintain constant radio contact with air traffic control units (ATC).

Each airport has a different radio frequency, and larger airports have several, for planes which are approaching, those near the airport, and those on the ground. When a pilot wishes to talk to the air traffic controllers at the airport, he simply sets the radio to this frequency, and only someone else on the same radio frequency will be able to hear the conversation. This prevents too much overcrowding on the airwaves. If the pilot then needs to talk to someone else on another frequency, he will let ATC know he is leaving their frequency, adjust his radio, and talk to someone else.

2. RADIO COMMUNICATION

2.1 Air-Ground Radio communication weaknesses. The increase of aircrafts that are involved in the air traffic, as a consequence of increasing air operators and aircrafts that they operate on daily basis, has lead to the intensification of air-ground communications.

In air-ground communications using a standardized system of expression

A misunderstood message from the ground-based air traffic controller, can cause a crash.

In 1951 English was designated for international aviation use.

Throughout the world, all aviation radio communication officially takes place in English. The only exceptions to this are transmissions between private pilots and unqualified radio operators at small airfields which do not expect to have any international traffic. These may use their own mother tongue.

Native speakers of other languages have as much difficulty using English as English-speakers would have trying to use theirs. A complicating factor is the existence of 38 dialects and numerous varieties of English. Even those who seem to speak English perfectly can make fatal errors, as did the Dutch pilot in Tenerife in 1977.

Often regarded as one of the worst aviation disasters in history involved the tragic deaths of hundreds, and the mad rush to regulation. On March 27, 1977 a PanAmerican 747-121 and a KLM 747-206B collided on the runway in low visibility. However, the cause of the accident is mostly blamed for the misunderstandings between ATC, and the pilots aboard the planes. When the KLM airplane was in position and holding, the co-pilot asked for a takeoff clearance. Air Traffic Control gave the clearance instructions, but never explicitly said they were cleared for take-off. When the co-pilot read back the clearance, he stated that they were now 'taking off' Again, without the explicit wording of 'cleared for takeoff' When the controller responded back with the words 'Okay' the pilots then regarded this as further clarification that an original clearance had been given. When KLM was on the takeoff roll, the Pan American plane and the controllers both radioed at the same time, canceling each other's calls that the KLM should not take off yet. KLM never heard the radio call and continued resulting in a crash that killed hundreds.

Once the investigations were completed, it was concluded that the most probable cause of the crash was the ambiguity of the English language that led the KLM pilots to believe that they were cleared to takeoff even without a clearance. The use of a non-standard phrase 'Okay' was the likely culprit in solidifying the KLM crew of their take-off clearance. Limited visibility, of course, was an issue, but was not the cause of the ambiguity.

2.2 A possible solution. A solution for the improvement of air-ground radio communication is the usage of preselected messages, which combine their eloquence with the shortest duration of presentation.

The messages will be reproduced in a phonic and graphic mode (voice & text message).

Using preset radio messages requires the existence of a database of radio reports (according to radiotelephony manual) both aircraft and ground (ATC units)

Essentially using preselected messages will be such:

-Depending on aircraft position in space, the board will display the appropriate radio

-This message will be received by the ATC unit with which the aircraft is in radio contact

-On the ground (ATC unit) the message will be displayed and will play sound

- It will also be displayed reply

-Reply will be sent to the aircraft

-The response message board will be displayed and will be played sound

-On board will be displayed message of confirmation

-Message of confirmation will be sent to ground

This can be relatively easily realised, by using, within a “combined system” the existing equipment.

a. on board:

- Radio-connection stations
- IFF (identification friend or foe)
- GPS (global position system)

-TCAS (traffic collision avoidance system)
b. on ground:
- Radio-connection stations
- ground radars

3. CONCLUSIONS & ACKNOWLEDGMENT

There are solutions to increase air traffic safety. This is one of them.

Advantages of using combined radio communication system:

-ensure a fast radio communications between aircraft and air traffic control units

-is avoided crowded radio talks

-ensure the accuracy of message

-remove misunderstanding due to linguistic peculiarities

-avoiding situations in which the crew did not understand the message

-speed of message exchange

-ease of use combined communication system

-safety radio calls

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DIAGNOSIS OF FAULTS IN INDUCTION MACHINE MANUFACTURING

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***Abstract**: Although there are now modern technologies of induction machine manufacturing, however, in production, a relatively large number of faults have been identified, which increase the share of manufacturing-related costs and the consumption of materials. In recent years, many methods for diagnosing the manufacturing faults and the defect flow from operations have been developed. However, the proposed methods are not completely settled and they do not provide an adequate prediction upon the occurrence of defects. The objective of this work is monitoring three-phase induction machine faults on the manufacturing line, in order to establish a strategy to reduce wastage in the process of manufacture. Tests were conducted on a sample of 20 types of induction motors, over a year. Internal and external faults were monitored on the manufacturing line: phase-earth breakdown faults, phase to phase breakdown faults, different resistances per phase, insulation faults and other manufacturing faults. A graphical analysis and a strategy to reduce the number of faults have been established.*

***Keywords**: induction machine, manufacturing, monitoring, faults, graphical analysis, strategy*

1. INTRODUCTION

Induction machine protection and fault diagnosis have been subjects of research since the appearance of this category of equipment. First, producers of induction motors relied only on simple protections to ensure their safe operation. As the induction motor load and function were further complicated, fault-diagnosis methods have been designed and improved.

For operation, the first objective of the maintenance department is to keep the machine and electrical equipment in good operating condition to prevent failures and manufacturing losses [4]. Economic benefits are obtained when there are maintenance programs based on fault diagnosis and prognosis. Online information on the faults are an important aspect of system maintenance.

To obtain a high degree of safety and high performance in the operation of these technical systems, the researchers' attention is turned towards monitoring and evaluating the reliability of the design defects, manufacturing and operating. The literature presents a series of studies and researches related to the development of new analytical tools for quality and reliability predictions, so as to obtain a good working condition [2,7,10]. For manufacturing, the main objective is to reduce the flow of manufacturing waste. It can be reduced if the causes of faults are known. Rotating electrical machine malfunction causes are rooted in design, manufacturing tolerance, assembly, installation, operational environment and nature of the task of the carrying out maintenance program [3,6].

The induction motor, rotating electric machine like any other, is subject to both

electromagnetic forces and mechanical forces, whose interaction is normal, resulting in stable operation with minimum noise and vibration, without damage. When failure occurs, the balance between these forces is lost, leading to a worsening of the fault.

In [8], the internal and external faults of the induction machine and the diagnostic methods for these defects are classified by the nature of the source of failure.

A proportion of 38% of the induction machine faults are due to the insulation system. Early detection of these faults results in saving the motor's total destruction.

Another significant proportion of the distribution of faults in electric motors is occupied by the bearings faults and broken rotor bars, about 50%. Screening methods and faults causes are analyzed and presented in [1,9,10]. Although they are more rigid and durable than those manufactured, cast rotors always show cracks or breaks, which represent 5-10% of the induction machine faults [2].

Recent research are aimed at establishing procedures as close as possible to the ideal diagnostic procedure: with a minimum of measurements, to be able to provide sufficient information with which to conduct analysis for diagnosis, to accurately and quickly indicate incipient failure modes. All studies related to the development of procedures and diagnostic tools are based on the classification of faults and failure sources [7,8]. Most of the induction machine diagnosis methods are based on the principle that the asynchronous machine is a symmetrical electromechanical system. Any fault that changes the symmetry properties can be identified by signals proceeding from sensors that measure mechanical and electrical quantities: current, voltage, magnetic flux, torque, speed.

Researchers' attention was focused on methods for induction machine faults detecting, in [4,7,9,10,11], and very few studies have been made towards the forecasting direction and upon fault loss reduction strategies.

This paper aims at monitoring the faults on the manufacturing line in order to establish a strategy to reduce the number of faults.

2. FAULT MONITORING ON THE MANUFACTURING LINE

Faults were monitored in a rotating electrical machinery manufacturing company production line, with powers from 0.09 to 1.5 kW, with speeds of 750 rpm, 1000 rpm, 1500 rpm and 3000 rpm and with 230/400 voltage.

On the line, there have been analyzed:
- stator execution;
- rotor;
- assembly.

In Table 1, 2, 3, 4 induction motor lots and their faults are eclasified and evaluated.

Table 1. Total verified motors in 2010

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total
Induction machines tested in 2010	15064	18616	22957	20562	23942	25141	24360	18277	25556	23054	24511	18118	260158

3. FAULT DIAGNOSIS AND GRAPHICAL ANALYSIS

3.1 The stator faults and graphical analysis.

In the production line, the first step is the fault control before stator impregnation.

Table 2. Stator fault types

Critical faults	Main faults	Secondary faults
phase-earth breakdown	incorrect sizes	improper wire connection
phase to phase breakdown	turns out of the head coil	
wrong links	incorrect insulation	
different resistance per phase	improper welding	

Table 3. Total tested stators

Months	1	2	3	4	5	6	7	8	9	10	11	12	Total
Stators tested in 2010	16617	20109	24428	20817	25414	25681	24234	19827	27012	22843	25916	16487	269385

Table 4. Total stator faults in 2010

Faults \ Months	1	2	3	4	5	6	7	8	9	10	11	12
phase-earth breakdown	133	160	199	214	318	418	379	226	376	289	342	191
phase to phase breakdown	76	95	122	204	272	410	319	271	354	279	292	234
wrong links	2	10	20	12	17	21	15	3	16	7	10	3
different resistance per phase	30	11	24	38	18	20	35	17	24	10	25	16
incorrect sizes	46	79	104	104	163	184	159	112	246	145	254	90
turns out of the head coil	24	32	62	63	110	88	63	41	96	72	111	33
incorrect insulation	119	137	173	178	392	366	316	248	362	286	369	198
improper welding	47	55	86	86	115	162	178	94	136	182	95	80
improper wire connection	36	26	68	62	65	43	62	51	71	81	57	48
Total stator faults	513	605	858	961	1470	1712	1526	1063	1681	1351	1555	893

a) Critical faults (Fig.1, Fig.2)

1) Phase-earth breakdown: destruction of electrical insulation, which leads to direct contact between one phase stator winding and stator package (consisting of electrical sheets).

The fault appears in the following:
- coil head formation process, when insulation is subjected to shear stator teeth with the outermost stator laminations;
- nonlinearity stator lamination of the package;
- core insulation damage during winding.

2) Phase to phase breakdown: wrong layout (winder inattention) of the coil head insulation of stator winding phases.

The fault appears in the following:
- coil head formation process when the insulation between phases can be moved quite easily;
- core insulation damage during winding.

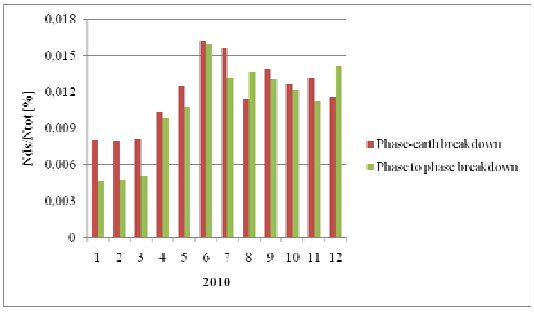

Fig.1. Phase-earth breakdown and phase to phase breakdown

N_{ds}/N_{tot} represents the percentage ratio between the number of stator faults and the total number of stators monitored each month.

Fault increase in June and July may be due to low power stator production; the head of the coil being formed with difficulty, leading to insulation shearing. Other reasons are the small size of the insulation between phases or the hitting of the conductors during the head coil forming.

3) Wrong links:

This fault appears in the following:
- lack of the employee's information upon the change of the winding scheme;
- careless welding process for series-connected coils per phase;
- careless seales in the connection conductors (colour code compliance).

4) Different resistance per phase

The fault appears in the following:
- failure to record the number of turns required on the windings;
- wrong links.

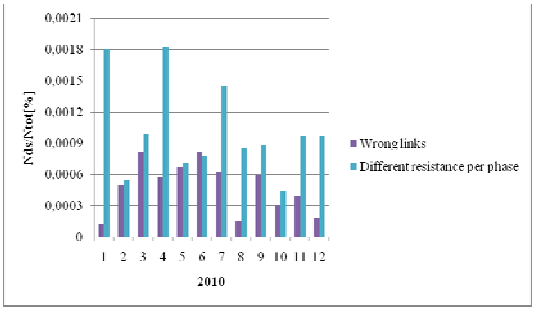

Fig.2. Wrong links and different resistance per phase

Varied types of stator fabrication and their quantity may be a cause of fault growth for wrong links. Introducing, on the manufacturing line, certain types of stators whose characteristics (voltage, resistance, number of turns) change, may influence the growth of a different resistance per phase fault type.

b) Main faults (Fig.3)

1) Incorrect sizes

This fault appears in the following:
- manufacture or misuse of templates specific to each phase coil;
- poor adjustment of the head coil device forming.

2) Turns out of the head coil

This fault appears in the following:
- stator winding;
- isolation between phases;
- head coil binding;

- head coil forming.

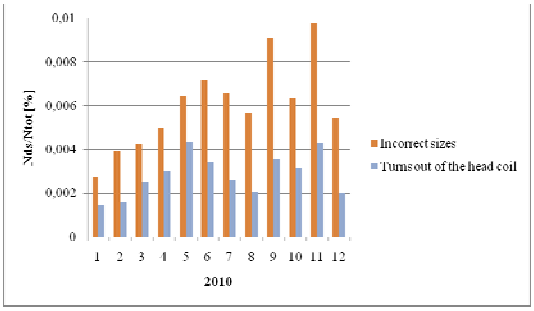

Fig.3. Incorrect sizes and turns out of the head coil

3) Incorrect insulation

This fault appears in the following:

- inadequate insulation settlement of the stator phases in the head coil;
- inadequate insulation settlement between coil phases;
- nonlinearity insulation feathers;
- bending under the insulation failure;
- uneven tightening of the head coil.

4) Improper welding

This fault appears in the following:

- welding for series-connected coils per phase;
- welding wire connection.

c) Secondary faults (Fig.4)

1) Improper wire connection

This fault appears in the following:

- welding wrong connection conductors;
- failure of connection wire colour code.

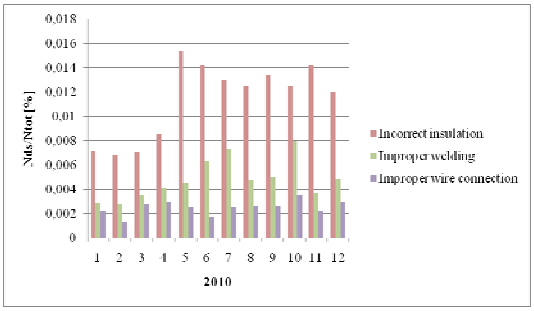

Fig. 4. Incorrect insulation, improper welding and improper wire connection

3.2 Motor faults and graphical analysis. Next, stator control on the production line takes place after motor mounting.

Table 5. Fault types after motor testing

Critical faults	Main faults	Secondary faults
breakdowns	Io; Po; Ik; Pk; DPC	axial clearance
interrupted phase	vibration	manufacturing poor quality
blocked bearing	friction	
wrong links	bearing noise	
starting torque	electromagnetic noise	
winding smoke	clockwise rotation	

Table 6. Total motor faults in 2010

Faults \ Months	1	2	3	4	5	6	7	8	9	10	11	12
breakdown	235	223	313	225	262	319	309	236	321	297	356	226
interrupted phase	71	74	64	84	49	92	74	70	133	135	114	111
Io; Po; Ik; Pk; DPC	62	75	75	39	88	125	137	60	127	165	96	110
eccencentry	286	300	376	344	371	377	373	278	378	377	465	331
bearing noise	79	103	92	59	76	87	114	70	126	97	96	23
electromagnetic noise	37	44	20	12	6	46	43	39	43	31	27	26
manufacturing	0	23	22	37	20	19	30	20	0	71	58	28
Total faults	770	842	962	800	872	1065	1080	773	1128	1173	1212	855

a) Critical faults (Fig.5)

1) Breakdowns (phase-earth, phase to phase): destruction of electrical insulation and wrong layout (winder inattention) of the coil head insulation of stator winding phases.

2) Interrupted phase: the electromagnetic circuit is broken.

3) Blocked bearing: incorrect installation, unbalanced voltage supply, overheating, impure oil lubrication.

4) Wrong links: impurities, excessive vibration.

5) Starting torque: broken rotor bar or defective bearings.

6) Winding smoke: conductor insulation damage (email terephthalic in single or double layer).

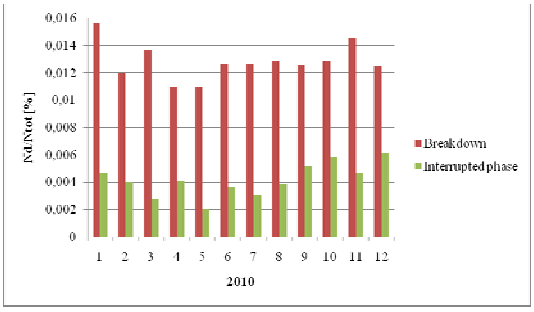

Fig. 5. Breakdown and interrupted phase

N_d/N_{tot} represents the percentage ratio between the number of motor faults and the total number of motors monitored each month.

Faults due to the insulation breakdown, even after impregnating the stator, are in a quite high percentage. These faults are due to the collision of the stator insulation during transportation or in frame pressing.

b) Main faults (Fig.6, Fig.7)

1) Io; Po; Ik; Pk; DPC (different phase current): failure to comply with the limits imposed by the laboratory diagram.
2) Vibration: bearing game, unbalanced voltage, overload, wrong installation, rotor fault.
3) Friction: eccentricity, rotor insulation touches.

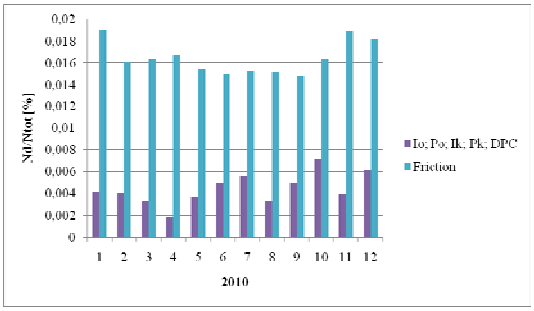

Fig. 6. Io, Po, Ik, Pk, DPC and friction

4) Bearing noise: wrong installation, lack of lubrication, impure oil, overload.
5) Electromagnetic noise: rotor bar inclination angle, uneven winding scheme (higher harmonics).
6) Clockwise rotation: wrong connection links.
c) Secondary faults
1) Axial clearance: wrong installation.
2) Manufacturing: broken ribs, inappropriate paint.

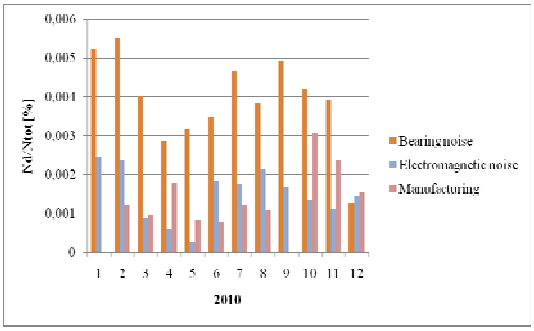

Fig. 7. Bearing noise, electromagnetic noise and manufacturing

The listed faults have the following symptoms:
- voltages and currents of air-gap line are unbalanced;
- increased torque pulsations;
- induction machine torque decreased;
- increased losses and reduced efficiency;
- excessive heat;
- excessive vibration;
- noise.

Through failure analysis on the production line, an action plan has been established for reducing the number of faults:
- investigation of the possibility of using new insulating materials, more resistant to the action of technological factors. A solution to reduce faults due to the insulation system is to improve the quality of the insulating materials and treatment processes;
- development of new testing methods;
- implementation of monitoring procedures, which are placed in new positions for verification.

In Fig. 8 the process for fabricating improved induction machines is illustrated.

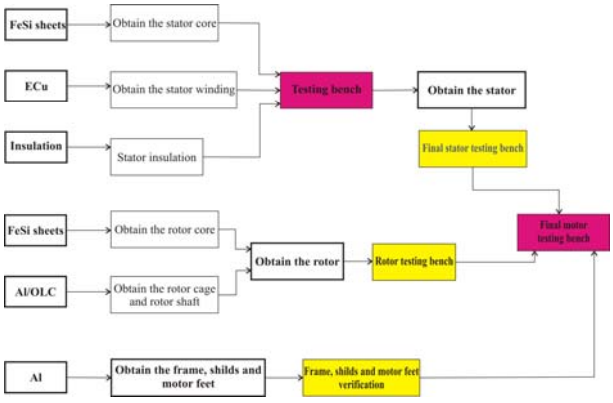

Fig.8. Improved manufacturing line of induction machine

For the execution of induction motor control, only two banks existed (indicated in

red) despite which, as presented in graphical analysis, regardless of motor speed and power, there manifest a lot of defects without being able to find their early appearance.

Through the introduction of three control benches (indicated in yellow) on the technological line, manufacturing faults are reduced. In the first control bench, before stator impregnation, a device was introduced for checking the direction of magnetic field rotation.

At the final testing of the stator, insulation faults can be detected. Rotor verification after manufacturing reduces the types of defects and the electromagnetic noise due to the angle bar inclination. Paint defects, broken ribs can be prevented by the introduction of the third control bench, after frame, shields, and feet production.

4. CONCLUSIONS

Insulation systems used in the construction of induction machines are still the main factor in the breakdown of the manufacture process. They must fall into the class of insulation for which the motor is manufactured, so as to be the best in terms of quality and to withstand electro-mechanical actions.

If the human intervention in the manufacturing process is reduced, the percentage of failures occurring in the induction machine is lower. This implies the mechanization and automation of all stages of the manufacturing technology process and the introduction of new methods and new control benches for monitoring the induction machines faults. Knowing the faults since the design stage and monitoring the manufacturing technology process can reduce the induction machine damage, with obvious effects on the maintenance costs.

ACKNOWLEDGEMENT

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CONSIDERATIONS REGARDING MODAL TESTING OF ELECTRIC MOTORS PARTS

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Abstract: *In the present paper there will be presented the main possibilities of modal testing of an electric motor of 1.1 kW power and 1500 rpm. It is developed a practical methodology of impact hammer test procedure of some mechanical components and the associated natural frequencies found by FEM. In the same time there are presented the damping ratio functions found for these parts.*

Keywords: *modal analysis, electric motor model, experimental test*

1. INTRODUCTION

One of the most important problem in mechanical structures analysis it is represented by the response at dynamic loads. From a mathematical point of view, the dynamic response can be modeled by the matrix equation:

$$[\mathbf{M}]\{\ddot{\Delta}\} + [\mathbf{C}]\{\dot{\Delta}\} + [\mathbf{K}]\{\Delta\} = \{\mathbf{F}\}, \qquad (1)$$

where $[\mathbf{M}]$ is the inertia matrix, $[\mathbf{C}]$ is the damping matrix, $[\mathbf{K}]$ is the stiffness matrix, $\{\ddot{\Delta}\}$ is the accelerations vector, $\{\dot{\Delta}\}$ is the velocities vector, $\{\Delta\}$ is the displacements vector, and $\{\mathbf{F}\}$ is the dynamic external loads vector.

In equation (1) both matrixes $[\mathbf{M}]$ and $[\mathbf{K}]$ can be expressed in a direct way while the damping matrix $[\mathbf{C}]$ can be defined as a linear combination of inertia and stiffness matrixes:

$$[\mathbf{C}] = \alpha\{\mathbf{M}\} + \beta[\mathbf{K}], \qquad (2)$$

where α and β are two coefficients.

The values of α and β coefficients can be found as functions of frequency. When the mode shapes have proportional damping, between these two coefficients can be written the relationship:

$$\alpha + \beta\omega_i^2 = 2\omega_i\zeta_i, \qquad (3)$$

where ω_i is the rotationary frequency, given in rad/s, that corresponds to the mode shape "*i*" and ζ_i is the damping ratio of the same mode shape [4].

A good approach of the finite element model of any mechanical structure involve a good approximation of the damping, especially internal damping. This means to find the damping ratio as function of frequency. The

damping ratio values can be found only by modal experimental tests.

2. THE FINITE ELEMENT MODELS

There were analysed three parts of the electrical motor: the rotor, the stator and the electric motor frame. All these three parts were modelled 3D in IDEAS and the finite element analysis was done using the ABAQUS soft.

2.1 The rotor. The 3D model was done considering the detailed draw considering the main dimensions and particularities of the part. The finite element model consists of 7015 nodes and 32495 elements (Figure 1).

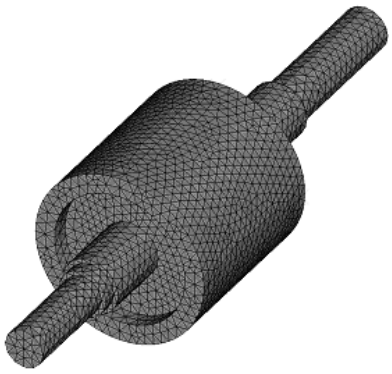

Figure 1

The considered material density was chose according with the real mass of 2.9 kg and the Young's modulus took into the consideration was the value of steel E = 2.1e5 MPa.

There were analysed three different cases of boundary conditions: free-free, simply supported on the bearings mounting region and fixed with special elements spring that have the same stiffness as the bearings.

Considering the case of free-free rotor there were found the first six zero natural frequencies and the following ten important natural frequencies: 43.099 Hz, 56.521 Hz, 128.44 Hz, 138.16 Hz, 271.86 Hz, 389.95 Hz, 519.81 Hz, 587.22 Hz, 619.34 Hz and 699.77 Hz. Practically, one is interested in all mode shapes and considering the visualised imagines of the deformed shape for the first ten natural frequencies all are of bending mode excepting the value of 271.86 Hz that corresponds for the torque mode.

2.2 The stator. As in the previous case, the stator 3D model was done based on detailed draw. The finite element model consists of 9971 nodes and 38029 elements (Figure 2).

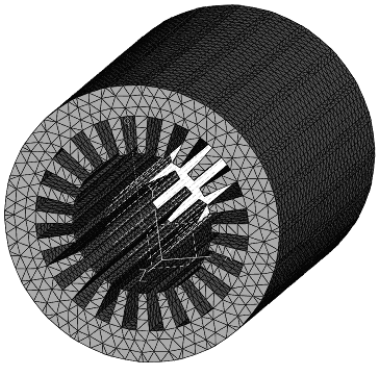

Figure 2

For an approached modal analysis the stator was weighed, without coiling. The total mass was about 2.5 kg and it was considered a material density that gives this weight for the model. The Young's modulus took into the consideration was the value for steel E = 2.1e5 MPa.

The stator was considered free. The first six natural frequencies were zero and then there were found the following important natural frequencies: 70.132 Hz, 133.84 Hz, 184.43 Hz, 300.57 Hz, 323.32 Hz, 340.26 Hz, 376.63 Hz, and 407.14 Hz. All these values correspond to the bending mode shapes.

2.3 The electric motor frame. The 3D model was done considering the detailed draw. This part of the electrical motor is done of aluminium castings with a real mass of 1.3 kg.

The finite element model consists of a number of 66.725 elements and 21.644 nodes (Figure 3).

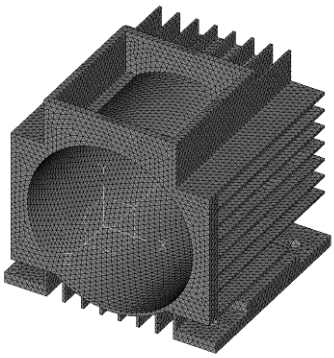

Figure 3

The density value was choose to obtain for the FE model the same mass and the Young's

modulus was E = 0.7e5 MPa, the value for aluminium.

This part, as the other two, was considered as free-free boundary conditions. Besides the six values of zero for natural frequencies were also found the following main values: 18.577 Hz, 28.952 Hz, 37.043 Hz, 47.640 Hz, 59.094 Hz, 76.488 Hz, 97.427 Hz, 119.90 Hz, 136.79 Hz, and 148.64 Hz.

3. EXPERIMENTAL SET-UP

Experimental modal analysis was done using the method of impact hammer. The used equipment was: impact hammer type 8206-003 Brüel&Kjær, four accelerometers type 4507B Brüel&Kjær, Pulse 12 platform type 3050 Brüel&Kjær, programs for signal processing type 7705 and 7709, and soft ME'scopeVES, v.5. The applied procedure of modal testing was that that is described in technical literature [1, 2, 3, 5, 6].

3.1 The rotor modal analysis. The set up is presented in figure 4.

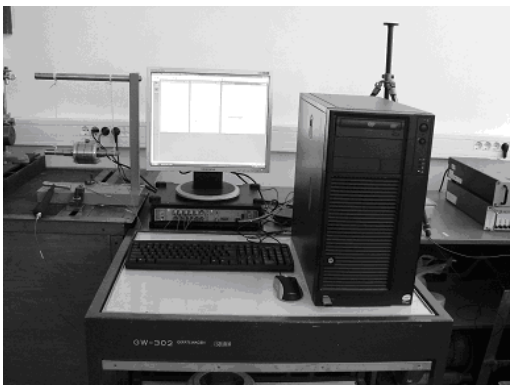

Figure 4

All the four accelerometers were mounted around the rotor at 90° (Figure 5). The hammer hits were applied between the accelerometers and the used tip was aluminium made.

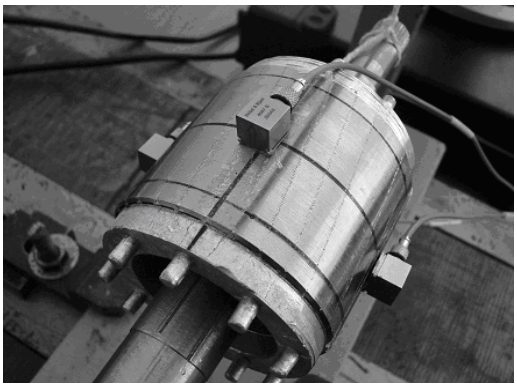

Figure 5

The signals were recorded both in time and frequency domains. The time domain response shapes, in all testing cases, were like the graph presented in Figure 6, and the frequency response shape is presented in Figure 7.

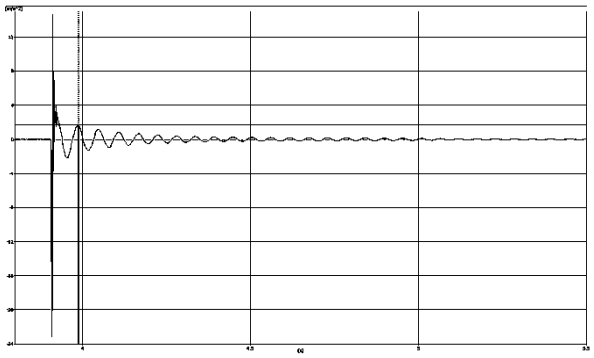

Figure 6

Considering the measurements done at all four accelerometers it was found an average global damping ratio of $\zeta = 0{,}08475$, and an average damping period of $T_a = 0{,}067\ s$.

Based on thsese values one can find the damping frequency $\omega_a = 93{,}778\ [rad/s]$.

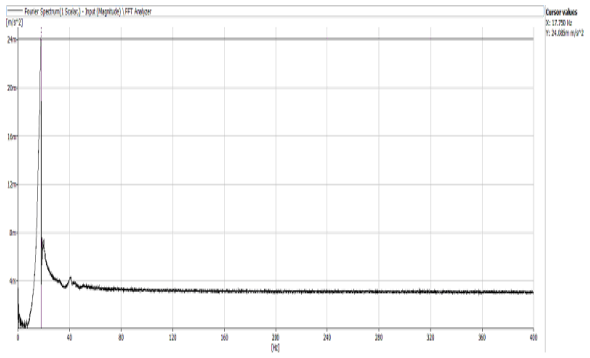

Figure 7

Thus the natural frequency is:

$$\omega_n = \frac{\omega_a}{\sqrt{1-\zeta^2}} = 94{,}116\left[rad/s\right], \qquad (4)$$

and $f_n = 14{,}979\ Hz$.

In the same time, the recorded signals were analysed using the ME'scopeVES, v.5 soft (Figure 8).

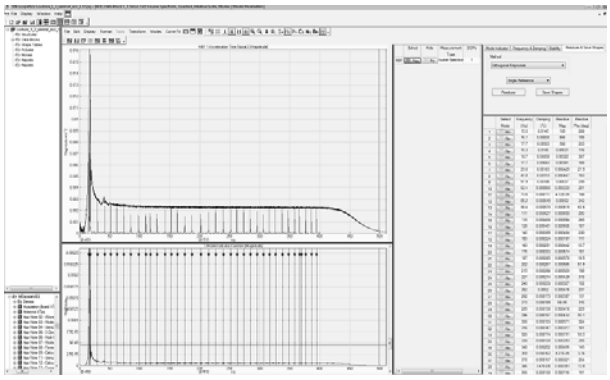

Figure 8

Based on this soft it was possible to be found, for different frequencies, the damping ratio ζ. Taking into consideration the founded values it was calculated, in MatLab a function of damping ratio as (Figure 9):

$$\zeta(f) = e^{-0{,}971422} f^{-2{,}574125} \qquad (5)$$

with a regression coefficient of $R^2 = 0{,}881$ and f is the frequency in Hz.

The first five natural frequencies found were: 15.3 Hz, 29.8 Hz, 42.9 Hz, 62.4Hz, and 85.2 Hz.

3.2 The stator modal analysis. The results obtained in case of rotor were very pour with a lot of distortions. As cause it was considered the structure with many armature laminations that were not perfect mounted. The whole could not work as a single structure and there were recorded many frequencies generated by the uncoupled armature that vibrate alone (as single bodies).

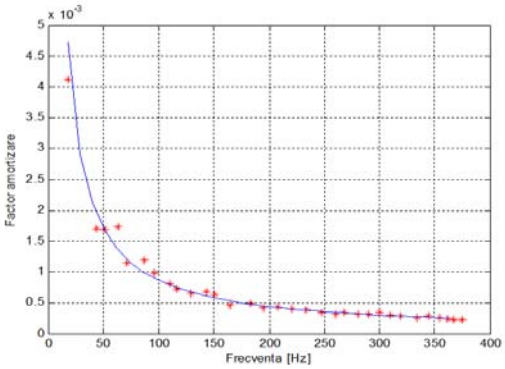

Figure 9

3.3 The electric motor frame modal analysis. As in the case of the stator, the frame was simply supported on a thick sponge part (Figure 10). There were considered three point for signal measuring, denoted by 1,2 and 3 in Figure 10.

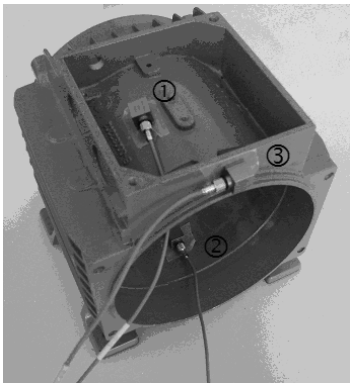

Figure 10

The test consists of set of five hits in four different points, around the frame. The time response (Figure 11) and the frequency response (Figure 12) recorded at all three accelerometers had the same shape.

The signals measured by all accelerometers were analysed using the ME'scopeVES, v.5 soft (Figure 13).

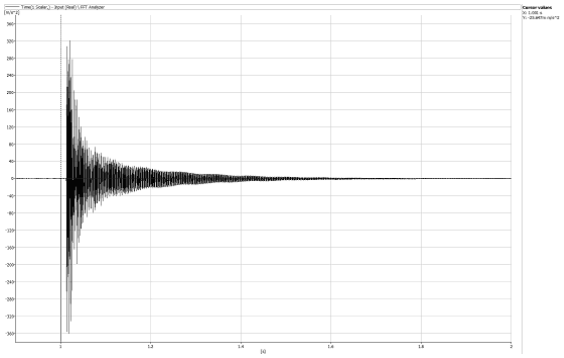

Figure 11

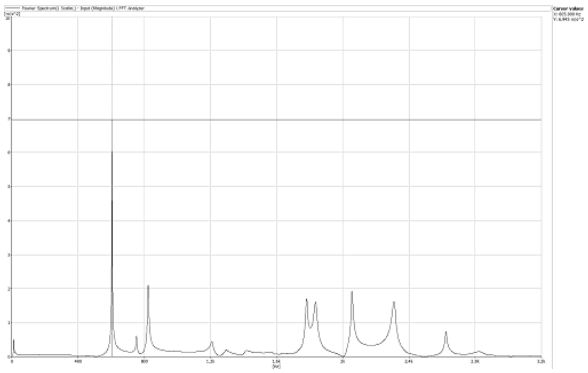

Figure 12

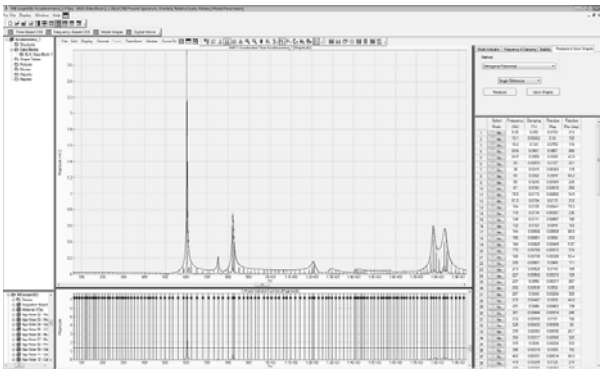

Figure 13

The damping ratio ζ for different frequencies was found based on the data processed with this soft. In MatLab was defined a function of damping ratio as (Figure 14):

$$\zeta(f) = e^{1,2293} f^{-0,9853} \quad (6)$$

with a regression coeficcient $R^2 = 0,898$ and f is the frequency, in Hz.

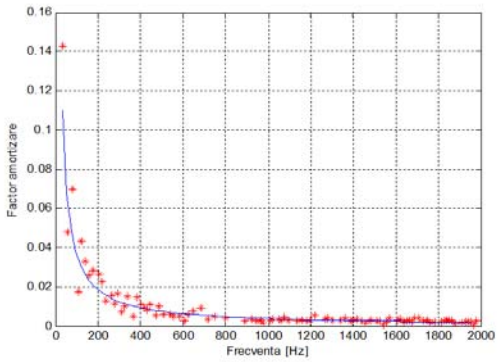

Figure 14

The measured natural frequencies were: 14.0 Hz, 604.5 Hz, 753,5 Hz, 823.0 Hz and 1304 Hz. As it can be seen in relationships (5) and (6) the obtained damping ratio ζ has an exponential variation law as function of frequency. Both functions offer an approximate calculation in the range up to 400 Hz.

4. CONCLUSIONS

In the frame of this paper there were presented two possibilities of finding the natural frequency of three mechanical parts of electric motors: one based on finite element method and the other one based on experimental set-up.

The importance of parts natural frequencies results from the need resonance phenomenon avoid. In the same time any fault can be associate with working frequencies that is close to natural frequencies.

The finite element models are pure mathematical models and the values that were

found can be influenced by the assumptions done in parts modelling.

In case of rotor, in the first five determined natural frequencies there were found only two values that are approximately equals: 43.099 Hz and 56.521 Hz – FEM, and 42.9 Hz and 51.9 Hz - modal testing. In the case of the stator it was difficult to be found the experimental natural frequencies as was above described. In the case of the electric motor frame it was found only one approached value in case of low frequencies but for the high frequencies there very close values. This can be explained by the fact that the high values are associated with the cooling flange vibrations.

Based on experimental modal analyses there were found two functions of damping ratio variation, relationships (5) and (6). These functions can be used in any finite element soft to create the model of structural damping described by the relationship (2).

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RESEARCHES AND EXPERIMENTS ON TELECOMMUNICATIONS OPTICAL FIBER WELDING

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***Abstract**: This paper presents the welding phases of optical fibers and welding technology of five types of optical fiber in following combinations: unimodal, multimodal and with modified dispersion.It is presented welding equipment and working parameters for each execution phase. The welding joining presents properties and qualities that are superior to mechanical joining.*

***Keywords**: optical fiber, welding of optical fiber, welding quality, optical fiber welding phase*

1. INTRODUCTION

Optical fiber communication systems are the most effective signal transmission cables, occupying a higher frequency band used for different purposes: telephony, data, video telephony with high frequency and security.

Through optical fiber we understand a optically transparent medium, very long, with circular cross section and refractive index and symmetric radial steady or variable, separately by another material with constant refractive index lower, because the dividing surface to produce total reflection of light radiation without loss. An optical fiber may be associated with a dielectric waveguide used for the propagation of electromagnetic energy at optical frequencies.[1]

2. OPTICAL FIBERS WELDING PHASES

In the technology of welding optical fiber these steps are necessary[2]:

- Fiber preparation for welding- FS-FO-1;
- Implementation of the welding process - FS-FO-2;
- Follow-up parameters - FS-FO-3;
- Assembly - FS-FO-4.

In the implementation phase we introduced the welding process:

1) The approaching of the optical fibers - FS-FO-2-1;
2) Alignment and determination of the cutting angles of the two fibers subjected to weld - FS-2-2-FO;
3) Recognize of the differences in fibers and determination of concentricity of the two fiber-FO-FS-2-3;
4) Electrical arc - FS-FO-2-4;
5) Concentricity measurement and the estimated loss of fibers after welding - FS-2-5-FO.

Briefly, the phases of the weld are shown in Figure 1.

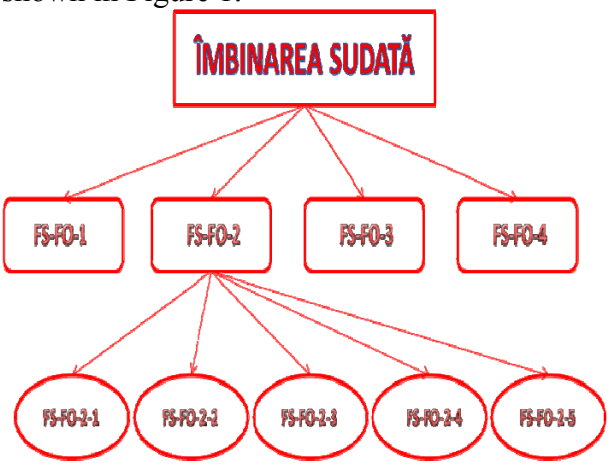

Fig. 1 Optical fiber welding phases

FS-FO-1 - fiber preparation for welding

Fiber-optic cable can be made from a wire up to 432 or more fiber yarn. To solder these wires, the cable must first be stripped. It removes all the outer casing, silk yarn and then the inner shell so as to have access to buffers containing optical fibers (Fig. 2 - Fig. 3).

Fig. 2 - the optical fiber cable after elimination of the protective outer casing

Fig. 3 – Eliminating the inner liner of fiber cable protection

As far as protections buffers are eliminating is observed that are coated with a gel that prevents water penetration. This gel is cleaned using alcohol-based solvents. After removing the gel from the protective tubes (buffers), they are cut with special pliers, that is designed to cut only the plastic casing, without touching and scratching the optical fibers.

FS-FO-2 - implementation of the welding process

For welding optical fibers, we need a special device capable of made this operation, taking into account the size and type of joint. In figure 4 is presented Fujikura FSM 50S device. Its main components are:

- welding mechanism composed in turn of the welding head, micro cameras and mechanism for securing and guiding the optical fiber;
- LCD - where fiber movement can be viewed in real time, welding and weld analysis result;
- heating block where the sleeve shrink after being placed over the fibers stick welding seam, making it integral with;
- the controls body block;
- power supply.

Fig. 4 - Ultrasonic Welding Fujikura fiber type, model FSM 50S

Figure 5 - guiding mechanism, welding equipment and electrodes microcamerele fiber

The welding mechanism is shown in Figure 5[5]

- The welding head consists of two electrodes, a laser with gas or electric, a gas flame, or a tungsten filament through which passes an electric current. In case of the device produced by Fujikura, FSM 50S, the welding head consists of two titanium electrodes that produce an electrical arc capable of creating glass melting temperature;
- Micro cameras placed at an angle of 90 degrees to each other to look at any time at the fiber on both axis;
- Fiber guide mechanism is located on both sides of the electrodes. This mechanism is designed to provide optical fiber and to push fiber toward each other in the welding process to make the merge.

FS-FO-2-1 - The approaching of the optical fibers

Once the fiber that ends to be welded are prepared, peeled and cut, they are fixed in the welding apparatus of the fiber guiding mechanism, leaving a gap of approximately 1 mm to electrode axis. In figure 6 is shown the distance from the axis of the fiber electrodes on the left. Same fiber and space is left on the right, figure 7, then is used a protective shield of the welding head and is pressed the SET button, which starts the welding operation.

Fig. 6 - The attachment of the fibers for welding

Fig. 7 - Distance from the fiber to welding electrodes before the welding process

Approximation fibers (difference or "gap setting") can be seen in figure 8. The LCD screen images appear on both micro cameras that give us the x-axis and y-axis position, fiber at a zoom of 147 times. Thus we can get a first opinion on the surfaces to be welded. If there are irregularities in the surface, the process of peeling and cutting surfaces is restarted. During this phase you can see how the device aligns the two fibers on the two axes.

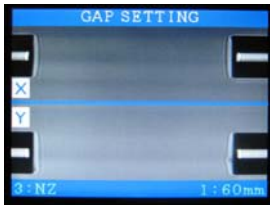

Fig. 8 - Setting gap

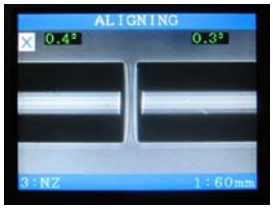

Figure 9 - Align fibers

FS-FO-2-2 - Alignment and determination of the cutting angles of the two fibers subjected to weld

Figure 9 is observed on the LCD screen, a single fiber to come into contact at a zoom of 295 times. Last fine adjustments are made to align the two fibers. It can be seen at the top of the screen the cutting angle of the fiber axis perpendicular to the axis of symmetry. In this case, the left has a fiber angle of 0.4 degrees and 0.3 degrees the right one. If this angle is greater than 3 and welding cannot be achieved, and the operation of the fiber preparation must be repeated.

FS-FO-2-3 - Recognize of the differences in fibers and determination of concentricity of the two fiber

After the fibers were aligned are show the differences in the fiber core at the bottom of the screen as shown in figure 10. In the bottom left it shows the difference between the two axis of the fiber cores, 0.1µm in our case and in the right side shows the difference between the axis of the outer casing of the fibers of 0.2µm in this case.

During this time the fibers are approaching more and more till their gap decreased to zero.

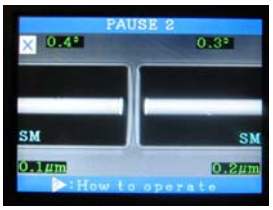

Fig. 10 – Fiber recognition and determination of the two fiber differences concentricity

Fig. 11 – The welding through an electrical arc

FS-FO-2-4 – Electrical arc

When optical fibers are in contact, a brief electrodes discharge is used to burn off any dust or dirt from the fiber ends. At a time that can be set between 1ms and 1s after this initial arc occurs the main arc between the two electrodes, an arc that develops a temperature of 2000°C, which leads to the melting temperature of the fiber in the contact area (Fig. 11). During this time the fibers of the directions mechanism are closer to one another, with 15µm. This distance covers any differences in the fiber cut and after welding is resulted a continuous fiber.

FS-FO-2-5 - Concentricity measurement and the estimated loss of fibers after welding

It is made an estimate of the attenuation of the signal over optical fiber, taking into account the wavelength of light radiation passing through the fiber core diameter, refractive index of fiber core index of refraction of the optical fiber casing of the device and light source intensity.

Measuring principle is based on the refraction of light through different density media. This light is delivered by a source at a certain angle, passes through the coating of the first fiber (in the peeling) is refracted at the contact with its core penetrating core, is reflected within the core, passes through the fiber and the other fused after passing from the core wrapper is captured and measured. Knowing the amount of radiation transmission and reception apparatus is a conversion loss is estimated in the weld as shown in figure 12. It

must not be less than 0.03 dB. In the case that it does the steps above are repeated, resuming the welded joint.

Fig. 12 - Measuring the attenuation

Also you can see in the bottom of the screen the influenced concentricity of the fiber core and the outer casing from the weld. In this case, offsetting the core has remained constant at 0.1 mm and the outer casing offsetting decreased from 0.2 to 0.1 mm.

If the welding corresponds qualitatively, in sense that mitigation is less than 0.03 dB, the next process, the hardening of the weld, is made in the end using a heat-shrinkable sleeve.[4]

Place the sleeve over the weld, taking care not to crack, after which the heating device is placed at the top of the welding machine (Fig. 13), where there is an electrical resistance that heats the sleeve. After heating, the adhesive melts and adheres to the inner tube welded the fiber and the outer tube through its contraction causes the metal resistance element to be firmly attached to the two fibers providing mechanical resistance welded weld.

Figure 14 provides a protective sleeve for the mechanical shock and vibration environment. Due to good adhesion, the sleeve provides a protective environment, protecting the welding of liquids and contaminants.

Fig. 13 - The heating device

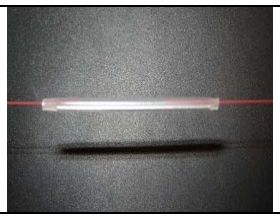

Fig. 14 – Welding protective sleeve

3. RESEARCHES ON THE LOSS LEVEL IN WELDED JOINTS IN WELDING DIFFERENT TYPES OF OPTICAL FIBER

To test these requirements, we have made many experiments on five sets of connecting optical fibers of different types:

1) Single mode fiber (SM) with single mod fiber;
2) Single mode fiber (SM) with modified dispersion fiber (dispersion shifted fiber - DSF);
3) Single mode fiber (SM) with multimode fiber (MM);
4) Fiber dispersion fiber as "nonzero switchover times" (nonzero switchover times dispersion shifted fiber - NZDSF) - Multimode fiber (MM);
5) Multimode fiber (MM) multimode fiber (MM);
6) Modified fiber dispersion fiber (dispersion shifted fiber - DSF) - modified dispersion fiber (dispersion shifted fiber - DSF).

In this set of experiments we measured the loss at the welded joint and the number of attempts to achieve a reliable welding (with less than 0.03 dB attenuation).

Welding machine used was Fujikura FSM50S product.

In the experiments we choose two single mode fiber welding temperatures, i.e. 35ºC, 20°C, 10 °C, 0 ºC and -5 ºC throughout the experiment using Fujikura apparatus FSM50S.

In this set of experiments was also measured the loss of the welded joint and the number of attempts to achieve a reliable welding (with less than 0.03 dB attenuation).

To increase the mechanical shock resistance welding and the forces of pressure and torque, weld is protected by a shrinkable sleeve adhering to the two fibers and has a metal insert that ensures a high resistance to such forces.

The research was conducted on two samples for assessing the loss of single mode fiber at a welding (SM) with a fiber single mode (SM) at ambient temperature 22 ° C.

Fibers have been merged shell thickness of 125 mm and 9 mm thick core. After the pre-peeling operations, etching and surface preparation phase of FS-FO-1 has moved to the execution of the welding process, namely SF-FO-2 phase.

Phases of the first evidence can be seen in Figure 15.

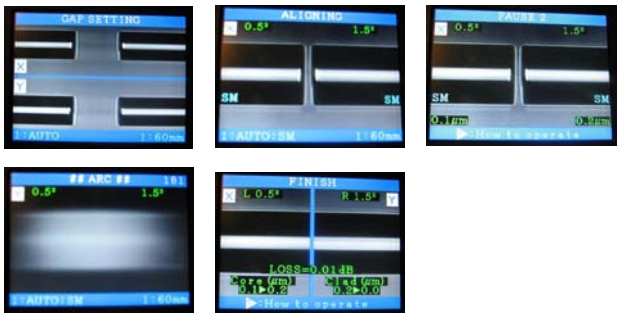

Fig. 15 - Phases of welding the first evidence of a fiber with a fiber SM – SM

In the first image the phase FS-FO-2-1 is observed, respectively the gap between the two fibers. This image is a view on the two axes, two images taken simultaneously with the television camera device. These fiber images are made at a zoom of 147.

The second image shows the phase FO-FS 2-2, at a zoom of 295 and is observed how the two fibers are recognized by the device as single mode and how to focus camera. In the upper left corner is shown the right cutting angle of the fiber on the left and right respectively. In our case the fiber on the left has a cutting angle of 0.5 degrees and 1.5 degrees on the right one. The two angles are less than 3 degrees, so it falls within acceptable limits.

The third image shows the phase-FO-FS 2-3. Once the fibers are automatically aligned to show differences in the fiber core - 0.1 mm respectively in the upper left corner and fiber casing - 0.2 mm respectively in the upper right corner.

The fourth image shows the phase-FO-2 FS-4, the weld. Is observed how the arc is concentrated in the contact area between the two fibers. Arc reflection may well bee seen the outer casing, but also can be seen well defined core area, this light is more dense area. Image two, three and four are zoomed by 295.

In the fifth image of figure 15 is presented the phase-FO-FS 2-5 and is shown the estimated welding loss of 0.01 dB. The core shows that the combined area increased from 0.1 mm to 0.2 mm while the outer casing offsetting decreased from 0.2 mm to 0µm.

Phases of the two samples of welding a single mode fiber with a single mode fiber can be seen in Figure 16.

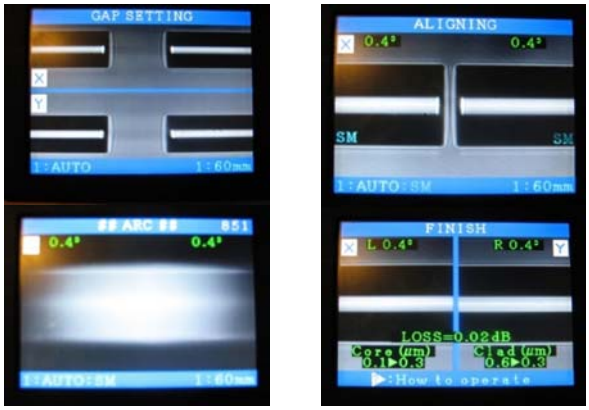

Fig. 16 - Phases of the two samples of welding a fiber with a fiber SM SM

The first image shows the phase-FO-2 FS-1 at a zoom of 147.

The second image shows two phase-FO-FS 2-2, at a zoom of 295. Is observed how the two fibers are recognized by the device as single mode and by the focus camera. In this case the fiber on the left has a cutting angle of 0.4 degrees and 0.4 degrees on the right one. The two angles are less than 3 degrees, so it falls within acceptable limits.

The third picture shows the phase FO-2 FS-4 and shows the welding at a zoom of 295. Is observed how the arc is concentrated in the contact area between the two fibers. Arc reflection can be seen in the outer casing, but also comes from well defined area.

The fourth image of figure 16 presents the phase FO-FS 2-5 and shows the estimated welding loss of 0.02 dB. Also the core shows that the combined area increased from 0.1 mm to 0.3 mm while the outer casing offsetting decreased from 0.6 mm to 0.3 mm.

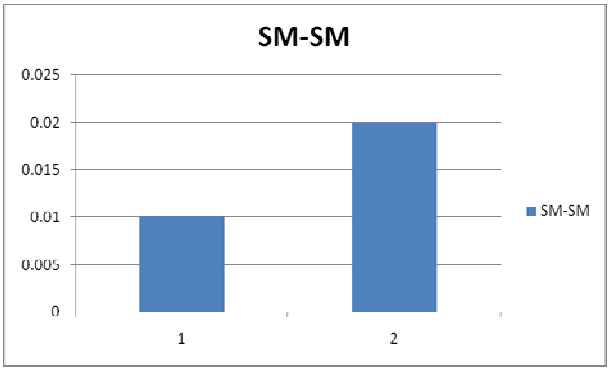

Fig. 17 - Loss on a level of welded joints in welding MS fibers with a fiber SM

4. CONCLUSIONS

Solder joints, from the point of view, is a combination that require a large initial investment ($ 15,000 - $ 50,000), depending on the accuracy of welding equipment purchased, but the cost for a weld is small ($ 0.5 - 1 , $ 5). Typical loss is less than 0.03 dB.

Description of the phenomena of welding sequences for comparison, current and displacement of fibers helps the understanding of arc welding during production.

Introducing the concept of phasing welding FS-FO makes it possible to understand phenomena before, during and after welding of optical fiber telecommunications.

Great importance should be given to cleaning and etching operation because in the presence of protective gel is impossible to weld the optical fibers.

The stripper and the guillotine are special tools, high quality and are essential in the preparation of optical fiber for the weld, the quality depends on how it has been peeled and chopped fiber.

It is easily seen from the summary table that at temperatures approaching 0 ° C problems in welding optical fibers, but not because the device when cooling weld because of its fragility. Following welding of fibers is not recommended in freezing water.

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THE CONCEPTION OF A COMPUTER FOR HEIGHT COMPUTATION ON TELECOMMUNICATION ANTENNAS

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***Abstract**: Telecommunication antennas are the main constructive and technological components for accurate transmitting of emission – reception signal. The construction and the sizing are essential elements for a high quality transmission. The presented computer in this paper permits the computation of height for telecommunication antennas that are located between two main stations in order to obtain a direct visualization line which avoid the obstacles. The computer takes into consideration the following: emission frequency, earth curvature (radius), distance between earth and the obstacle, the so called Fresnel zone and the refraction effects in the atmosphere. Solutions for antennas with same height and with different heights with natural obstacles between stations of different heights are presented. It is possible to compute the height of telecommunication antennas on a direct visualization line taking into account refraction effects in atmosphere.*

***Keywords**: telecommunication antennas, computer, Fresnel zone, refraction*

1. INTRODUCTION

Telecommunications antennas (TC) are the main constructive and technological components used for accurate transmitting of emission – reception signal.

The category of tower-shaped buildings and pillars includes: radio and television towers, radio masts, lighthouses, some high towers, chimneys, towers of power transmission lines and more.

Tower-shaped buildings are usually embedded in the foundations. Pillars are related to building foundation and articulated with cables anchored at different heights.

Towers and pillars were the spatial compositions, lattice or solid cylindrical shape of their surfaces, made of thin sheet metal. Cross section can be square, triangular or round. Construction and dimensions of height to cross is very high. The vertical section in construction can be vertical or slightly inclined

with some curvature, vertical section widening towards the base.

2. THE CONCEPT OF RADIO TRANSMISSION [1]

To send information between the subscriber and the mobile network using a radio channel anyone who has traveled by car while listening to a radio show, noted how the quality of reception changes over time (or tunnel crossings between two hills, etc.).

This effect is called "shadowing" or long-term fading, and is the main problem of radio communications.

Knowing the reaction channel of communication (radio channel) it is important to choose those methods of modulation or coding, the base station antenna parameters (position, height, type) so that communication be of a good quality.

Due to natural barriers (landforms, vegetation, etc.), and because of relatively low construction height, the antenna dish are rarely direct vision, in other words, rarely, there is a direct propagation path (LoS - Line of Sight).

Such a channel BTS - MS except of the free space propagation (direct spread) several ways of propagation (along with moving furniture) is known. These paths are the result of the phenomena of reflection, diffraction or scattering radio waves (Fig. 1).

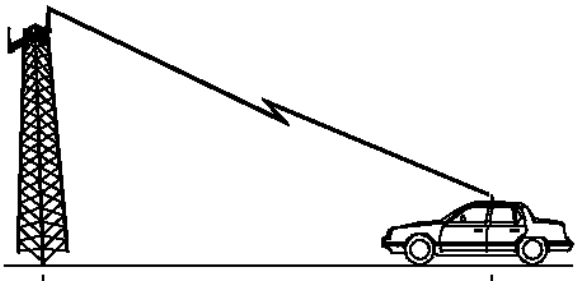

Fig. 1. Propagation in free space

Reflection occurs when an electromagnetic wave encounters a barrier much larger than the wavelength, resulting from reflection on the surface of the earth where the mobile (MS) with it constructively or destructively interfere.

Diffraction occurs when the antenna between the transmitter and receiver structure interposes an impenetrable mass and electromagnetic (hill, mountain, large building, etc.), however, behind it is finding a radio-frequency electromagnetic field. This is explained by the phenomenon of diffraction, which is based on the appearance of secondary electromagnetic waves.

Diffraction is one of the mechanisms that explain the possibility of communications between buildings in urban and rural areas where is no LOS propagation.

Scattering occurs when in the direction of propagation there are objects with dimensions similar to the wavelength of radiation.

When a mobile wave moves within an area covered by electromagnetic field three propagation mechanisms influence the amount of received signals differently depending on the geographic and architectural configuration. An important aspect in the analysis of the radio signal is spread in existence or not of direct visibility (LOS). We can say that in large cities practically propagation takes place without the existence of LOS paths.

Weak signals is an important issue, they can be interfered by the signals (Fig. 2) strong undesirable working on the same channel as the desired signal. Therefore, the cellular system with frequency reuse, interference may occur if special precautions are taken. A special measure taken in this context refers to the alteration of the output power BTS and MS on the downside, if the distance between them is small enough to enable optimal communication with lower emission power.

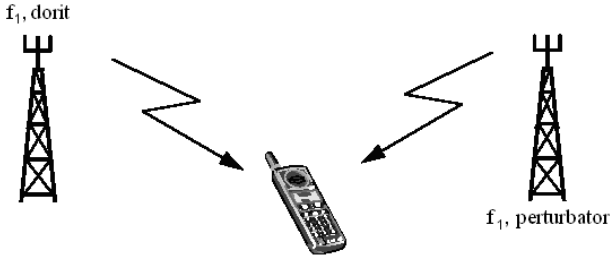

Fig. 2. Interference signals

Obstacles between cell base stations creates a shadow effect which decreases the received signal strength. When the station moves, depending on signal strength fluctuates between obstacles between the transmitting antenna - and receiving antenna Tx - Rx (there is an incoming signal fading or fluctuation).

Fading is a variation of signal intensity:

- Long-term fading (shadowing) (Fig. 3) is amended due to the shape of the land along the route of spread - fluctuations are slow.
- Short-term fading or Rayleigh fading (Fig.4), is due to waves arriving from the immediate vicinity of the mobile structures (structures within a distance less than 100λ are rapid fluctuations. In the latter case, it decreases to reach - 20dB (100 times) or even-30dB (1000 times) in some situations.

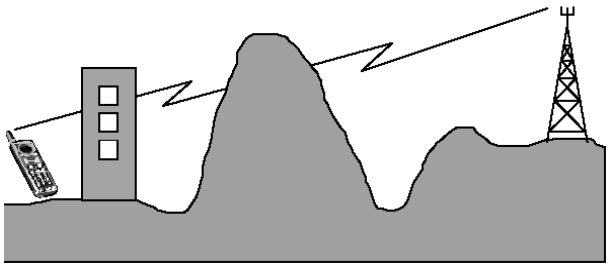

Fig. 3. Long-term Fading

Rayleigh fading (Fig. 4) occurs when the signal between two antennas passes through more than one way. In this case the signal is not received directly from the transmitting antenna. Moreover, he bounces (of buildings, for example) and is received in several different ways.

In this case, the signal is a sum of several identical signals which differ only in phase, resulting in a final signal which has the maximum and minimum envelope. Minimum time between two mobile stations depends on the speed and frequency of the radio channel.

It should be noted that the terms associated with fast and slow fading is an inappropriate choice by the fact that fading is a spatial phenomenon and not temporary. Justification is found in the fact that spatial variations are collected by a moving vehicle that changes position in time.

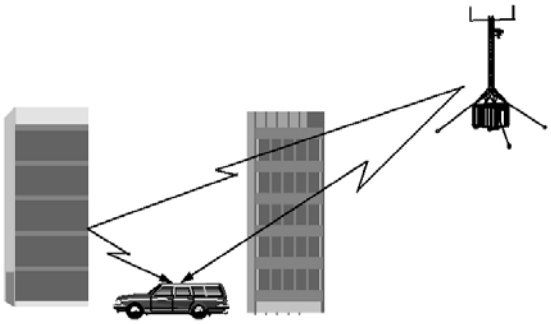

Fig. 4. Rayleigh fading

Time dispersion (Fig. 5) is another problem exists in digital broadcasts, which although it has its origins in reflections, is in contrast to multipath fading, as reflected signal arrives at an mobile object at big distance from the receiving antenna (Rx).

Propagation time dispersion due to interference between symbols (Inter-Symbol Interference) where consecutive symbols interfere with each other making the difficult task of their correct interpretation by the receiver.

The figure below sequence 1, 0 is issued by the base station and the reflected signal arrives a bit later than during the direct signal, the receiver detecting a symbol of the wave reflected at the same time as the symbol 0 from direct light. The symbol 1 interferes with the symbol 0.

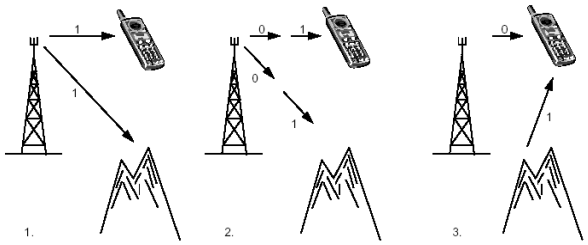

Fig. 5. Dispersion time

In the GSM radio channel transmission rate is 270Kb/s, which means that the length of a bit is 3.7 ms. So, a bit corresponds to 1.1 km, and if there is a 1 km reflexion from behind the mobile station, the signal is reflected by the Route 2 Km. In this case, mixing occurs between two direct and reflected signals, causing errors on the radio path. Their compensation is made through specific means.

Outdoor areas of a GSM coverage is assumed to be sufficient if the power received by a mobile is less than the amount projected to be around-90dBm (1 pW) over an area of 95% of total.

Indoor coverage is the percentage of the ground floors of all buildings in the area where the GSM signal strength is above the required signal of furniture, which is fixed at-97dBm.

Losses due to penetration of buildings are defined as the difference between the signal strength outside the immediate vicinity of the existing building and the signal strength on the ground floor.

3. Radio line viewing

At the microwave frequencies when performing an RF link between two remote sites that must exist between the two antennas to a line of view. But at these frequencies is not just the line of view from a site that you can see the other. When such distances exceeding eight miles, must take into account the following factors [4]:

- The curvature of the Earth;
- Distance from ground / obstacle Fresnel zone;
- Atmospheric refraction.

a. Earth Curvature

Figure 6 illustrates these concepts with an exaggerated representation of a long link.

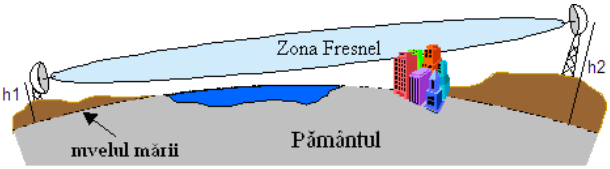

Fig. 6 Fresnel Zone with obstacle

Fresnel Zone (Fig. 7) is a long ellipsoid that lies between two antennas. The first Fresnel zone is such that the difference between the direct path (AB in the figure below) and an indirect way to achieve a single point on the edge of Fresnel zone (ABC) is half the wavelength.

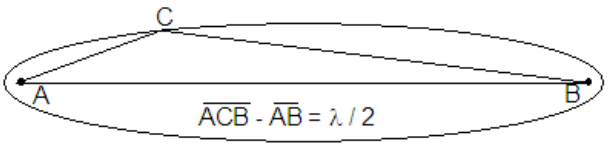

Fig. 7 Fresnel Zone

If a significant portion of the Fresnel zone is blocked, the signal reception can be greatly attenuated. In general it is necessary that at least 60% of first Fresnel zone is clear of obstacles for the propagation of radio wave to behave as would be in free space. 60% of first Fresnel zone is an ellipsoid with a narrower range that is 60% of the radius of the first Fresnel zone.

Even if half of the 2.4 GHz wavelength is only 6.2 cm long distances can be very large ellipsoidal radius. For example, a link distance of 50 km radius of the ellipsoid (60%) in the middle section is 23 m. The calculator can be used to calculate the radius at any point between two antennas. You can also change the percentage of the first Fresnel zone.

Fresnel zones (Fig. 8) uses a serial number corresponding to the number of multiples of half wavelength, the difference of the radio wave propagation path from the path direct. The first Fresnel zone is thus an ellipsoid whose surface corresponds to a path difference of half wavelength and is the smallest volume of all other Fresnel zone [1].

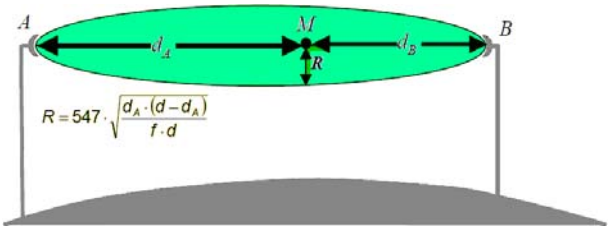

Fig. 8. Fresnel Zone between the two stations located on a surface equivalent of the earth (beam is right).
d_A = Distance from antenna to point M, km
d_B = Distance from antenna B to point M, km
d_A+d_B = d = distance between antennas A and B, km
R = radius of Fresnel zone at point M, m
f = frequency, MHz

b. Distance from ground / obstacle

Refractive properties of the atmosphere are not constant. Variations in atmospheric refractive index (expressed by the radius of the earth - the factor k) can force land irregularities to intercept all or part of Fresnel zone. Distance to the obstacle from the line of view (Fig. 9) can be described as a criterion to ensure that sufficient antenna heights, so that in the worst case of refraction (the factor k is minimal), the receiving antenna is located in the region of diffraction.

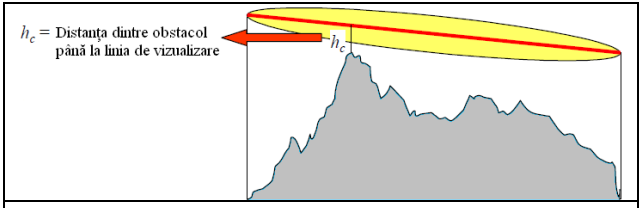

Fig. 9. Distance between barrier to the viewing line

Direct path between sender and receiver must have a distance from the ground or any obstacle to the line of view at least 60% of the Fresnel zone radius to ensure propagation in free space. Distances from the ground / obstacle must match local climatic conditions.

Small values of k down the line view (requires higher antenna heights) but offers better protection from interference from other antennas. Higher values of k give a high-line viewing (requires smaller antennas heights) but expose the link to interference from other antennas.

c. Atmospheric refraction

In normal weather conditions, radio waves do not propagate in a straight line, having a slightly downward slope. This is due to atmospheric refraction affecting the radio waves propagate horizontally. To consider this bending downward, all calculations are performed using a higher route to Earth's radius, so that radio waves can be considered as having straight line propagation.

The computer can simulate the Fresnel zone, can change the Earth range multiplication factor (k factor) and take into account the different atmospheric conditions. Under normal conditions, the factor "k" is 4/3. However, unusual weather conditions can cause about significant changes in the refractive profile. For greater certainty of the link using a lower value of factor k[3].

Solution for equal antenna height

For any given distance, the computer displays the Fresnel zone antenna height (same on both ends) so that the Fresnel zone (Fig. 10) just wipe the surface of Earth as shown in the figure below.

Different antenna heights

It is unusual for both antennas to be the same height, so that the computer allows the addition of various heights for the two end points (all heights are above sea level, h1 and h2 in the figure above).

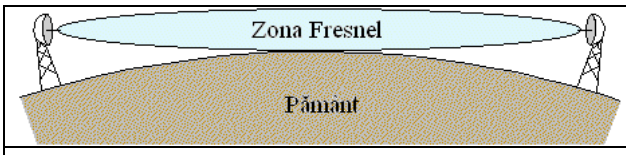

Fig. 10. Fresnel Zone – earth curvature

The computer calculates the path that is the point where Fresnel zone is closest to earth at sea level. It displays both a distance from the site and the distance between the earth at sea level and the lower limit of Fresnel zone. A negative distance means that the Fresnel zone overlaps with the profile of the Earth.

Avoiding an obstacle

The computer determines whether there is enough space above an RF obstacle, or alternatively, how high should be erected antennas to avoid the obstacle. The software need to know each potential obstacle on the path and the distance from one of endpoints and obstacle height above sea level. Draw the path in "Google Earth" is a quick way to identify buildings or structures that are the direct route and find their distances from the points of the head. You may need to use topographic maps, drawing a line between the points of the head and create a profile just on the land. If there are buildings or trees on the track, it is necessary to determine or estimate their height above ground height to be added to the land of those points.

For each of these points of potential obstruction, is calculated place and distance from the site of an obstacle height above sea level in the bottom left of your computer. On the right side of the computer it displays vertical separation barrier between the top and bottom of the Fresnel zone. If this value is negative, it can increase the height of one or both antennas to the distance ground / obstacle is greater than zero.

If more than 60% of first Fresnel zone is free of any obstacle, then spread the RF link will be similar to that of free space.

4. CALCULATOR FOR DETERMINING THE ANTENNA HEIGHT[2]

The computer designed in the paper enables the computations of the heights of telecommunications antennas located between two stations, to get a direct line of view, which avoids an obstacle.

The computing of the Fresnel zone (Fig. 11) and antenna height helps them determine if there is a 'direct line of view "between two distant points, or alternatively, how each antenna to be lifted up to avoid an obstacle. The calculator takes into account the Earth curvature and refraction effects in the atmosphere.

If there is a very long link frequency, these effects must be taken into account.

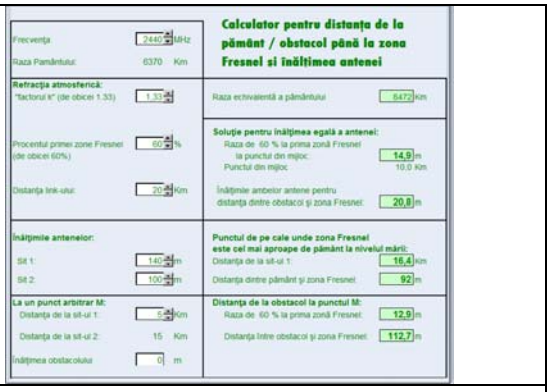

Fig. 11 Antenna height calculator

5. CONCLUSIONS

When calculating coverage of a GSM cell, it should be noted that the power of radio waves decreases with the inverse distance squared (d^2), except that the claim is valid in the empty spaces (the two antennas of the MS and BTS can be seen between them.)

Since stations (MS) are close to earth, we can say with certainty that interference and reflections from the ground cannot be neglected, and the presence of obstacles between the two antennas almost always occurs in crowded spaces. As a consequence, the spread at ground level is more difficult in the urban environments and the received power typically varies with d^{-4}.

Lack of radio frequency (is expensive) put the network designer to re-bind them. The frequencies used in a cell are reused in other cells at distances sufficient that interference is to be eliminated. In reality, this cannot be

totally avoided and a cell with interference between radio channels with the same frequency (co-channel interference) and radio channels that have adjacent frequencies between (Adjacent Channel Interference).

The human body, cars and buildings introduce additional attenuation on the radio channel.

The computer designed to assess the antenna height for a direct view between emission and reception points.

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MONITORING THE UNBALANCE IN POWER MICRO-GRIDS

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Abstract: *Micro-power grids are network components in which the consumers are active entities, i.e. they communicate with distribution network and contribute to the production of electricity, in particular, through renewable energies. Consumer involvement on energy efficiency has positive consequences if their electrical micro-plants are interconnected with the distribution network. But, the interconnections rise many and different quality problems. Unbalanced regime in the three-phase system of voltages and currents of power micro-grids depends on both the degree of unbalance and the harmonic pollution induced by the consumers connected to the grids. The consequences of unbalances have a negative impact on the performances of the network and the consumers too. The paper deals with the analysis of the methods of the unbalance indicators establishing according to the international recommendations. Analysis is useful for calculation of the current through the neutral and the active and reactive power losses. Based on the parameters of consumers – the phase voltages and currents and their phase difference - a simulation program in LABVIEW is proposed, which allows the establishment of the specific unbalance indicators. The simulation is validated by experimental measurements.*

Keywords: *electrical micro-plants, active entities, energy efficiency, electrical unbalance, low-voltage electrical grid, quality indicator of electrical energy, unbalance factor.*

1. INTRODUCTION

Three-phase systems whose waveform voltage and current are periodically with the period *T*, is balanced if the waveform is equal in magnitude and are time-shifted to each other by *T*/3. Otherwise, the three-phase system is unbalanced. The balance definition refers not only to the wave form; therefore the system may be balanced even in the presence of distorted wave forms.

The study of the combined effects of the distorted and unbalanced wave forms in the three-phase systems with neutral provides useful information for designing the neutral conductor. An ideal operation of a three phase system has the form of voltage and current sinusoidal wave and balanced so that the three phases are equally charged and neutral current is zero. This condition is usually taken as reference for dimensioning phase conductors. For the neutral conductor, some regulations allow its reduced sizing as compared to the phase conductors. In power micro-grids with neutral the quality of electrical energy is affected by the unbalanced and non-linear consumers which lead to relatively high currents in the neutral [4].

Analysis of the power systems in non-sinusoidal operation is particularly important, the specialized recent literature bringing many contributions on the concepts and definitions related to the system variables [6,1].

The effects of the unbalance in the power system and the distortion of the wave forms were approached in several articles. The measurements of the currents and the voltages on the neutral have been presented in [10,7,8,2], for practical cases, with different types of distorted loads.

It is necessary that these unbalances should be monitored especially due to the emergence of intelligent networks, with distributed generation (GD). With the advent of intelligent electrical networks (Smart Grids) with distributed generation (GD) capacity is considered a good opportunity in terms of monitoring power quality.

An important aspect of these networks is the bidirectional circulation of electrical energy, in which consumers are active entities, because the production of electricity in particular renewable energy is very close to the consumer. For this purpose it is necessary the monitoring of these micro-networks unbalance. In this paper we propose a system of continuous monitoring of voltage and current form for the three phases and of voltage and current unbalance factor.

In this paper a continuous monitoring system of phase voltage and currents wave forms is proposed which give the information on unbalance indicators.

2 UNBALANCED REGIME

For the analysis of unbalanced regimes several methods are used, such as component system networks introduced by Clarke and Stanley Park, or the symmetrical components introduced by Stokvis-Fortescue [5]. The symmetrical components method is most advantageous for the study of symmetrical or asymmetrical connection of consumers without or with harmonic pollution.

2.1. Unbalance in sinusoidal regime. Unbalanced current modeling in a micro-grids are based on Stokvis-Fortescue theorem, which states that a three-phase sinusoidal system in a particular case - the current three-phase system - can be decomposed into three symmetrical systems: positive, negative and zero.

The phase unbalanced current can be determined using symmetrical components relationship:

$$[\underline{I}] = [\underline{T}] \cdot [\underline{I}_{sim}] \quad (1)$$

where:

- the column matrix of currents unbalanced system is:

$$[\underline{I}] = [\underline{I}_R \quad \underline{I}_S \quad \underline{I}_T]^t \quad (2)$$

- the column matrix of symmetrical components is:

$$[\underline{I}_{sim}] = [\underline{I}_0 \quad \underline{I}_1 \quad \underline{I}_2]^t \quad (3)$$

- the exponent t refers to matrix transposition,
- $[T] = \begin{vmatrix} 1 & 1 & 1 \\ 1 & a^2 & a \\ 1 & a & a^2 \end{vmatrix}$ is the transformation matrix

The symmetrical components of the phase currents can be written as follows:

$$[\underline{I}_{sim}] = [\underline{T}]^{-1} \cdot [\underline{I}] \quad (4)$$

where:

- $[\underline{T}]^{-1} = \frac{1}{3} \cdot \begin{vmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{vmatrix}$ is the inverse transformation matrix in which $a = e^{j \cdot \left(\frac{2 \cdot \pi}{3}\right)}$ is the rotation operator [5].

Symmetrical current systems are characterized by the absence of negative and zero sequence components.

2.2. Unbalance in non-sinusoidal regime. In power micro-grids the voltage harmonics are insignificant, so that only currents harmonics presence os take into account.

In a matrices' representation of complex current vector $\underline{I}$, for each harmonics of k order a colon complex vector of phase current is defined:

$$\left|\underline{I}^k\right| = \left|\underline{I}_R^k \quad \underline{I}_S^k \quad \underline{I}_T^k\right|^t \quad (5)$$

The symmetrical components of the k harmonic of the phase currents can be written as follows:

$$\left|\underline{I}_{sim}^{k}\right| = T^{-1} \cdot \underline{I}^{k} \quad (6)$$

where the symmetric components are:

$$\left|\underline{I}_{sim}^{k}\right| = \left|\underline{I}_{1}^{k} \quad \underline{I}_{2}^{k} \quad \underline{I}_{0}^{k}\right|^{t} \quad (7)$$

A distinction is possible between balanced and unbalanced phase current of fundamental components:

$$I_{p}^{b1} = I_{p}^{u1} \quad (8)$$

A distinction is also possible for distortion phase current:

$$I_{p}^{d} = \sqrt{\sum_{k=2}^{\infty}\left(I_{1}^{k}\right)^{2} + \left(I_{2}^{k}\right)^{2} + \left(I_{0}^{k}\right)^{2}} \quad (9)$$

Usual the unbalance indicators are defined taking in account only the characteristics of fundamental phase current.

2.3. Indicators of unbalanced regime. Calculation of zero, positive and negative sequence components in the case of unbalanced voltages and currents system is presented in [9,3,11].

Phase voltage unbalance rate (PVUR) is proposed by IEEE standards [12], defined by the relationship:

$$PVUR\ [\%] = \left|\frac{U_{f\ med} - U_{f\max}}{U_{f\ med}}\right| \cdot 100 \quad (10)$$

where: $U_{f\ med}$ represents arithmetic average of the rms phase voltages; $U_{f\max}$ is the highest value of measured phase voltage.

Voltage unbalance factor (VUF) is another indicator proposed by the IEC standards [13], defined with symmetrical components method by the relation:

$$VUF\ [\%] = \left|\frac{\underline{U}_{2}}{\underline{U}_{1}}\right| \cdot 100 = \left|\frac{\underline{U}_{R} + a^{2} \cdot \underline{U}_{S} + a \cdot \underline{U}_{T}}{\underline{U}_{R} + a \cdot \underline{U}_{S} + a^{2} \cdot \underline{U}_{T}}\right| \cdot 100 \quad (11)$$

where: U_1 is the positive sequence voltage, U_2 is the negative sequence voltage, and $\underline{U}_{R}$, $\underline{U}_{S}$, $\underline{U}_{T}$ signify the measured rms values of the fundamental phase voltages, and a is the transformer operator.

Similarly are determined unbalance current factor. According to IEC and IEEE standards, the unbalance voltage and current factors are usually denoted by K_U, respectively, K_I

3. UNBALANCE MONITORING

The paper proposes an analysis of the procedure monitoring and the indicators evaluation into a power micro-grid in which different types of regimes exists: unbalanced, distorted or combined - unbalanced-distorted operation. The aim is to establish the measures to eliminate or reduce the energy losses.

3.1. Description of analyzed micro-grid. A power micro-grid with active consumers was considered, which is supplied from a PT X transformer point of 6.0/0.4 kV.

Passive consumers are lighting, induction motors, computers, fans, converters, inverters and laboratory equipments. In the majority these are controlled by electronic equipment, having the nonlinear voltage-current characteristics, being the sources of disturbances through the generation of harmonics in the network. Thus, the waveforms of voltages and currents are differently distorted on the three phases. Power system studied is shown in Fig. 1.

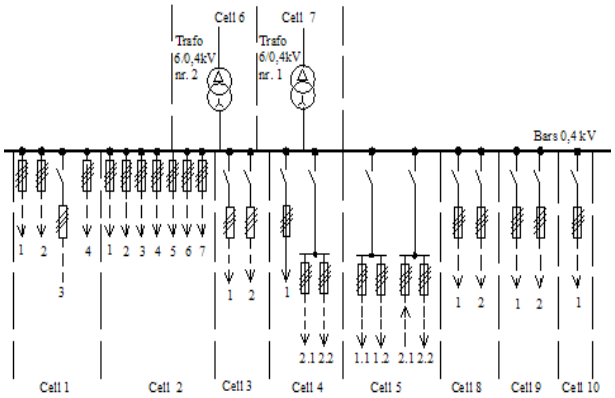

Fig. 1. Single-phase scheme of the supplying of PT-X transformer point 6.0/0.4 kV

The transformer point PT-X consists in 10 distribution cells G-P1...G-P10 with a single bar system, the working supply is ensured from the transformer number 2 in the cell P6 and the reserve supply is ensured from the transformer number 1 in the cell P7 without AAR-type automation. In the cell P5 on the circuit 2.1 is supplied from the photovoltaic panels.

3.2. Monitoring system. To achieve security and stability of micro-grid is necessary to monitor these parameters, particularly the unbalance parameters.

The paper proposes a system of continuous monitoring system of voltage and current form on the three phases and voltage unbalance voltage and current factor (Fig.2).

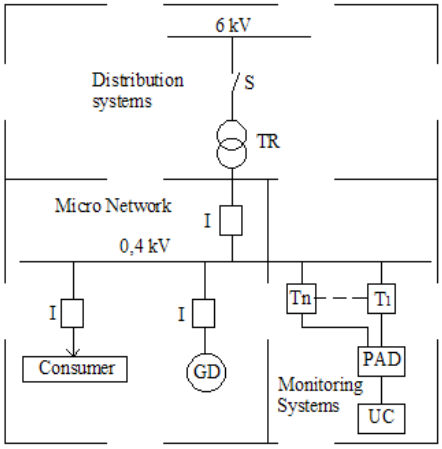

Fig.2. Monitoring system of power micro-grid unbalance

In Fig. 2 there are: S – separator; TR - 20.0/0.4 kV transformer, I – switch gear, DG - distributed generation, T1 - transducers, PAD - data acquisition card, UC – central unit.

Through transducers, data acquisition card collects information from the micro-grid (current, voltage, power, frequency) and transmits to the central unit where the information are stored and processed. A complex system of control, protection and power quality monitoring is obtained. The tool developed can be used to monitor micro-grids unbalance in sinusoidal and non0sinusuidal regimes.

3.3. LabVIEW programming software. The central unit (CU) uses a LabVIEW graphical programming software for data acquisition and proceeding and for using the virtual instruments for measuring and control devices. One of its advantages compared to conventional devices is the ability to be easily transformed by changing or replacement program. The front panel of the application is presented in Fig. 3.

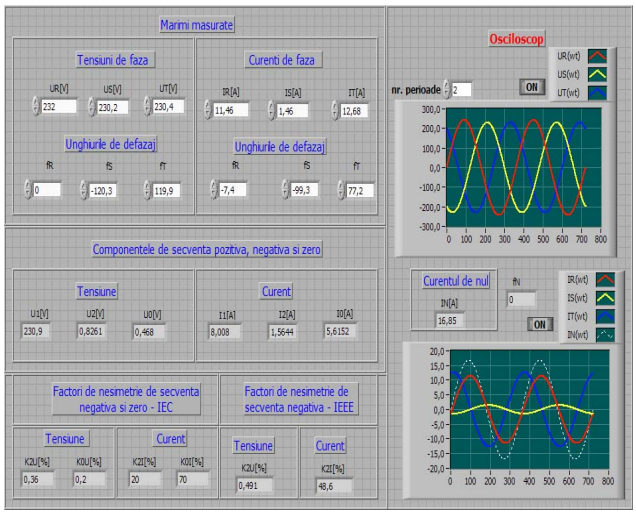

Fig. 3. The front panel of the application

The front panel is structured in following blocks:

- Measured values of voltages, currents and phase ongles;
- Neutral current;
- Components of positive, negative and zero sequence voltage and currents;
- Negative and zero voltage and current unbalance factors;
- Two oscilloscopes for phase voltages, currents and neutral current waveforms.

In the measured values block there are recorded the rms values of phase voltages and currents and their phase angles. In neutral conductor block is set the effective value of calculated/measured neutral current.

The values obtained for the positive, negative and zero sequence components, are compared with permissible levels and are shown.

In unbalance factor block is calculated and displayed levels of negative and zero sequence unbalance factors.

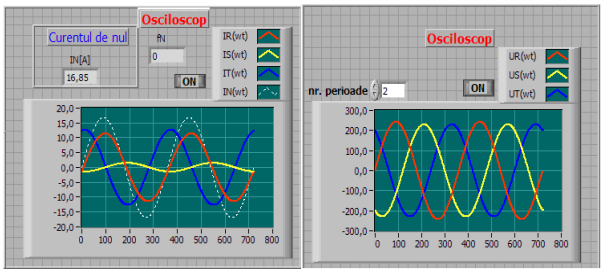

Fig. 4. Waveforms of phase voltages and currents

Oscilloscope block (Fig.4.) is used for viewing:

- waveforms of the phase voltages by consumers;
- waveform of phase currents by consumers;
- waveform of neutral current.

The developed tool can be used to monitor micro-grids because the consumers can be drastically affected under the influence of a high voltage unbalance.

3.4. Experimental data and results. With the proposed software the parameters of micro-grid supplied from PT X transformer point 6.0 / 0.4 kV with 10 minute periods have been monitored. For one week of monitoring, a large amount of information was obtained, and to obtain meaningful data, an aggregation of measured parameters was performed.

The levels of voltage and current unbalance negative factor obtained with the proposed software are presented in Fig. 5 and Fig. 6.

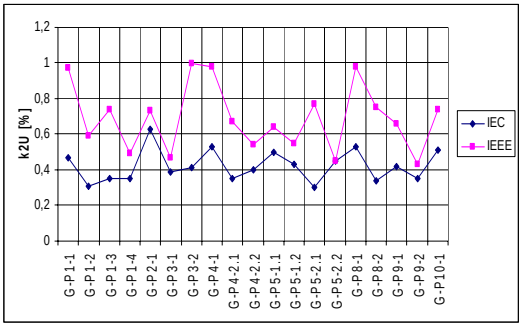

Fig. 5. Voltage unbalance negative factor K2U for the issues from „PT-X”

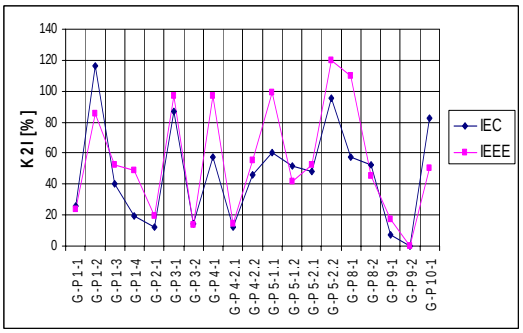

Fig. 6. Current unbalance negative factor K2I for the issues from „PT-X”

Some observations can be underlined:
- Voltage unbalance negative factor is within the limits imposed by current standards;
- Current unbalance negative factor exceeds the maximum value imposed by standards;
- For the low values of unbalance, the unbalance factor can be calculated with the relationship given by the IEEE;
- Definitions proposed by the IEC and IEEE give almost identical results, where the zero sequence components is below the limit permitted by the regulations. When the zero sequence components is greater than the limit, both definitions may overestimate or underestimate the level of unbalance.

4. CONCLUSIONS

Due to the increasing number of single-phase loads with nonlinear nature and due of the development of power electronics that produce unbalances, the unbalance regimes increase and a continuous monitoring system is required to estimate the level of voltage waveforms deformation and of voltage unbalance degree, and to evaluate the unbalance factors.

Definitions proposed by the IEC and IEEE standards give almost identical results, where the zero sequence component is below the limit permitted by the regulations. When the zero sequence component is greater both definitions may overestimate or underestimate the level of unbalance.

The proposed monitoring system is useful in analysis of power micro-grid unbalance, contributing to the increasing of the performance of micro-grid and reducing he power consumption.

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EMBEDED SYSTEM FOR MONITORING THE TEMPERATURE INSIDE A VEHICLE

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Abstract: *Nowadays, providing a thermal comfort level is one of the main goals in the vehicle environment and HVAC systems. In this sense, considerable research regarding factors that influence thermal comfort has been accomplished. These factors appear due to the influence of convective, radiative and conductive heat exchange created by the external thermal loads and by the internal heating and ventilation system. The goal of the paper is to investigate the efficiency of the air conditioning system of a vehicle and how quickly the system raises the inside air temperature in a cold environment. The method used for evaluating the thermal comfort was monitoring the air temperature at different body zones by using dedicated digital temperature sensors. The human surface was divided into six segments, each segment being covered with temperature sensors connected in a network. Therefore, an embedded data acquisition and monitoring system was used. The experimental results are emphasized and the differences between the temperature at feet and head level are analyzed.*

Keywords: *thermal comfort, air temperature, monitoring, data acquisition system, control system, air conditioning, thermal manikin, vehicle*

1. INTRODUCTION

Nowadays, people are increasingly dependent on transportation. Therefore, it is important to ensure the optimal thermal comfort in the vehicle, for the passengers and also for the driver [15].

The thermal comfort represents a subjective sensation that occurs in a human body and is the result of the combined effect of six parameters – air temperature, air humidity, mean radiant temperature, air velocity, level activity and clothing type.

The thermal environment inside a vehicle is more complex than inside a building and thus difficult to evaluate. These difficulties appear due to the influence of convective, radiative and conductive heat exchange created by the external thermal loads (solar radiation) and by the internal heating, air conditioning and ventilation system [3].

Achieving a thermally comfortable vehicle environment for passengers has become an issue of primary importance that needs to be assessed. An optimal level of thermal comfort in a vehicle environment can be obtained only by using an automatic air conditioning and climate control system [2].

The goal of the paper is to investigate the efficiency of the air conditioning system and how quickly the system raises the inside air temperature in a cold environment. Also, the

differences between the temperature at feet and head level are analyzed.

The method used for evaluating the thermal comfort inside a vehicle was monitoring the air temperature at different body zones by using a thermal manikin and dedicated digital temperature sensors. The surface of the thermal manikin was divided into six independently monitored segments. Each zone on the surface layer of the manikin was covered with temperature sensors connected in a grid in order to monitor the temperature. Therefore, an embedded control and data acquisition system was used. The experimental results are emphasized in order to analyse the efficiency of the HVAC system.

2. THE THERMAL COMFORT

Over the last years, considerable researches regarding the thermal comfort have been accomplished. The study of thermal comfort in vehicles was developed from basic thermal comfort research and applied works relating to factories and buildings. The first research in vehicles dealt mainly with agricultural vehicles and public transport systems such as subways, trains and buses.

Achieving a thermally comfortable vehicle environment has become an issue of major importance

According to Hensel, the thermal comfort is associated with temperature sensation. The difference between temperature sensation and thermal comfort is that temperature sensation is a rational experience that can be described as being directed towards an objective world in terms of "cold" and "warm". On the other hand, the thermal comfort is an emotional experience which can be characterized in terms of "pleasant" and "unpleasant" [4].

According to ASHARE 55 and ISO 7730, the thermal comfort is defined as “a condition of mind which expresses satisfaction with the thermal environment” [17,18].

Vink described the thermal comfort as “a pleasant state of physiological, psychological, and physical harmony between a human being, and his or her environment” [16].

Parsons considered that “the comfort is a psychological phenomenon not directly related to physiological state or physical environment” [11].

Mansfield defined thermal comfort as a lack of discomfort and Conway states that the thermal comfort depends on the ability of the human body to self adapt to the environment [1,8].

Temming states that, inside vehicles, there are no homogenous temperature areas. The temperature at head level is greater than at feet level. The air temperature inside a vehicle depends on the “class” of the vehicle, its size and quality [15]. Temming observed that, for increasing the thermal comfort, a reduced air flow has to be applied in the passengers’ area at reduced external temperatures, and a moderate air flow has to be applied at high external temperatures. The heated air should be directed towards the bottom half of the passenger’s body and the cold air should be directed toward the upper half. Because of the reduced volume of the vehicle (as compared to buildings) the air flow can be easily directed to specific zones [15].

Many researchers suggest that factors such as interior upholstery, interior and exterior lights, whole volume of the vehicle and the number of passengers can affect thermal comfort [6,13,14].

The climatic conditions can be changed dramatically because of the dynamic vehicle environment. In the vehicle environment, there are three factors which dramatically affect the vehicle environment: the HVAC system, windows and solar radiation. In such an unpredictable environment, it is more difficult to estimate and control the optimally thermal comfort levels [3,10,15]. Most of the research which tested these influences is focused on air temperature. In this sense, the researchers concluded that air temperature is the most important parameter that influences thermal comfort [3,5,7,9].

The usual method for evaluating the efficiency of the air conditioning system is to apply sensors to measure the air temperature at feet and at head level. The main purpose is to investigate how quickly the system will raise the temperature in a cold environment and to study the difference between the temperature at feet and head level.

3. ARCHITECTURE DESCRIPTION AND MEASURING METHOD

The optimal comfort level can be obtained only with automatic air conditioning systems. In the automatic system, the desired temperature is set and the system's role is to maintain it constantly by using inside temperature and humidity sensors placed in key points inside the vehicle. The air flow and the fun speed are automatically controlled using the information received from the inside /outside temperature sensors.

In Fig. 1 there is illustrated a typical HVAC system and the interior air flow repartition through tubes and air vents.

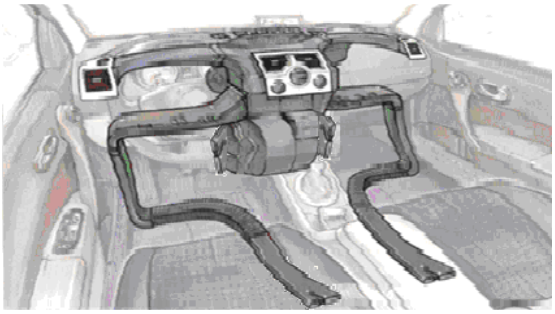

Fig. 1 Air flow distribution inside the vehicle

To monitor the air temperature inside the vehicle, control and data acquisition systems were implemented [12].

The architecture of the control and data acquisition system is illustrated in Fig. 2.

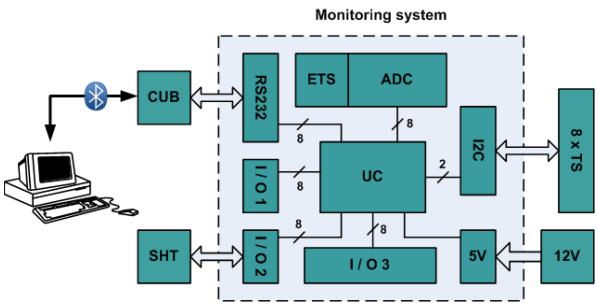

Fig. 2 The architecture of the control and data acquisition system

As is can be seen in Fig.2, the implemented system consists of:

(i) Microcontroller module;
(ii) Temperature sensors (TS);
(iii) Bluetooth module (CUB);
(iv) Humidity and dew point sensor (SHT);

The microcontroller module consists of: (i) ATMega 128 microcontroller (UC) used to master the control and acquisition processes; (ii) embedded temperature sensor (ETS) used to measure the mean temperature and to control the monitoring process; (iii) analog to digital converter (ADC) used for acquiring information from the ETS; (iv) Inter Integrated Circuit (I2C) protocol used to communicate with the digital temperature sensors (TS); (v) input – output ports (I/O): I/O1 used to enable / disable the monitoring processes, I/O2 used to communicate with SHT, I/O3 used to connect the bar graph; (vi) RS232 port used to interconnect the microcontroller module with CUB.

In the monitoring process of the air temperature at feet, arm and head level, a network of eight LM75 digital temperature sensors were used.

Data from temperature sensors and the control information were transmitted to a local storage and processing unit (Laptop) by using the Bluetooth module (CUB). This module consists of a RS232 to Bluetooth converter, LMX9838 type.

Also a SHT11 humidity and dew point sensor was used to observe the humidity variation while increasing the temperature inside the vehicle's interior.

The monitoring process is enabled when the internal combustion engine (ICE) and the HVAC system of the vehicle are started. The ICE is running at idle speed and the HVAC system is running in automatic mode set at 22 °C.

In Fig. 3, there is illustrated the control strategy used by the temperature monitoring system.

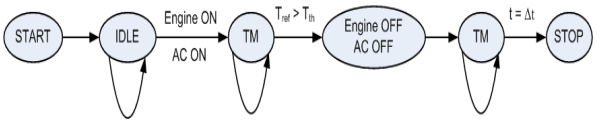

Fig. 3 Flow diagram for monitoring the air temperature

The ETS permanently communicates with the data acquisition system (DAQ). The control system (CS) interrogates the data acquisition system and processes the information to identify when the mean air temperature reaches the preset threshold temperature value. At this moment, the control system indicates to switch off the HVAC system and the ICE. The monitoring process continues for a predefined time to identify the evolution of the temperature and how quickly the temperature decreases. When the predefined time is reached, the whole system is stopped. The data are transmitted via Bluetooth to the laptop. The stored data are processed in MatLab Software.

4. EXPERIMENTS AND RESULTS

In Fig. 4 there is illustrated the control and data acquisition systems, the Bluetooth module and the digital temperature sensors used in the monitoring process.

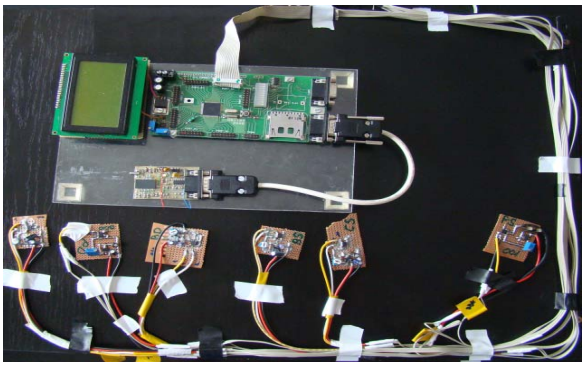

Fig. 4 Monitoring implemented system

For the experiments, a Renault Clio 1.5dci-2005 was used. In order to monitor the temperature evolution inside the vehicle, a thermal manikin was used. The thermal manikin surface was divided into six independently monitored segments: the foot zone, the arm zone and the face zone. Each zone on the surface layer of the manikin was covered with digital temperature sensors connected in a network.

In Fig. 5 and Fig. 6 there are illustrated the position of the temperature sensors and the control and data acquisition systems – top view and side view.

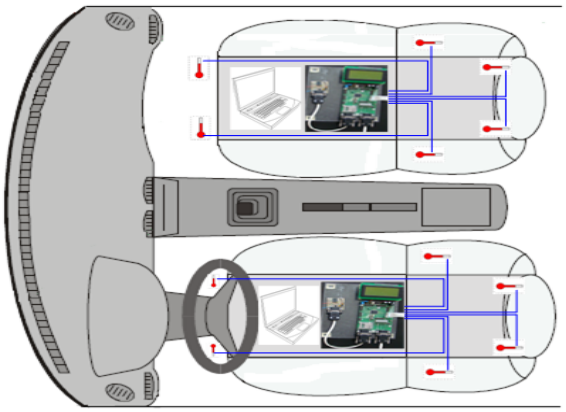

Fig. 5 Positioning of the temperature sensors and the CS and DAQ – top view

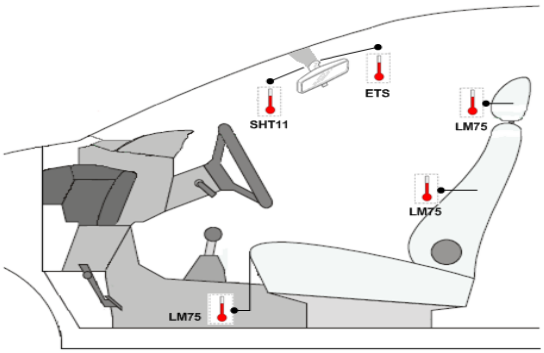

Fig. 6 Positioning of the temperature sensors and the CS and DAQ– side view

The inside air temperature was monitored both for the driver and the front passenger. The experiments were made in different days at different outside air temperature.

The internal combustion engine of the vehicle was started and running at idle speed, the HVAC system was started in automatic mode, set at a threshold value (T_{th}). At that moment, the monitoring process was enabled. After the monitored temperatures reached the threshold value, the ICE and HVAC system were stopped. The temperature evolution was still monitored until a predefined time (Δt) was reached.

The experimental results are illustrated in the following figures.

In Fig. 7 there are illustrated the inside air temperature monitoring results for the driver zone when the outside temperature was -11 °C and the interior temperature was -8 °C. The CS and DAQ monitored the temperature evolution for 65 min when the engine and HVAC system are running, and 29 min when the engine and HVAC system are stopped.

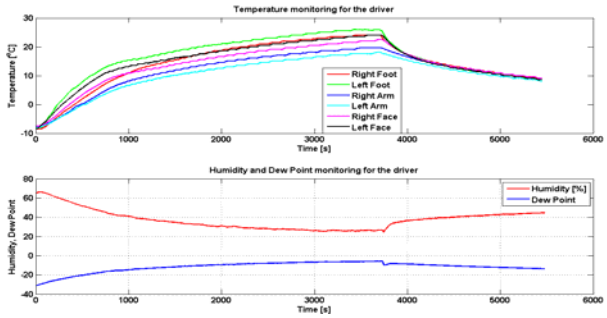

Fig. 7 Temperature monitoring for the driver at outside temperature of -11 °C

In Fig. 8 there are illustrated the inside air temperature monitoring results for the passenger zone when the outside temperature was -9 °C and the interior temperature was -6 °C. The CS and DAQ monitored the temperature evolution for 75 min when the engine and HVAC system are running and 27 min when the engine and HVAC system are stopped.

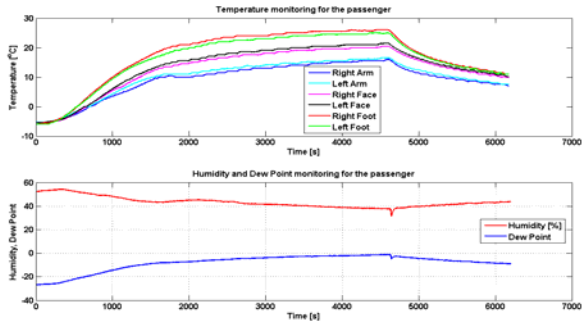

Fig. 8 Temperature monitoring for the passenger at outside temperature of -9 °C

In Fig. 9 there are illustrated the inside air temperature monitoring results for the driver zone when the outside temperature was -19 °C and the interior temperature was -17 °C. The CS and DAQ monitored the temperature evolution for 95 min when the engine and HVAC system are running and 30 min when the engine and HVAC system are stopped.

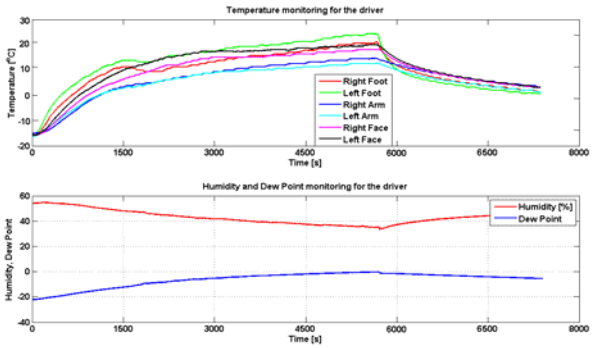

Fig. 9 Temperature monitoring for the driver at outside temperature of -19 °C

In Fig. 10 there are illustrated the inside air temperature monitoring results for the passenger zone when the outside temperature was -20 °C and the interior temperature was -18 °C. The CS and DAQ monitored the temperature evolution for 90 min when the engine and HVAC system are running and 25 min when the engine and HVAC system are stopped.

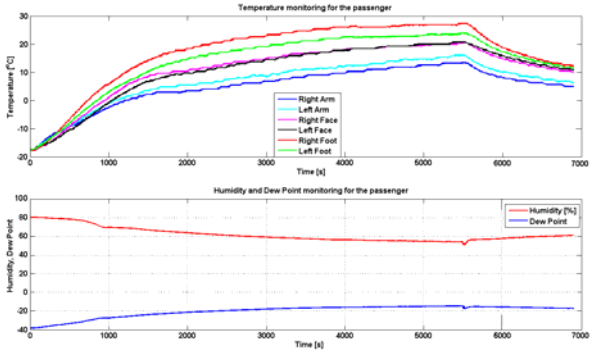

Fig. 10 Temperature monitoring for the passenger at outside temperature of -20 °C

As it can be seen in the experimental results, there is a delay between the moment when the ICE is started and the moment when the inside air temperature starts to increase. This is due to the ICE which cannot cover the necessary heat till it reaches its operating temperature. The delay depends on the outside temperature value and increases at extreme low temperatures.

The experimental results are in accordance with the standards, the temperature at feet level being higher than at head level.

5. CONCLUSIONS

The aim of the HVAC system is to obtain a comfortable temperature as quickly as possible and to eliminate the local thermal comfort.

The performances of the HVAC system were illustrated in the experimental results. Its efficiency increases as the outside temperature increases. In extreme cold weather conditions, experienced across the globe, the efficiency is reduced and it takes a lot of time to heat the vehicle's interior.

The main disadvantage of the HVAC system was identified during the starting regime of the vehicles until the ICE reaches its operating temperature. During this period, the ICE cannot ensure the necessary heat for heating the vehicle interior. In this sense, auxiliary heating devices are required.

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ASPECTS ON THE FUNCTIONAL OPTIMIZATION OF THE *TRR* –TYPE INDUSTRIAL ROBOT

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Abstract: *In the present paper, the authors aim to functionally optimize an industrial robot structure of a modular serial construction necessary for the creation of a flexible manufacturing cell with military application. The suggested algorithm highlights the obtaining of different equations of the robot's movement by using Lagrange's formalism. The calculus method provides the stressing of the concerned robot's total kinetic energy, determines both the virtual elementary mechanical work and the generated propulsive force and moments. Once the different movement equations have been obtained, the authors will determine the research servomotors necessary for taking into service the mobile equipment of the MO-1 prehension device attached to the robot structure. The scientific procedure aims at choosing those research servomotors which thus obtained through a mathematical algorithm meet feasibility, economy, profitableness and flexibility criteria, in order to serve with minimal energetic consumptions the flexible manufacturing cell.*

Keywords: *robot, dynamic, modelling, cell, optimization*

1. INTRODUCTION

At the design stage of industrial robots, an assessment of some indices is necessary, such as: the number of liberty degrees, the workspace shape and size, the mobility, the load capacity, the service factor, etc. Such an evaluation is possible only by conducting a dynamic study of the robots. The dynamic studies performed on industrial robots allow the choosing of the action motors, as well as the optimum arrangement of modules in a modular robot structure, so that the energy consumptions are minimal. For the dynamic modelling, the study of two fundamental mutual issues of the industrial robots' dynamics is aimed at. In the case of the first problem, also known as the direct problem, the following are determined: the time-depending variation laws of the coordinates and generalized speeds, being aware of the constructive mechanical parameters of the robot, the time-depending variation laws of motor forces and moments and the initial conditions of the robot movement. In the case of the second essential problem, also named the reverse problem, the following are determined: the time-depending variation laws of the motor agent (motor forces and moments) if the constructive mechanical parameters of the robot and the time-depending variation laws of the generalized coordinates are known. Among the industrial robots' dynamic study, we mention: Lagrange's formalism, the principle of dynamic virtual movements, the Newton-Euler method and the iterative method.

2. DYNAMIC MODELLING OF THE TRR-TYPE SERIAL-MODULAR ROBOT

For the dynamic modelling, Lagrange's formalism will be used; we also mention the fact that each module within the industrial robot's component has only one liberty degree, the movement being achieved through an independent action, command and positioning on each movement axis. For the dynamic modelling, according to the robot's kinematic schema presented in figure 1, the following measures will be considered: l_1, l_2, l_3 - constructive parameters of the robot, $q_k, \dot{q}_k, \ddot{q}_k, (k = 1 \div 3)$ - generalized coordinates, speeds and accelerations, $k = 1 \div 3$ - number of liberty degrees, $\overline{F}_1, \overline{M}_2, \overline{M}_3$ - motor force and moments, $\overline{P}_i, (i = 1 \div 3)$ - weight forces of the robot's modules, $J^{(2)}_{\Delta_2}, J^{(3)}_{\Delta_3}$ - the mechanical inertia moment related to the (Δ_2) axis of the rotation module 2 mobile equipment and of the module 3 part interdependent with module 2, i.e. the mechanical inertia moment related to the (Δ_3) axis of the rotation module 3 mobile equipment and of the prehension device part interdependent with module 3.

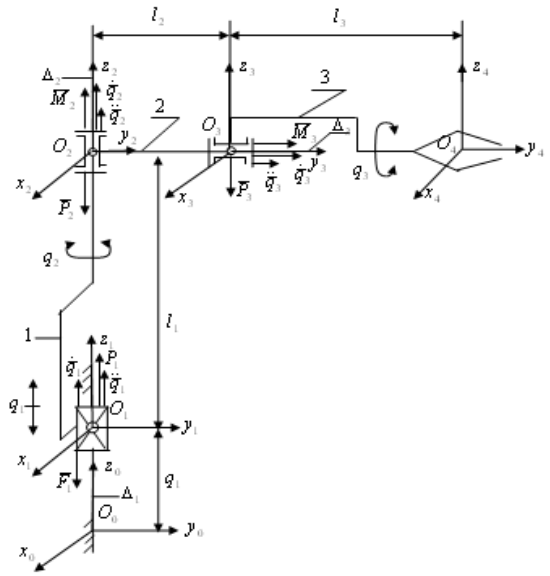


Fig. 1 Kinematic structure of the TRR industrial robot

The dynamic equations of the robot are deduced by using Lagrange's equations of type II, written as follows:

$$\frac{d}{dt}\left(\frac{\partial E_c}{\partial \dot{q}_k}\right) - \frac{\partial E_c}{\partial q_k} = Q_k, k = 1,2,3, \quad (1)$$

relation where: E_c is the kinematic energy of the robot, and Q_k stands for the generalized forces.

In the weight centres of the industrial robot modules the following Cartesian coordinates' systems are being introduced: $O_oX_oY_oZ_o$ - fixed system from the robot's base and $O_iX_iY_iZ_i, (i = 1 \div 3)$ - main systems of mobile inertia. The results are:

$$x_{ci} = y_{ci} = z_{ci} = 0, J_{xiyi} = J_{yizi} = J_{zixi} = 0. \quad (2)$$

Under these conditions, the kinematic energies, corresponding to the robot's coordinates can be consecutively obtained, starting at the robot's base:

$$E_{c1} = \frac{1}{2} m_1 \dot{q}_1^2, E_{c2} = \frac{1}{2} m_2 \dot{q}_1^2 + \frac{1}{2} J^{(2)}_{\Delta_2} \dot{q}_2^2,$$
$$E_{c3} = \frac{1}{2} m_3 \left(\dot{q}_1^2 + \dot{q}_2^2 l_2^2\right) + \frac{1}{2} J^{(3)}_{\Delta_3} \dot{q}_3^2. \quad (3)$$

Taking relation (3) in account, the robot's total kinematic energy can be noted as:

$$E_c = \frac{1}{2}\left(\sum_{i=1}^{3} m_i\right)\dot{q}_1^2 + \frac{1}{2}\left[J^{(2)}_{\Delta_2} + m_3 l_2^2\right]\dot{q}_2^2 + \frac{1}{2} J^{(3)}_{\Delta_3} \dot{q}_3^2. \quad (4)$$

The $Q_k, (k = 1 \div 3)$ generalized forces, are obtained by giving the system elementary virtual movements so that the generalized coordinates vary in turn, respectively with the $\delta q_1, \delta q_2, \delta q_3$ elements, and the virtual elementary mechanical work δL, corresponding to the weight centres, motor forces and moments and to certain virtual elementary movements compatible with the robot's links, is:

$$\delta L = F_1 \delta q_1 + M_2 \delta q_2 + M_3 \delta q_3, Q_1 = F_1 - \left(\sum_{i=1}^{3} P_i\right), \quad (5)$$
$$Q_2 = M_2, Q_3 = M_3.$$

The differential movement equations of the TRR robot are obtained from relation (1) where the relations (4) and (5) are introduced, consecutively giving *k* the values 1, 2, 3. The system of differential equations is set in the

hypothesis that all movements of the robot are simultaneous.

Thus, the following are obtained:

$$\begin{aligned}
&(\sum_{i=1}^{3} m_i)\ddot{q}_1 + m_3 l_2 \ddot{q}_2 = F_1 - (\sum_{i=1}^{3} P_i) \\
&m_3 l_2 \ddot{q}_1 + (J_{\Delta_2}^{(2)} + m_3 l_2^2)\ddot{q}_2 = M_2 \\
&m_3 \ddot{q}_1 + J_{\Delta_3}^{(3)} \ddot{q}_3 = M_3.
\end{aligned} \tag{6}$$

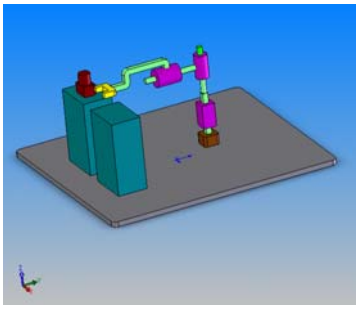


Fig. 2 3D modelling of the TRR industrial robot realized by the Solid Works soft

3. SETTING THE MOTOR MOMENT NECESSARY FOR TAKING INTO SERVICE THE MO-1 ORIENTATION MOBILE EQUIPMENT

By using the last two relations of set (6), related to the two rotation modules of the studied robot and by imposing numerical values for the optimal functioning of the MO-1 orientation module which owns two liberty degrees (rotations of the TRR robot) in the organological structure, we can determine the motor moments, respectively the servomotors for operating the MO-1 mobile equipment, staring at the designed module's organology. Hence, the expressions of M_2 and M_3 function of the MO-1 orientation module construction are:

$$\begin{aligned}
&M_2 = \frac{30}{\pi} \bullet \frac{P_2}{n_2}, n_2 = n_{m2} \bullet \frac{z_1'}{z_2'} \bullet \frac{z_3'}{z_4'}, \\
&P_2 = P_{nm2} \bullet \eta_{r1}' \bullet \eta_{12}' \bullet \eta_{r2}' \bullet \eta_{34}' \bullet \eta_{r3}' \\
&M_3 = \frac{30}{\pi} \bullet \frac{P_3}{n_3}, n_3 = n_{m3} \bullet \frac{z_1}{z_2} \bullet \frac{z_3}{z_4}, \\
&P_3 = P_{nm3} \bullet \eta_{r1} \bullet \eta_{12} \bullet \eta_{r2} \bullet \eta_{34} \bullet \eta_{r3},
\end{aligned} \tag{7}$$

where the following notations were made: η_{r1}', η_{r1} - the output of a pair of radial bearings, η_{12}', η_{12} - the output of the cylindrical, respectively cone-shaped, gearing, , η_{r2}', η_{r2} - the output of the axial radial bearings from the rotation axis II, and VI, η_{34}', η_{34} - the output of the cone-shaped gearing, η_{r3}', η_{r3} - the output of the pair of radial-axial bearings from the rotation axis III, and VII, $z_1', z_1 \div z_4', z_4$ - the number of the gearing's grinders used for building the MO-1 module, $\frac{z_1'}{z_2'} \div \frac{z_3}{z_4}$ - the reports of the gearing's transmission from the MO-1 module's organological structure. Afterwards, the M_2, respectively M_3, motor moments for operating the MO-1 module are determined, considering the differential movement equations of the robot and the organology of the projected mobile equipment:

$$\frac{P_{nm2}}{n_{m2}} = \frac{\pi \cdot \frac{z_1'}{z_2'} \cdot \frac{z_3'}{z_4'}}{30 \cdot \eta_{r1}' \cdot \eta_{12}' \cdot \eta_{r2}' \cdot \eta_{34}' \cdot \eta_{r3}'} \cdot$$
$$\cdot [m_3 l_2 \ddot{q}_1 + (J_{\Delta_2}^{(2)} + m_3 l_2^2)\ddot{q}_2],$$
$$M_{m2} = 9550 \cdot \frac{P_{m2}}{n_{m2}} [\text{Nm}],$$
$$\frac{P_{m3}}{n_{m3}} = \frac{\pi \cdot \frac{z_1}{z_2} \cdot \frac{z_3}{z_4}}{30 \cdot \eta_{r1} \cdot \eta_{12} \cdot \eta_{r2} \cdot \eta_{34} \cdot \eta_{r3}} \cdot \quad (8)$$
$$\cdot (m_3 \ddot{q}_1 + J_{\Delta_3}^{(3)} \ddot{q}_3),$$
$$M_{m3} = 9550 \cdot \frac{P_{m3}}{n_{m3}} [\text{Nm}].$$

By entering numerical values, we will obtain:

$$M_{m2} = 1{,}623[\text{Nm}], M_{m3} = 1{,}362[\text{Nm}] \Rightarrow$$
$$M_{m2,3}\,\text{STAS} = 3{,}25[\text{Nm}],$$

And, from the catalogue, we will choose the continuous flow Merkes MH2 operation servomotor (see fig. 3), equipped with TIRO and features from the catalogue.

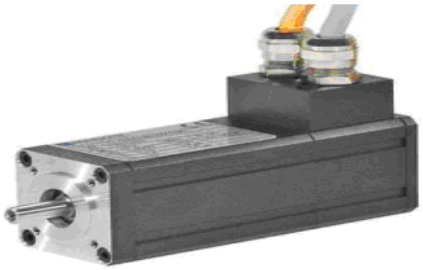
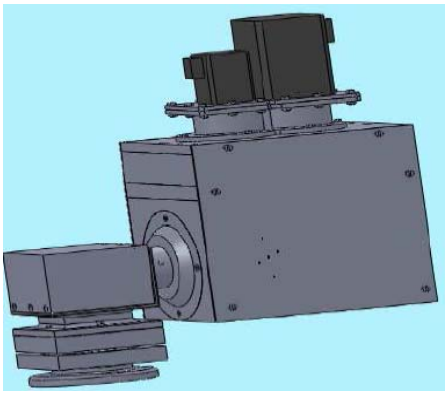


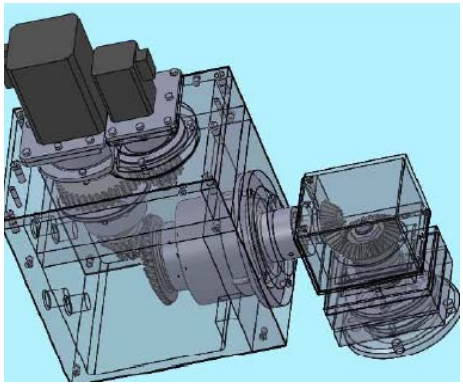
Fig.3 MH3 catalogue operation servomotor

4. THE FUNCTIONING AND CONSTRUCTION OF THE MO-1 PREHENSION DEVICE'S ORIENTATION MODULE

Figure 4 displays the constructive version of the prehension device's orientation module with two liberty degrees and, taking this figure into consideration the main components of the module can be identified. Thus, the MO-1 module contains the following constructive elements: operation motors, coupling, motor support spares, radial-axial roll bearings, respectively axial ball bearings, on one row, cone-shaped gearing from the rotation axis 1, cylindrical gearing, respectively cone-shaped from the rotation axis 2, input shaft (rotation axis 2), prehension device clamping element, satellite-holding bar, intermediate shaft, exterior casing of the module, input shaft (rotation axis 1).



a)



b)

Fig. 4 MO-1 prehension device's orientation module: a) 3D model; b) section in module

The projection of the MO-1 orientation module has been realized based on calculus prescriptions by using the Solid Works soft. Further on, the functioning on the two rotation axes of the rotation module will be presented. The two rotation movements of the directed element on which the clamping device is mounted are featured by the *n1* and *n2* revolutions. Operating the first continuous flow motor, the cone-shaped gearing is taken into movement, hence obtaining at the module output the *n1* revolution. By operating motor 2, the movement gets to the satellite-holding bar by means of the cylindrical gearing and the cone-shaped one. Hence, a rotation movement with the *n2* revolution of the prehension device and a rotation movement of the latter are obtained. In order to obtain high

positioning precisions, the used motors are equipped with TIRO-type transcribers. In conclusion, we can state that the usage of electrical operations on orientation modules from the mechanical structure of modular construction robots and of cylindrical and cone-shaped gear decelerator, leads to compact constructions, with reduced gauge and minimal energy consumptions.

5. CONCLUSIONS & ACKNOWLEDGMENT

The serial manufacturing of a large number of industrial robots with various architectural versions, performing in different-shaped and different-dimensioned workspaces, according to the manipulation programme requirements, can be realized by conceiving models of modular-structured robots. The modular conception is based on the individual achievement of modules of which construction allows their assembly with other modules. Thus, we obtain varied industrial robots' architectures, which can be delivered to beneficiaries in compliance with the criteria of the actual application.

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DETECTION OF ERRONEOUS OPERATION IN TTL INTEGRATED CIRCUITS USING MODULUS FUNCTIONS OF NOISE MARGINS

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Abstract: *This paper presents a procedure for detection of erroneous operation in present–day TTL integrated circuits, that is based on using of the modulus functions of noise margins. There are illustrated the values of the modulus functions of noise margins that allow to detect the erroneous operation in TTL integrated circuits.*

Keywords: *logic integrated circuit, TTL, logic level, noise voltage, noise margin, modulus function, erroneous operation detection*

1. Introduction

The TTL integrated circuits have evolved rapidly towards high performances and increased complexity, becoming the logic integrated circuits with the largest utilization [1] – [4].

There is a diversity of functional parameters which must be considered for their using in apparatus and equipment destined to various applications. The noise margins have a distinct importance for the appreciation of functioning in the presence of electromagnetic disturbances [5] - [37].

The paper is organized as follows. The theoretic considerations regarding the definition of noise margins are presented in Section 2. The noise margins functions are developed in Section 3. Finally, conclusions are provided in Section 4.

2. Definition of noise margins

Considering the NAND Gates connected as shown in Fig. 1, the input voltage V_I of the NAND Gate Load is equal with the output voltage V_0 from the NAND Gate Driver, so that

$$V_I = V_0 \qquad (1)$$

If an unwanted voltage called as "noise voltage V_N" is induced into conductors between the NAND Gate Driver and the NAND Gate Load, from adjacent current-carrying conductors, as seen in Fig. 2, the input voltage V_I becomes

$$V_I = V_0 \pm V_N \,. \qquad (2)$$

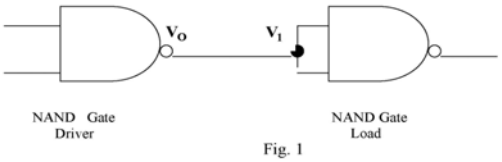

Fig. 1

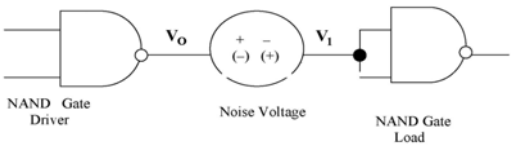

Fig.2

Corresponding to the logic levels low (L) and high (H), we have the input voltages :

$$V_{IL} = V_{OL} \pm V_{NL} \quad (3)$$

and

$$V_{IH} = V_{OH} \pm V_{NH} \quad (4)$$

respectively.

The worst case values are:

$$V_{IL} = V_{OL} + V_{NL} \quad (5)$$

and

$$V_{IH} = V_{OH} - V_{NH} \quad (6)$$

From (5) and (6), we obtain:

$$V_{NL} = V_{IL} - V_{OL} \quad (7)$$

and

$$V_{NH} = V_{OH} - V_{IH} \quad (8)$$

respectively.

The noise voltages V_{NL} and V_{NH} are known as "direct current noise margins", they represent the low and high noise margins, being denoted by NM_L and NM_H, respectively.

With (7) and (8), the noise margins NM_L and NM_H can be expressed as

$$NM_L = V_{IL} - V_{OL} \quad (9)$$

and

$$NM_H = V_{OH} - V_{IH} \quad (10)$$

respectively.

When

$$NM_L = NM_H \quad (11)$$

the noise margins are symmetric.

If

$$NM_L \neq NM_H \quad (12)$$

the noise margins are asymmetric.

Depending on the values of input and output voltages for TTL NAND 7400/5400 series shown in Table 1, we obtain the values of noise margins illustrated in Table 2.

The voltages $V_{IL\ max}$ *and* $V_{IH\ min}$ represent the maximum input voltage recognized by a NAND Gate Load as a logic "0" and the minimum input voltage for a logic "1" , respectively. As regards the voltage $V_{OL\ max}$ *and* $V_{OH\ min}$, they represent the maximum output voltage of a NAND Gate Driver for a logic "0" and the minimum output voltage for a logic "1", respectively.

The noise margins NM_L and NM_H represent the maximum values of the noise voltages that assure the functioning of the TTL integrated circuits without destroying them and without degradation of L and H voltage levels.

The maximum noise margins are limited by the device characteristics and / or by considerations of symmetry between the low and high noise margins.

3. Detection of erroneous operations using modulus functions of noise margins

In a previous paper [37] we have defined the modulus functions of the noise margins NM_L and NM_H in the forms

$$f(V_{IL}, V_{OL}) = |V_{IL} - V_{OL}| = \begin{cases} V_{IL} - V_{OL} & \text{if } V_{IL} > V_{OL} \geq 0 \\ 0 & V_{IL} = V_{OL} \\ V_{IH} - V_{OH} & \text{if } V_{IH} > V_{OH} \geq 0 \end{cases} \quad (13)$$

and

$$f(V_{OH}, V_{IH}) = |V_{OH} - V_{IH}| = \begin{cases} V_{OH} - V_{IH} & \text{if } V_{OH} > V_{IH} \geq 0 \\ 0 & V_{IL} = V_{OL} \\ V_{OL} - V_{IL} & \text{if } V_{OL} > V_{IL} \geq 0 \end{cases} \quad (14)$$

respectively.

TABLE 1 VALUES OF INPUT AND OUTPUT VOLTAGES FOR TTL NAND 7400/5400

Voltage	Measure	Family /Year of appearance							
		(TTL)	L	H	S	LS	F	ALS	AS
		1964	1967	1967	1969	1971	1979	1980	1982
VIL max	V	0.8	0.7	0.8	0.8	0.7	0.8	0.8	0.8
VIH min	V	2	2	2	2	2	2	2	2
VOL max	V	0.4	0.3	0.4	0.5	0.5	0.5	0.5	0.5
VOH min	V	2.4	2.4	2.4	2.7	2.7	2.7	2.7	2.7

TABLE 2 VALUES OF NOISE MARGINS

Noise margins		Measure	Family /Year of appearance							
			(TTL)	L	H	S	LS	F	ALS	AS
			1964	1967	1967	1969	1971	1979	1980	1982
NM	NML	V	0.4	0.4	0.4	0.3	0.2	0.3	0.3	0.3
	NMH	V	0.4	0.4	0.4	0.7	0.7	0.7	0.7	0.7

The cases in which the modulus function are

$$f(V_{IL},V_{OL}) = |V_{IL}-V_{OL}|=0 \quad \text{if} \quad V_{IL}=V_{OL} \tag{15}$$

$$f(V_{IL},V_{OL}) = |V_{IL}-V_{OL}| = V_{OL} - V_{IL} \quad \text{if} \quad V_{OL} > V_{IL} \geq 0 \tag{16}$$

$$f(V_{OH},V_{IH}) = |V_{OH}-V_{IH}|=0 \quad \text{if} \quad V_{OH}=V_{IH} \tag{17}$$

and

$$f(V_{OH},V_{IH}) = |V_{OH}-V_{IH}| = V_{IH} - V_{OH} \quad \text{if} \quad V_{OL} > V_{IL} \geq 0 \tag{18}$$

correspond to a malfunction of the drive and / or load NAND Gate shown in fig. 1 We can detect thus the erroneous operation in TTL integrated circuits, using the modulus function of noise margins.

4. CONCLUSIONS

The noise margins have a distinct importance for logic integrated circuits with the propose of appreciation the functioning in the presence of electromagnetic disturbances. Their values must be considered both in the choosing as in the using of TTL integrated circuits in apparatus and equipment destined for various applications.

The paper has presented the procedure of detection of erroneous operation in TTL integrated circuit by using the modulus functions of noise margins.

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A FRAMEWORK FOR CREATING MIXED ROBOT FORMATIONS WITH PHYSICAL AND VIRTUAL AGENTS

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Abstract: This paper proposes a solution for creating mixed formations with virtual and physical agents and describes a framework for studying stigmergy in such formations. The central element of the solution is the concept of virtual pheromones, defined as engrams created by the agents not in the environment, but in a map of the environment, stored by a pheromone server. This map acts like a shared memory area for all the agents, embedding information usable for defining paths and actions, and is dynamically updated by the server, which is in permanent communication with the agents, through a radio link. A model of the virtual pheromone is proposed, describing the spatial diffusion, and evaporation. Possible uses of this concept for controlling the real-time motion of the agents are explored.

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Keywords: Virtual pheromones, pheromone server, spatial diffusion, controlling the real-time motion.

1. INTRODUCTION

Afterwards, a great number of scientific papers proposed various methods for creating *artificial pheromones*. Some researchers propose solutions based on spreading chemicals in the environment, just like ants do. (Purnamadjaja 2007, and Genovese 1992). Others (Payton 2005) use short-range infrared transceivers to relay messages between mobile robots, while others (Mamei 2005, Susnea 2008) propose the use of RFID tags, deployed in the environment, to store some data structures, interpreted as *digital pheromones*.

The term *"virtual pheromone"* was mainly used in connection with software agents (Szumel 2006).

In all of the above implementations, artificial pheromones are psysical, chemical or informational entities *distributed* in the environment, thus having the benefit of the intrinsec robustness of any decentralized multi-agent system.This paper presents a centralized approach on using artificial pheromones, wherein virtual pheromones are engrams created by the agents *not in the environment, but in a map of the environment, located in a pheromone server*.

In this approach, the agents use their own localization system to periodically report their position to the pheromone server, via a radio communication link. When the pheromone server receives a data packet containing the current position of an agent, it locates the agent on the internal map, then computes the pheromone concentrations for that particular position, and sends back to the client a response packet containing this data. Thereafter, the agent acts as if it had its own differential pheromone sensors, and adjusts its position so that it gets as close as possible to the pheromone trail. The system can operate with fixed, predefined paths embedded in the pheromone map, or, when multiple agents are involved, it can modify the pheromone concentrations as if the agents would leave

pheromone trails on their way, just like real insects do. In this last case, the pheromone paths stored by the server dynamically change as agents move through the environment, creating a realistic emulation of a natural swarm.

Beyond this introduction, this paper is structured as follows:

- Section 2 proposes a model of the virtual pheromones
- Section 3 contains a description of an experiment where physical agents follow a virtual leader by means of a pheromone server.
- Section 4 presents some experimental results, and
- Section 5 is reserved for discussion and future work.

2. A MODEL OF THE VIRTUAL PHEROMONES

Natural pheromones are chemical substances released in the environment by some insects and other animals, in order to influence the behavior, and sometimes even the physiology of other members of the same species.

Ant foraging is the most common example of pheromone-based interaction. When an ant finds a food source, it starts spreading pheromone on its way back to the nest, leaving a trail that indicates the path to the food to the other ants. Every ant that senses the pheromone trail tends to follow the existing path and reinforces the pheromone trail by spreading additional pheromone.

On the other hand, the pheromone is subject to evaporation, and, when the food source is exhausted, in the absence of reinforcement, the trail disappears. This indirect coordination between agents by means of modifying the environment by an action, which stimulates similar subsequent actions, in a positive feedback process, is called *stigmergy* (Grassé 1959).

Any model of the natural pheromones should address at least the following aspects:

- Spatial diffusion.

Pheromone diffusion gradients provide valuable navigational information and also encode useful information about obstacles that obstruct pheromone propagation. Normally, insects sense the pheromone by means of two movable antennas located on the sides of the head. This allows the insect to sense the spatial gradients of the distribution of the pheromone.

- Superposition of the effects of multiple pheromone sources.

The overall intensity of the pheromone, sensed at a given point, is a result of the superposition of the effects of multiple pheromone sources. Figure 1 illustrates this mechanism.

- Evaporation.

The intensity of the pheromone effect decrease with time. This process reduces obsolete or irrelevant information, and also provides the colony with a mechanism to find the shortest path to the food. If two or more paths of different lengths are available between the nest and the food source, longer paths require more time for the ants to reach their target. The process of evaporation reduces the intensity of the pheromone on longer paths, and therefore more ants tend to choose the shorter path. Eventually, the shortest path is used by most of the ants, and longer paths disappear. See figure 2 for an illustration of this process, as explained in the so-called double bridge experiment (Deneubourg 1990).

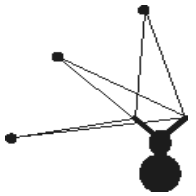

Fig. 1 An illustration of the spatial diffusion and superposition.

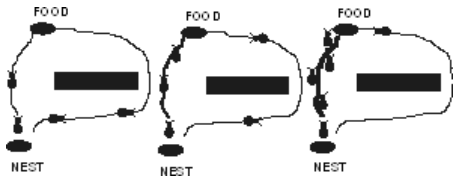

Fig. 2 The double bridge experiment

The spatial diffusion can be modeled with (1):

$$p(x) = \begin{cases} p_0\left(1-\frac{x}{\sigma}\right) & 0 < x < \sigma \\ 0 & x \geq \sigma \end{cases} \quad (1)$$

where $p(x)$ is the pheromone intensity sensed at the distance x from the source, and σ is the maximum distance at which the pheromone source p_0 is detectable.

The evaporation can also be described by a simple, linear function of time (2).

$$p(t) = p_0\left(1-\frac{t}{\tau}\right) \quad (2)$$

By combining (1) and (2), the pheromone intensity along the x axis can be described by the equation (3)

$$\bar{p}(x,t) = \begin{cases} p_0 \bar{\imath}\left(1-\frac{x}{\sigma}\right)\left(1-\frac{t}{\tau}\right) & 0 < x < \sigma \\ 0 & x \geq \sigma \end{cases} \quad (3)$$

where $\bar{\imath}$ is the unit vector of the x axis.

Using (3), the effect of N pheromone sources, located at the distances d_1, d_2, ... d_N from a point $R\ (x_0,y_0,\theta_0)$ can be expressed by:

$$\bar{P} = \sum_{k=1}^{N} p_0 \bar{\imath}_k \left(1-\frac{d_k}{\sigma}\right)\left(1-\frac{t}{\tau}\right) \quad (4)$$

The equation (4) is the model of the pheromones, we have used in our experiments.

The resulting intensity of the pheromones can be sensed with two "virtual antennas", located laterally on each side of the agent, at the distance b from each other.

The coordinates of the right (R) and left (L) antennas are given by (5).

$$\begin{aligned} x_R &= x_0 - \frac{b}{2}\sin\theta_0 \\ y_R &= y_0 - \frac{b}{2}\cos\theta_0 \\ x_L &= x_0 + \frac{b}{2}\sin\theta_0 \\ y_L &= y_0 + \frac{b}{2}\cos\theta_0 \end{aligned} \quad (5)$$

Knowing the position (x_0,y_0,θ_0) of an agent, and the distribution of pheromone sources, the server can compute with (4) and (5) the intensities of the pheromone P_L, P_R at the level of each antenna. Since the virtual antennas are assumed to be located symmetrically along the axis of the agent, the difference (P_L-P_R) can be used as an expression of the positioning error with respect to the pheromone trail.

Once the values of P_L, and P_R are reported back to the agent, this acts as if it had its own differential pheromone sensing system.

Note that all the calculations are executed by the server. This greatly reduces the computational load at the level of the control system of the agent, which may lead to drastic cost reduction thereof.

3. AN EXPERIMENT FOR MIXING PHYSICAL AND VIRTUAL AGENTS

3.1 *Objective*

The main objective of the experiment described in this section is to demonstrate the feasibility of the idea of creating cooperative

formations including physical and virtual agents.

The simplest cooperative behavior – "follow the leader" - was selected, with the difference that the leader was a simulated, virtual robot, (simulated with MobileSim) while the follower was a physical robot, namely the robot Pioneer3-DX. Both the robot and the simulator MobileSim are manufactured by MobileRobots Inc. (MobileRobots, 2000).

The pheromone server was implemented with a desktop computer, connected through a IEEE 802.11g WLAN with the agents.

3.2 *Experimental Setup*

The structure of the equipment used in the experiment is presented in figure 3.

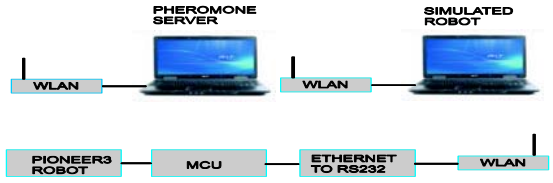

Fig. 3 The Experimental Setup

The motion of the simulated robot was manually controlled. A low cost/low power microcontroller unit (MCU) implemented a fuzzy controller for path following, by generating reference values for the speeds v_L, v_R of the left and right wheels of the differential drive robot, based on the pheromone intensities P_L, P_R, reported by the server. See (Susnea 2008b) for details on the fuzzy controller.

3.3 *Notes on the Actual Implementation*

The environment map used was a simple 2D grid map whose nodes were linked with a data structure containing information about pheromone source (if any) and a time stamp. Each cell of the map corresponds with a square area in the real world (see figure 4).

A special software application was written to generate and manage such maps. See figure 5 for a snapshot of the GUI of the map editor.

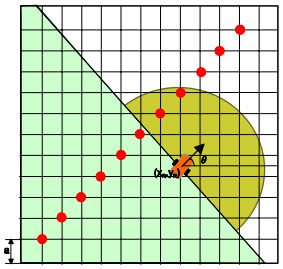

Fig. 4 The grid map embedding information on the pheromone distribution

The robot's sensitivity to pheromones was assumed to be directional, so that only a 180 degrees circular sector ahead of the robot is "visible" for the pheromone sensing antennas.

In the first phase of the experiment, the robots were instructed to follow a pre-defined pheromone trail. This was used to tune the FLC for path following and to test the communication functions.

In the second phase of the experiment, the pheromone trail was generated by recording successive positions of the simulated robot, and the physical robot was instructed to follow the pheromone trail created by the virtual leader.

In both cases, the pheromone trace was assumed to be time-invariant – the evaporation was not taken into consideration.

The environment was assumed to be a horizontal plane with no obstacles. The odometric system of the robot was used for position estimation.

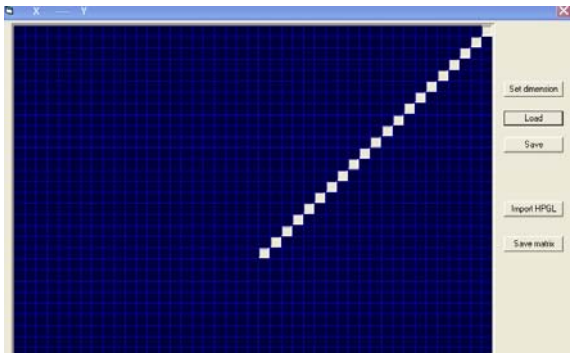

Fig. 5 Snapshot of the GUI of the map editor

4. EXPERIMENTAL RESULTS

Figures 6 and 7 present the actual path of a simulated robot, recorded with MobileSim,

superposed with the corresponding pheromone distribution map for pre-defined paths.

The path used for recording the evolution of the robot in figure 8 was generated by a virtual leader robot, manually controlled.

In all cases, the follower robot was controlled by a fuzzy logic controller implemented on a low cost microcontroller.

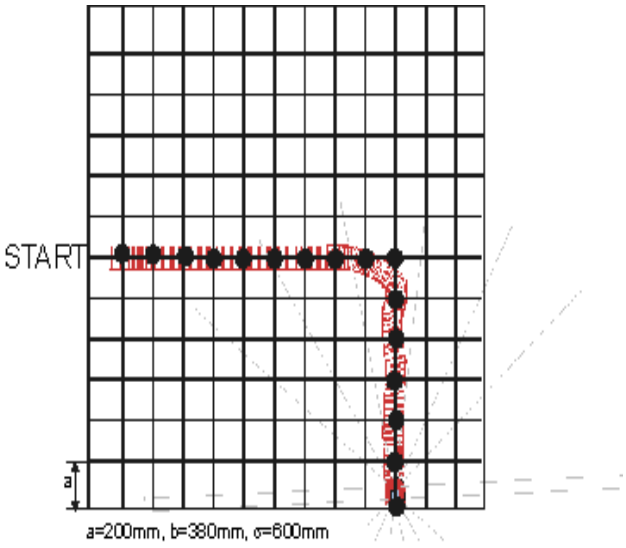

Fig. 6 Recorded path vs pheromone distribution

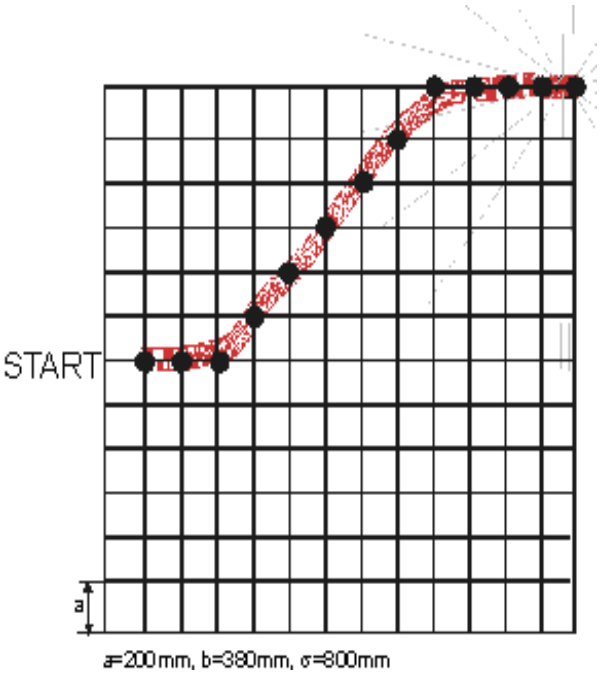

Fig. 7 Recorded path vs. pheromone distribution

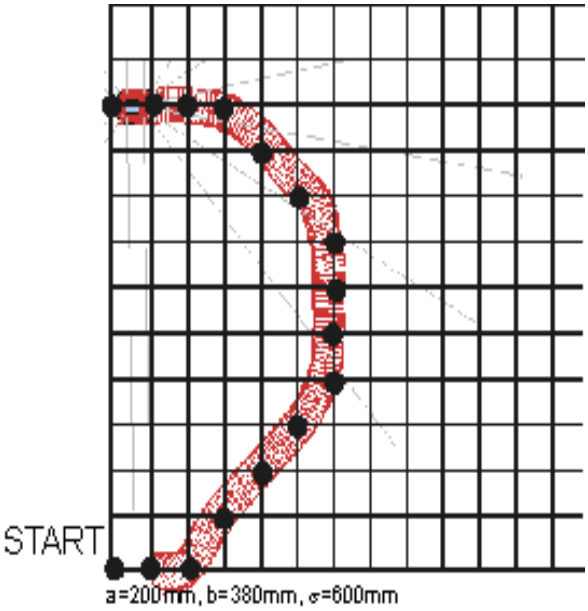

Fig. 8 Recorded path vs. pheromone distribution

5. DISCUSSION AND FUTURE RESEARCH

This centralist approach has been criticised and a-priori rejected (Parunak 2002) for lack

of robustness in case the pheromone server fails. However, this limitation can be easily eliminated by using a second backup server, which executes all the operations of the main server, except responding to the queries of the robot clients. If the main server fails to communicate for a specified time-out delay, the backup server automatically assumes the communication tasks. There are, instead, several important advantages of this method:

- It distributes the computational load between the server and the agents, thus allowing very simple control structures for the agents. This results in drastic cost reduction thereof.
- Convenient pheromone distribution maps, obtained, for example, in an Ant Colony Optimization process, can be saved for later use. Virtual agents can be used in the optimization process, and the results are immediately available for use with physical robots.
- Multiple pheromone types can be defined (e.g. “stay away from this area”, “find and pick a load”, “drop the load here” etc.).
- Virtual leader-robots, with high speed and maneuerability can be sent in real-time to influence and guide formations of physical robots.
- This method is applicable to control any type of military, civil, and industrial service robots. Existing robots can be easily modified to suit this control method.

One major drawback of the proposed method is that it relies on the agent’s localization system. For outdoor applications the GPS locators can give satisfactory results, but indoors a localization system better than dead reckoning must be implemented. Further research is needed in the following directions:

- Define a method to embed information about the obstacles in the pheromone distribution maps, and describe how obstacles influence pheromone diffusion.
- Experiment with other types of pheromones.
- Identify other possible applications of the method.

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ON INTEGRATING AUTONOMOUS MOBILE ROBOTS IN AN INTELLIGENT ENVIRONMENT

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Abstract: *Although very few robots actually go to Mars, we continue to design these machines following an antropomorphic paradigm, as if they were organisms operating in a totally unpredictable and hostile environment. In fact, in most situations, the environment in not only predictable, but also can be manipulated to support the missions of the autonomous robot, by including sensors, actuators, computing and communication equipment. In this approach, the robot itself becomes part of a distributed control system, wherein most of the sensing and control elements are located in a manipulated "intelligent environment". This may result in drastic cost reductions of the entire system.*
This paper introduces the concept of "intelligent environment" in robot control and analyzes two case studies of the implementation thereof: one is the problem of integrating autonomous mobile robots in flexible industrial assembly lines, the other is the the general design approach for creating personal robotic assistants for the elderly and disabled.
Some simple experiments illustrating the advantages of the concept are presented.

Keywords: *Autonomous mobile robots, intelligent environment, personal robotic assistant, flexible assembly lines, PLC, HMI*

1. INTRODUCTION

The antropomorphic paradigm we use when designing robots is, sometimes, counterproductive. We tend to expect too much from the robots. They are not necessarily supposed to sense the world the way we do, and their environment is not always unknown, or even hostile. In fact, most service robots operate in an environment that is not only known/predictable, but also can be manipulated to include sensors, actuators, computing and communication equipment.

One good example of such situation is the industrial environment, where industrial robots ([1], [2]), having limited autonomy (see fig.1) are far from covering all possible applications.

Martin Hägele et al. in [3] introduce the concept of "robot assistant at manual workspace" – a sort of robotic apprentice, ideally capable to hand tools or components to a human operator. The actual implementation of this idea, called rob@work, (see fig. 2), created by FRAUNHOFER IPA (www.care-o-bot.de), consists in a robotic arm installed on a wheeled mobile platform. The resulting machine is so complex, that it remained in an experimental stage.

Fig. 1. A typical industrial robot – basically a robotic arm, located on a fixed platform, with some sensors, and strict programming rules

Another type of service robots that operate in a known and manipulable environment are the "nursing robots".

The first attempts to design such robots date back in 1985, when Borenstein and Koren ([4]) described a mobile platform, equipped with a robotic arm, intended to support persons with disabilities in hospitals, or nursing homes.

The similarities in design with rob@work

are obvious. And so is the obstination in ignoring the robots environment.

Fig. 3. Rob@work from FRAUNHOFER IPA

Nearly two decades later, Pineau et al. ([5],[6]) conduct surveys about challenges and results in the research for creating nursing robots, and report more challenges than results.

To conclude this very short analysis about the state of the art in the field of service robots, we will state that one major reason we don't have yet commercially available, and really useful service robots (other than autonomous vacuum cleaners, or mowers) despite the tremendous number of paper published every year on robotics is the persistence in ignoring the environment where robots operate.

The following paragraphs propose a possible solution, by considering two case studies: one is the problem of integrating mobile robots in flexible assembly lines, the other is the general approach in designing personal robotic assistants for the elderly or disabled.

2. INTEGRATING MOBILE ROBOTS IN FLEXIBLE ASSEMBLY LINES

Most of the automation problems in industry are now efficiently solved using PLCs, connected in control hierarchies as shown in figure 3.

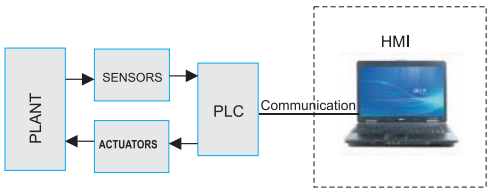

Fig. 3. A typical control system in industrial automation

On the other hand, a typical solution for controlling mobile robots is presented in fig. 4.

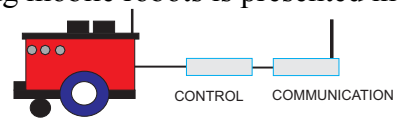

Fig. 4 A typical control system for mobile robots

The block named "CONTROL" in figure 4 is normally a computer, or microcontroller handling the kinematic control of the robot, while "COMMUNICATION" denotes the equipment dedicated to connecting the mobile platform to a remote computer for supervision and decision.

If the communication between the robot and this remote computer obeys a standard industrial protocol, accepted by most HMI software, than it would be possible to create control structures like the one presented in figure 5.

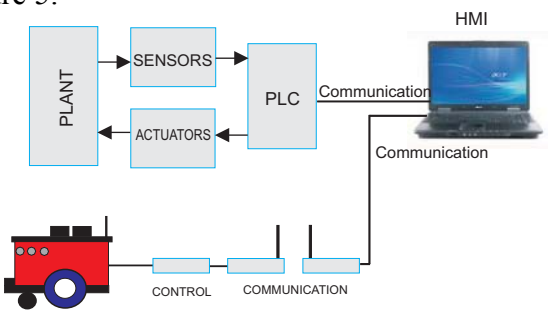

Fig. 5 A control structure capable to supervise a PLC controlled plant and a mobile robot

To prove the feasibility of this idea, we

have conducted a simple experiment with a simulated robot and a low cost HMI application, namely Winlog Lite, from SIELCO SISTEMI. (www.sielcosistemi.com).

The experimental setup is shown in figure 6. The robot simulator was MobileSim, a simple and efficient softare simulator from MOBILEROBOTS. (www.mobilerobots.com)

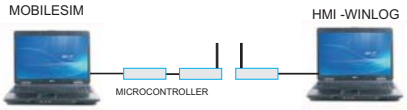

Fig. 6 Experimental setup for simulation

The microcontroller used was a low cost/low power chip, equipped with two serial communication interfaces. Its main tasks were:

- communicate with the robot, through a proprietary protocol,
- communicate with the HMI application according to the MODBUS RTU slave protocol,
- control the robot in real-time to the goal point specified by the HMI application, with obstacle avoidance.
- Report robot status information to the HMI.

Details on the actual implementation of the applications running on the microcontroller are presented in [7] and [8].

According to this approach, the robot itself is treated as an element of the environment, it is capable to react to/trigger events, and to interact with another sensors and actuators deployed in the environment.

It could easily execute tasks like transporting components between workstations, inspecting the assembly line and transmitting visual information in case of malfunction. Other functions could be performed through teleoperation.

3. ON THE IMPLEMENTATION OF COST EFFECTIVE NURSING ROBOTS

The idea of a smart environment for nursing robots is not entirely new. Park et al. describe in [9] a “smart house”, for people with physical disabilities, wherein an intelligent wheelchair, and a smart bed are capable to support the disabled for movement.

Moreover, Gharpure and Kulyukin propose in [10] a robotic system aimed to support blind people for shopping.

Based on the above mentioned literature, and on the analysis of many other projects not listed here for lack of space, we have extracted a list of distinctive features required for a low cost robotic assistant.

These requirements were previously presented in [11].

A simple and robust navigation system is an absolute requirement for such a robot..

It is highly desirable that the robotic assistant can perform the function of walking aid for persons with limited locomotion impairment. An intelligent wheelchair, or even a walker could be the ideal solution.

A robotic arm may seem desirable, but it is likely to dramatically increase the cost of the whole project

It is desirable that the robot have the capability to recognize a limited number of vocal commands. The attempts to design robots able to sustain a conversation in natural language with human operators have produced questionable results at much higher costs.

It is desirable that the robot can monitor some signals from the environment (e.g. the alarm system of the building, or some medical equipment) and control various appliances, lights, heating, air conditioner, etc.

It is desirable that the robot can interact with the communication system of the environment.

The function of cognitive prosthesis is optional, since it can be easily implemented on a stationary computer.

And, last but not least, it is highly desirable that the robot can be easily programmed.

In what concerns the actual implementation of such a machine, we proposed in [11] a distributed system of low cost microcontrollers capable to match the above listed requirements. Some of these elements must be carried by the robot, others are deployed in the environment.

Figure 7 shows the the minimal structure of the on-board equipment, while figure 8 depicts the equipment located on the ground.

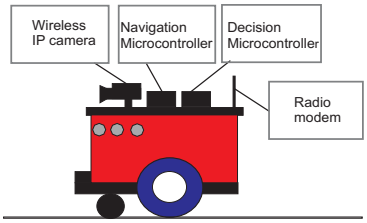

Fig. 7 The on-board equipment for a robotic assistant

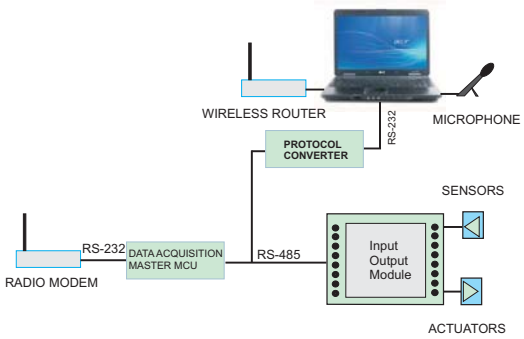

Fig. 8 The equipment deployed in the environment

Besides this, the actual vehicle contains its own on-board electronics, as shown in fig. 9.

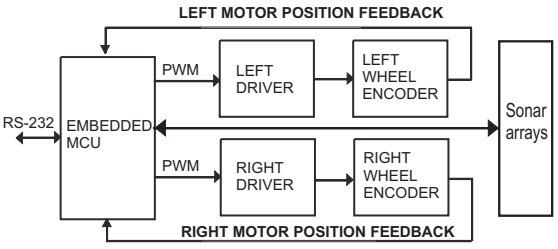

Fig. 9 Motion control electronics on vehicle

In addition to the four microcontrollers present in this structure, a regular personal computer and a wireless router connected to the Internet were included in the system. The tasks associated with this equipment are:

- Run a dedicated software for speech recognition. When a predefined voice command is recognized, this is treated like a regular digital input.
- Provide the physical interfaces for transmitting the images and sound collected by the wirelss IP camera carried by the robot through the internet.

4. CONCLUSION

It is now easy to notice that besides the low cost, there are many other advantages in the proposed solution: low power consumption, less effort to develop the software, use of regular, low cost data acquisition modules, etc.

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NEW DESIGN METHOD FOR ASYNCHRONOUS DIGITAL SYSTEMS

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Abstract: *In present paper, the authors propose a method for synthesis of the asynchronous digital systems using locally clock method.*

Keywords: *Digital logic, FSM, Fluence Graph, D Flip-Flop Latch, Transition Table, Logic Gates.*

1. INTRODUCTION

Driving an asynchronous digital system is a such complex task instead synchronous systems. The authors propose a method for synthesis of the asynchronous digital systems using Verilog HDL, and implement them into a FPGA devices, [1,2,3]. The proposed method presented in this paper has many features like:

- execution speed much better;
- maximize the combinational/sequential digital logic
- maximize the design performances (speed, low power, size)

A such of system is presented in figure 1. It contains the combinational logic modules, D type latches, input signals named input1,input2...inputN, output signals named output1,output2.....outputM, state variables named s1,s2...sk. The combinational system which implements an internal drive in signal, it is used for control the states of the digital system, disposal the hazard phenomenon from the digital systems. The entire system transit into a new state driving by the input signals which need to be stabile a period of time before changed and by the present states of the system.

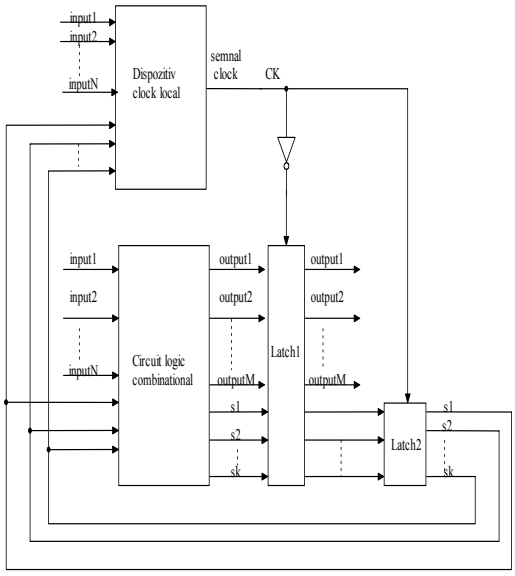

Fig.1. Digital Asynchronous System

In figure 1 it's shown the consist modules of the digital system:

- drive in signal device;
- combinational system who implements the system states equation ;
- D type latch1, latch2 are used to memorise the state of the system and also the outputs of the system;

The drive in signal (1) depends by the system's states notated with Q_i, input signals notated with X_j, where i=1,2,…n-1, j=1,2,…m-1; (n- states number variables, m-input number variables).

$$CK = F(Q_i, X_j) \qquad (1)$$

If signal CK=1 the system will go onto a new state, if CK=0 the system will stay in present state, it will can read the output values signals. While the states and outpus signals are computed, the input signals will not be changed, the system will work in fundamental mode.

2. DESIGN OF ASYNCHRONOUS DIGITAL SYSTEM WITH LOCALLY CLOCK METHOD

Let's consider an asynchronous digital system with functionality described by the fluence graph, figure 2:

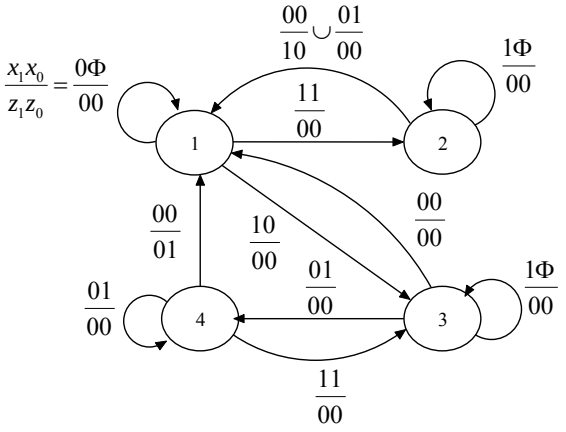

Figure 2. Graph table

The fluence table is described in figure 3.

Q_{n+1}/z_1z_0

$(x_1x_0)_n$ / Q_n	00	01	11	10
1	1/00	1/00	2/00	3/00
2	1/10	1/00	2/00	2/00
3	1/00	4/00	3/00	3/00
4	1/01	4/00	3/00	-/--

Fig.3. Fluence graph table

The equations are like, (2):

$$D_1 = y_{1,n+1} = [y_1(x_0 + x_1) + \overline{y_0}x_1\overline{x_0}]_n$$
$$D_0 = y_{0,n+1} = x_{1,n}$$
$$z_{1,n} = (\overline{y_1}y_0\,\overline{x_1}\,\overline{x_0})_n \qquad (2)$$
$$z_{0,n} = (y_1\overline{y_0}\,\overline{x_0})_n$$

The CK truth table is deducted from fig.3, like in fig.4:

$(x_1x_0)_n$ / y_1y_0	00	01	11	10
00	0	0	1	1
01	1	1	0	0
11	1	1	0	0
10	1	0	1	-

Fig. 4. CK truth table

Using the Veitch-Karnaugh, method it will compute the CK's equation (3):

$$CK = \overline{x_1}y_0 + x_1\overline{y_0} + \overline{x_0}y_1\overline{y_0} \qquad (3)$$

The D flip-flop circuits are described in fig.5:

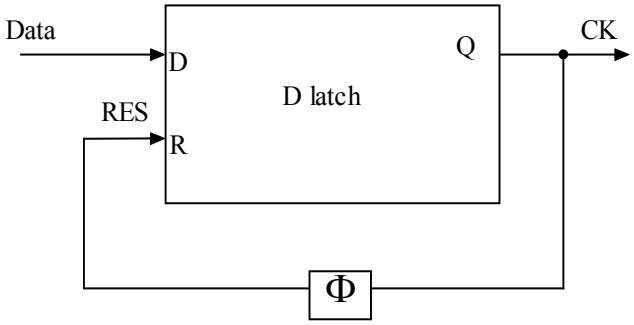

Fig.5. D flip-flop

z_1, z_0 - represents the outputs of the system

y_1, y_0 – represents the state of the system

The output signals z_1, z_0 and state signals y_1, y_0, has attached a D flil-flop latch. The D flip-flop latch1 stores the output signals while the latch2 stores the states signals. They are triggered on the positive clock signal – CK.
After a delay time, the CK signal is reseted who let the latch1 to be triggered.
The design of the proposed system is like in fig. 6.

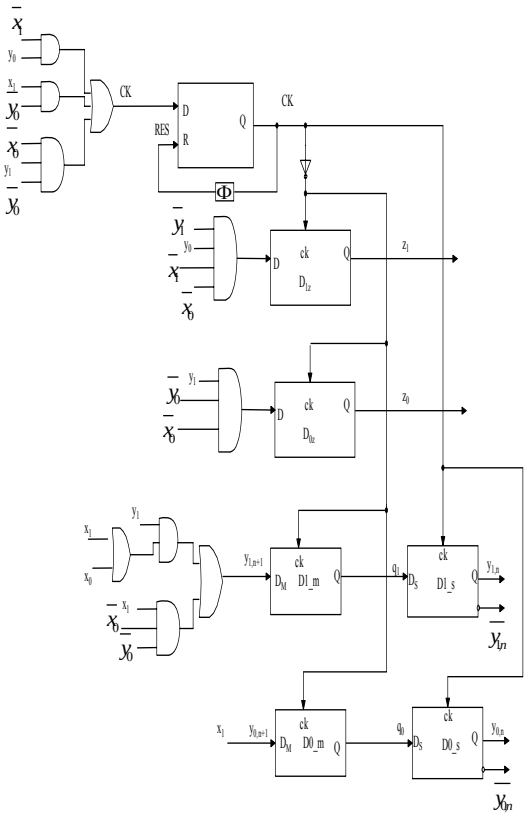

Fig 6. Design with D flip-flop

The entire digital system must meet the following restrictions:

- The minimum propagation delay of CK signal through the combinational system must be greater than the maximum propagation delay for every logic circuit which implements the input/output signals.

- Once the CK signal is triggered it can be reseted without digital hazard.

- Using the improved design described above, the entire asynchronous digital system will work concordant with the specifications.

- For a corect functionality, the following conditions must meet, fig.7.

$$\Phi << T$$
$$\Phi + \Delta = T$$
$$\Delta \le T$$
$$\Delta > \Phi$$

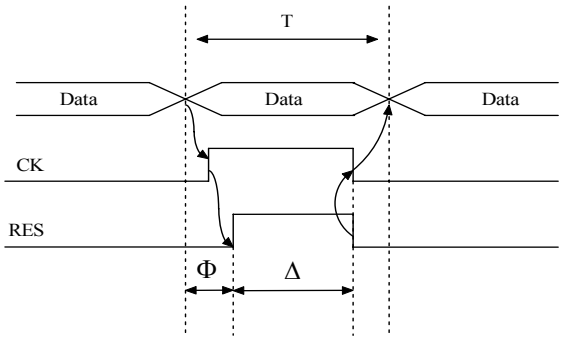

Fig 7. Functionality diagram

- If we set the value of delay time for the Q to Res signal $\Phi = 314ns$, we can use a RC circuit like:

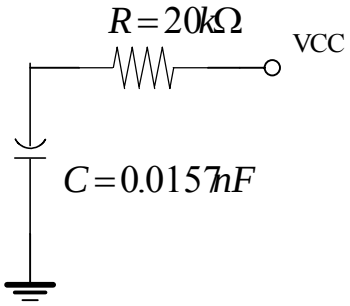

Fig. 8. RC circuit

3. CONCLUSIONS

- The CK signal and the output signals must be free of logic hazard inorder to met the system run like within the specifications;

- The minimum propagation delay of CK signal through the combinational system must be greater than the maximum propagation delay for every logic circuit which implements the input/output signals.

- Once the CK signal is triggered it can be reseted without digital hazard.

-

- Using the improved design described above, the entire asynchronous digital system will work like in the specifications.

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4.2 MECHANICAL ENGINEERING

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THE MATHEMATICAL MODELLING OF CHANNEL TEMPERATURE MEASUREMENT OF AIRCRAFT ENGINE EXHAUST GASES

František ADAMČÍK, Jan LABUN, Peter KRAJŇÁK

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Abstract: *One of the important diagnostic parameters of an aircraft engine is a process of the gas temperature behind the turbine. It is crucial for assessing the condition of its heat-stressed parts to identify the failure and before failure conditions and thus to determine the limits of the the operational limit . The solution part of a given problem is also the channel mathematical modelling of the exhaust gas temperature measurement.*

Keywords: *engine, exhaust gases temperature, mathematical modelling.*

1. INTRODUCTION

One possibility examining the properties of real objects is a mathematical description of processes in their development. The content of an identification system is then creating a mathematical model based on theoretical and experimental analysis.

For evaluating the technical conditions of aircraft turbo-engines (ATE), a key issue is the investigation of gas temperatures behind a turbine and monitoring of this parameter in operation. In most cases, for the purpose of its high reliability, thermoelectric sensors (thermocouples) are used. The dynamic error of thermocouples, however, prevents the use of gas temperatures behind a turbine recorded during the flight to diagnose engine dynamic behaviour in dynamic modes t_{4c}.

A possible solution is to create a mathematical model of gas channel temperature measurements recorded using the known operating parameters. This procedure requires the solution of tasks associated with the identification of ATE. The mathematical models and processing measured values can be implemented in Matlab Simulink [1, 2].

2. MODELLING OF CHANNEL TEMPERATURE MEASUREMENTS BEHIND A TURBINE

The dynamic error channel temperature measurement of gases behind a turbine can be corrected by establishing an appropriate model, the output will be its corrected value of temperature $t_{4c\ kor} \approx t_{4c\ sk}$. The solution is to create a forward dynamic model of channel temperature measurement of exhaust gases and then its inverse model (Fig. 1), where the required corrected temperature value will be on its output $t_{4c\ kor} \approx t_{4c\ sk.}$ The synthesis of a dynamic model of channel temperature measurement of gases behind a turbine is based on knowledge of its dynamic characteristics.

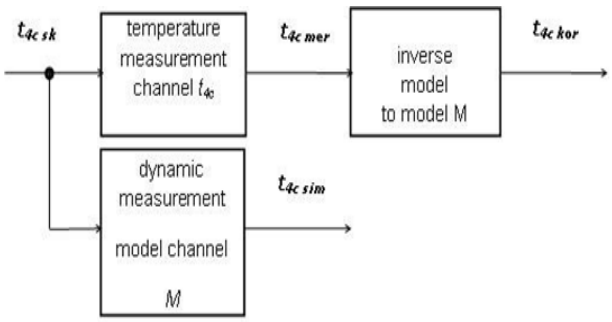


Fig. 1 Determination of the temperature t_{4ckor} using mathematical modelling

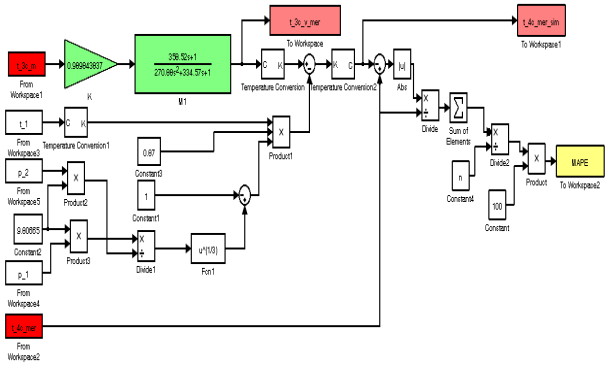


Fig. 2 Structural diagram of verification of the forward linear model channel temperature measurement t_{4c}

To create a linear model of the channel temperature measurement of gases behind a gas turbine, the data measured at a stand of ATE (outputs of the functional FET engine tests) were used with the required modification for use in Matlab Simulink [4, 5].

For verification of multiple versions of models (Fig. 2) and their behaviour in transient modes, the error was investigated between the outputs of the model $t_{4c\,sim}$ a $t_{4c\,mer}$ with quality evaluation using indicators of MAPE and MAAPE models. The outcome of this process was the selection of the optimal transfer function.

The similar verification procedure was designed for the inverse linear transfer function model of the channel temperature measurement of gases behind a turbine.

The verification procedure of inverse model was accomplished by structural scheme on Fig. 3. The output from model modifies the value of temperature $t_{4c\,kor}$.

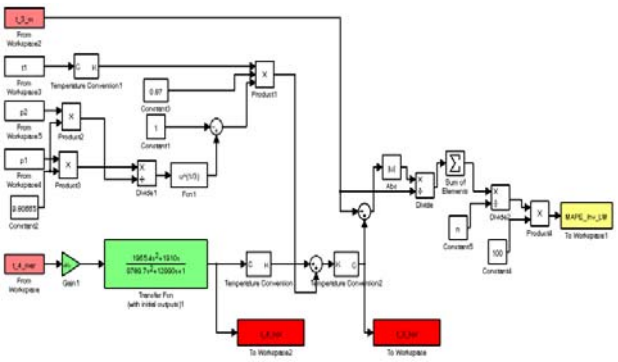


Fig. 3: Structural diagram of verification of the inverse linear model channel temperature measurement t_{4c}

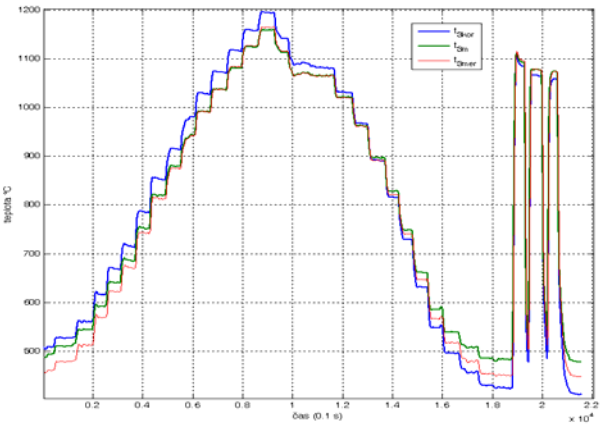
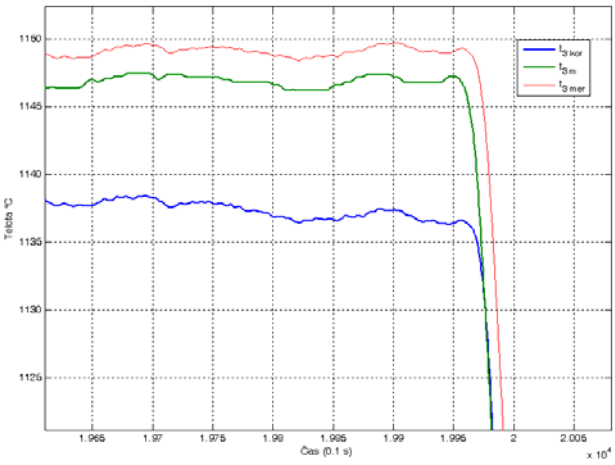


Fig. 4 Display output of a channel inverse linear model of temperature measurement t_{4c} for dataset FET



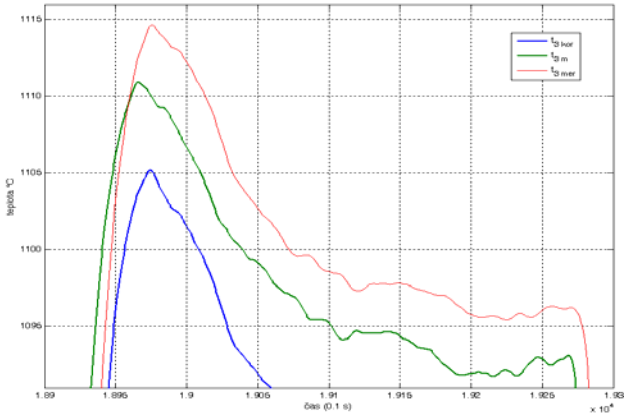


Fig. 5 Comparison of $t_{3c\ mer}$ (t), $t_{3c\ m}$ (t) and $t_{3c\ kor}$ (t) in the transient modes of engine

3. CONCLUSIONS

The goal of solving the above problems is to contribute to current trends in airline operations technology, i.e. to the the operational limit determination by the technical condition of aircraft turbo-engines through more accurate monitoring of heat stress.

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STRESS ANALYSIS WITH FINITE ELEMENT METHOD OF LARGE BEARINGS WITH HOLLOW ROLLERS USED IN WIND TURBINE SYSTEM

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Abstract: *In this paper is presented a method for increase the large bearings durability using hollow rollers, demonstrated through computer modeling.. Implementation of large bearings with hollow rollers in wind turbine system lead to significant gains in constant power plant operation simplifying management of inertial forces. The mathematical model has been implemented in an algorithm, by which it is possible to study stress distribution for various models of hollow rollers. The analysis with finite element method (FEM) is developed with MD Nastran software.*

Key words: *large bearings, Von Mises stress, hollow rollers, FEM.*

1. INTRODUCTION

With increasing the power of wind turbines also increases their size and inertial mass so, leading to increase the speed of the starting. The control of high speed is more difficult and the reduction of the inertial forces becomes mandatory.

The objective of the paper is to show a solution for increase the large bearings durability using weight reduction in large bearings construction, accomplished by the use of hollow rollers. The bearing life is strongly influenced by the stress and its reduction is conditioned by the specifics of the rollers geometry.

Reduction of inertial forces in wind power system is beneficial, leading to starting and braking more accurate and reducing the wear of parts in motion.

Because of the large moment of inertia of the rotor, the main design challenges include the starting, the speed control during the power producing operation, and stopping the turbine when required.

The main issue in the tower design is the vibration appearance. The tower vibration decrease with reduction of inertial mass.

2. DYNAMICS OF A WIND TURBINE SYSTEM

The energy of a wind turbine is the sum of the kinetic energy of the rotor, the gearbox and the generator (Fig.1). The inertia of the turbine blades will be much higher than that

of the electrical generator. The latter will have a much higher rotational speed however, which will also result in a large amount of kinetic energy. The inertia *J* of a body is:

$$J = \sum m_i \cdot r_i^2 \qquad (1)$$

where r_i is the radial distance from the inertia axis to the particle of mass m_i and the summation is taken over all particles of the body.

The total moment of inertia [1] for a three-bladed turbine is given by:

$$J = 3m_b r^2 \qquad (2)$$

unde m_b este masa unei pale, i r este raza centrului de greutate al palelor. Pentru o centrală eoliană tipică de 2MW masa totală a rotorului este în jur de 40t. [12]

Can write the equations of equilibrium [2]:

$$T_R - T_{CV_1} = J_R \frac{d\omega_R}{dt} + B_R \omega_R \qquad (3)$$

$$T_{CV_2} - T_G = J_G \frac{d\omega_G}{dt} + B_G \omega_G \qquad (4)$$

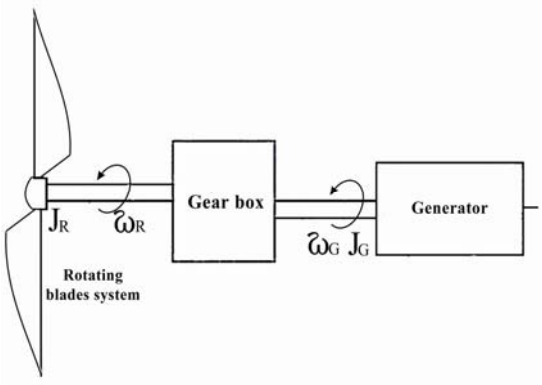


Fig. 1. Dynamic scheme of a wind system

where:

B_R and B_G are the constant friction in the rotor and generator system;

T_R is the rotor torque;

T_{CV1} is the gear box torque to the start;

T_{CV2} is the gear box torque to the end;

T_G is the generator torque to the end;

J_R is the moment of inertia of the rotor;

J_G is the moment of inertia of the generator;

ω_R is the rotational speed of the main shaft;

ω_G is the rotational speed to the start of generator.

From (3) result:

$$\frac{d\omega_R}{dt} = \frac{T_R - T_{CV_1} - B_R \omega_R}{J_R} \qquad (5)$$

Relation (5) leads to the obvious conclusion: importance of decreasing moment of inertia of rotor hence its inertial mass, will lead directly to increased rotational speed of main shaft so will enable faster start at low speed wind of power plant.

One of the ways we can reduce moment of inertia is given by reducing weight of bearings positioned in blades rotational system. For this, we propose the use of bearings with hollow rollers.

3. FINITE ELEMENT MODELING OF PROPOSED HOLLOW ROLLER

Practicability of hollow rollers in construction of large bearings was examined for a material type aiming deep carburization effect. The used material is allied steel: 15NiCr13. Roller dimensions are: L=220mm, R=60mm, [3]. Solid and hollow rollers have been modeled.

The finite element software MD Nastran is used to determine the values of Von Mises stress. Model of this simulation validate form of the roller and give to the researchers the possibility to choose the appropriate design.

The roller profile has a significant influence on the distribution of the contact stress hence, on the bearing load-carrying capacity and life. The best profile of the contact geometry is logarithmic [6]. The advantages of the logarithmic profile have been largely confirmed in research applications.

A recent study also suggested that an crowned profile would be better profile, which can be used to eliminate stress concentration [7]. In both cases manufacturing

precision is very high and affect the cost of the bearing. If the manufacture of the roller surface is not accurate enough, the uniform stress distribution may not be achieved, because the edge stresses cannot be eliminated, as expected.

Research has been conducted to an alternative roller structural form, hollow roller with different hollowness which is more flexible when responding to variations of bearing loads, and it should have less strict requirements on manufacturing precision.

To achieve the logarithmic profile and exponential profile, high manufacturing precision is required. For the hollow roller the profile remains cylindrical. There are two ways by which contact-stress distributions can be influenced: the surface geometry of the roller and the stiffness of the roller. The elasticity to the roller ends decrease contact-stress in this sections. The end-stress concentration can be reduced by using hollow rollers. FEM analysis was made to evaluate the design concept of the hollow roller and comparing it with traditional solid profiles of rollers.

In the simulation was considered an uniform load. The rolling element fatigue life [8],[9] is inversely proportional to the maximum stress to the ninth power (Lundberg-Palmgren) (6) or Zaretsky equation (7).

$$L \approx \left(\frac{1}{\sigma_{\max}} \right)^{9} \tag{6}$$

$$L = A \left(\frac{1}{\tau} \right)^{\frac{c}{e}} \left(\frac{1}{V} \right)^{\frac{1}{e}} \approx \frac{1}{\sigma_{\max}^{n}} \tag{7}$$

where:

A is a constant factor of material;

τ is critical shear stress;

c/e is Lundberg-Palmgren parameter (val. 9);

e is Weibull slope (val.1.1);

V is elemental volume;

S_{max} is maximum Hertz stress;

n is Hertz stress life exponent (val. 9…12).

Barnsby starting from the Ioannides-Harris theory [10], introduces the stress factor K_c.

$$K_c = 1 + \left(1 - C_L^{\frac{1}{4}} \right) \frac{\sigma_{VM,\lim}}{\sigma_{VM,\max}} \tag{8}$$

where:

$\sigma_{VM,\lim}$ is fatigue limit of Von Mises stress;

$\sigma_{VM,\max}$ is maximum of Von Mises stress;

C_L is lubricant parameter.

In this research was used for simulate the comportment of rollers, Von Mises stress criterion. The MD Nastran software found all stress components on each point and the results are conform with Von Mises stress equation [11]:

$$\sigma_{VM} = \frac{1}{\sqrt{2}} \sqrt{(\sigma_x - \sigma_y)^2 + (\sigma_y - \sigma_z)^2 + (\sigma_z - \sigma_x)^2 + 6 \cdot (\tau_{xy}^2 + \tau_{yz}^2 + \tau_{zx}^2)} \tag{9}$$

The magnitude of uniform load-distribution used for the analysisis 275 KN. Distributions of maximum Von Mises stresses are shown for solid cylindrical roller (fig.2), hollow roller with D_i=80mm (fig.3) and hollow roller with D_i=100mm (fig.4).

Crossing to the hollow roller bearings do not require major changes in technology. The present study deals with the problem of bearing resistance in assemblies bearings - wind power plant. New problems that face hollow roller bearings, are larger deformations and larger contact stresses.

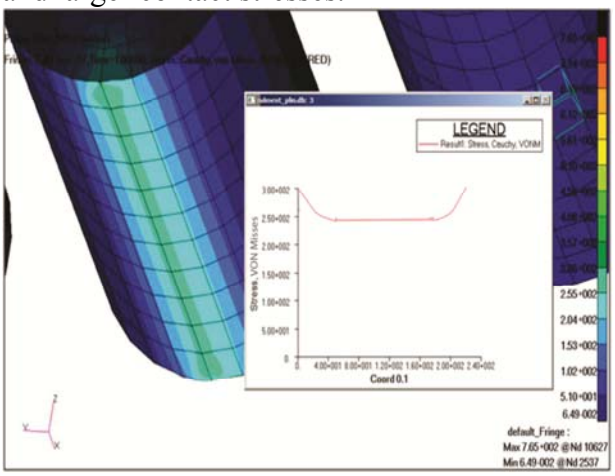
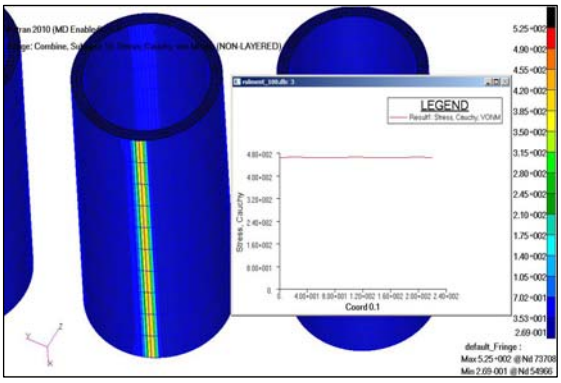


Fig. 2. Von Mises stress chart for solid cylindrical roller [Mpa]



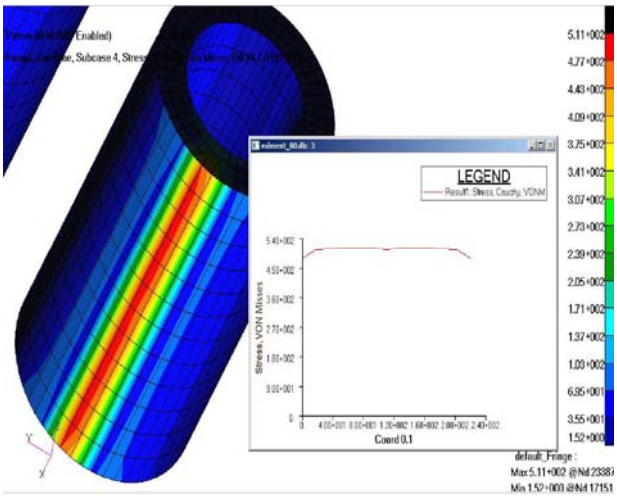


Fig. 3. Von Mises stress chart for hollowcylindrical roller with D_i=80mm [MPa]

Fig. 4. Von Mises stress chart for hollowcylindrical roller with D_i=100mm [MPa]

The research was conducted taking into account the real radial force of a wind power plant but the calculation was made on a single row bearing with cylindrical roller. In reality, these bearings are used rarely, generally using the bearings on two or four rows.

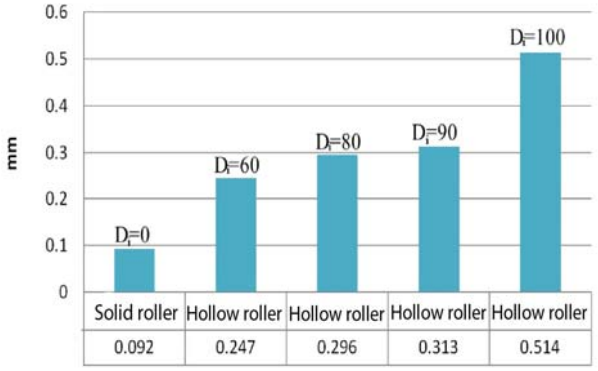


Fig. 5. Graph of deformations of bearing depending of hollowness-results obtained by finite element analysis

The research clearly shows that different hollow rollers, tested in simulations, not only reduces the inertial mass, but behave as good in deformations and much better in the contact stress.

In fig.5 and fig.6 can see the increasing of strains on the basis of the cavity. It is noted that this increase is lower for a bearing with outer diameter D = 1900mm.

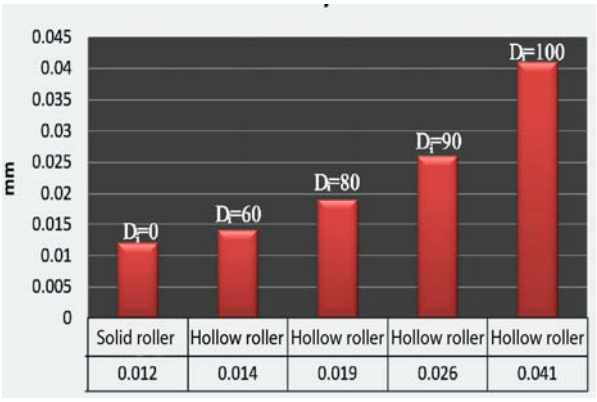


Fig. 6. Graph of deformations of roller depending of hollowness-results obtained by finite element analysis

4. CONCLUSIONS

The results of MD Nastran FEM for the Von Mises stress distributions for the hollow cylindrical roller under identical loads are interesting. Due to increased elasticity to the ends of hollow roller, the Von Mises stress decrease, the graphic being constant (Figure5 and Figure 6). Under the same conditions, the stress caused by the contact between the race and the hollow roller is less than the stress caused by the contact between the race and the solid roller.

Further, FEM simulation shows that a stress concentration occurs at the ends of solid cylindrical roller but for the hollow roller the stress concentration is the same on the entire length.

The results may indicate that for certain range of the roller geometry the use of hollow rollers will not weaken the strength of the bearing, on the contrary, increased its sustainability. In addition, about 50% of roller weight of a bearing could be reduced due to the introduction of the hollowness. FEM analyses demonstrate that the roller would render superior performance which could enable the elimination of the stresses at the ends of the roller. As a result, the roller could function similarly to a logarithmic-profile roller, but the manufacturing procedures of the roller are simplified.

The bearings with hollow rollers have advantages such as reduction of the inertial loads, weight reduction, material saving increasing of durability.

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IMPROVING WORKPLACE ORGANIZATION USING 5S METHOD

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ABSTRACT: *The objective of this paper is to present the benefits of 5S Method in workplace organizing in sorting rolls workshop. Workpace organization is the active component of any enterprise because by her life depending the consumption of energy or time. For this purpose the workplace organization are in continuous improvement, the revelation of this area was brought to management feature Japanese 5S Method. This method began to be used and big Romanian companies but with some reluctance. The results, after achieving the research presented in the paper, leading to emphasize efficiency of this method in the sorting workshop. The originality of the work is offered by the application of the method, using standard forms but also in evaluating of \method effectiveness.*

KEY WORDS: *workplace, improving, 5S Method, benefits, evaluation.*

1. INTRODUCTION

The organization of workplace is at the basis for organizing workshops, departments and factories because it depends in large measure the consumption for each work operation, mark or product, its size has a determining role on the elements needed for organizing time and space of production processes. It is a dynamic activity that starts from the product design and continue during the process of production, being necessary for the permanent agreement a existing organization of the new conditions created with the newest achievements of science and technology [7]. Along time, many studies have been done to improve workplace organization, but by this area is the revolutionary 5S Method.

2. GENERAL INFORMATIONS

The Lean manufacturing principles represent a radical departure from traditional plant techniques [2]. The employee's roles, skill-sets, process-requirements, and rules have changed. Lean manufacturing focuses on eliminating waste and improving flow using techniques such as value stream mapping, standard work, 5S, single minute exchange of dies, and visual management [4]. 5S is one of the most widely adopted techniques from the lean manufacturing toolbox[3]. Along with Standard Work and Total Productive Maintenance, 5S is considered a "foundational" lean concept, as it establishes the operational stability required for making and sustain continuous improvements[2]. The primary objective of 5S is to create a clean, orderly environment- an environment where there is a place for everything and everything is in its place. Beyond this, many companies begin their lean transformation with 5S because it exposes some of the most visible examples of waste it also helps establish the framework and discipline required to successfully pursue other continuous improvement initiatives[6].

3. EXPERIMENTAL RESEARCHS

This paper is mainly aimed at highlighting the benefits of 5S Method in workplace

organizing one workshop. To accomplish this goal have a set of experimental researchs conducted over a period of 18 months in the sorting rolls workshop, Figure 1 and Figure 2, to the enterprise S.C. Rulmenti SA Barlad,Romania.

Figure 1. Sorting roll worker

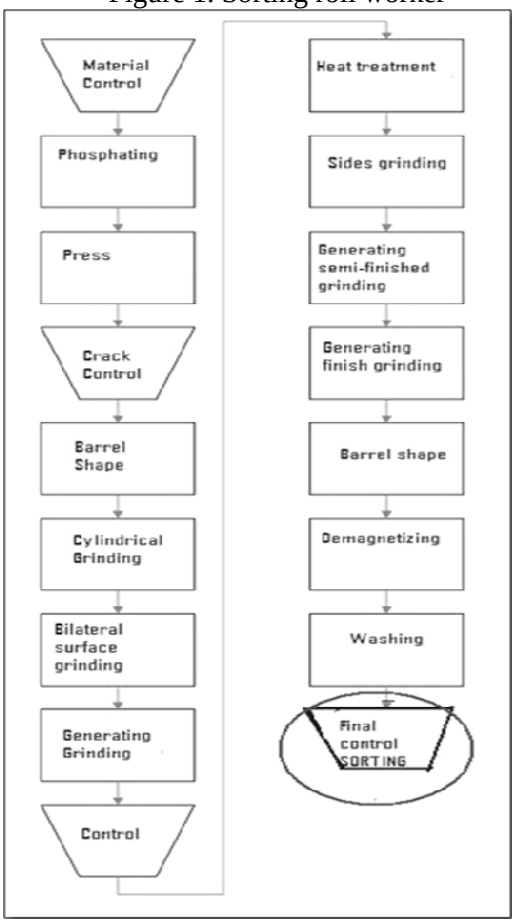

Figure 2.Rolls flow

The Method "5 S" or the five steps of proper maintenances - is a process of organizing and cleaning work area that is gradually and systematically carried out in five steps / stages. "5 S" is five words in Japanese (Seir Seiton, Seiso, Seiketsu and Shitsuke), denoting good maintenance together presented in figure 3.For the 5 S Method the goals are: creating a working environment clean, hygienic, safe and pleasant, the revitalization of the workplace, improve employee morale and motivation, to eliminate different types of paraphernalia by minimizing time to search tools, facilitating work made by workers, by reducing stress and work through the issue space.

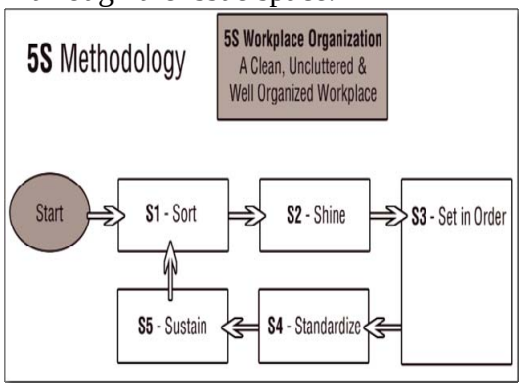

Figure 3. 5S Method

In sorting workshop, in addition to the machinery of the 5S method in control points and associated storage areas, must comply with the following rules:

- at the beginning of the batch removed from the work area all the products left over from previous order.
- it is processed in the same group of machines, products that are similar in sizes.
-products are identified with identification label and stored in separate areas and marked.
- the frequency of checking / sampling and related records are under control plans.
-the means / instruments of measurement must be valid within metrology and proper running.
-technical documentation and effective control must be in sort workshop, available at any time.
-on the control tables, should be receptacles for discarded and reprocessed products.
-workplace and control areas lighting must be adequate.
- additional visual inspection must be carried out 100%, the presence of cracks, after visual inspection of all surfaces, two checks will be made by different people.
-controlling the visual appearance of all surfaces is carried out at the tables of control required.
-measuring instruments and accessories are identified and stored so as to be kept clean and without risk of being damaged, to be easily retrieved when adjustments or changes are made landmark.
-products should be handled carefully and

placed in containers so as to avoid hitting them.

Applying 5S was done using the following program, presented in table 1.

Seiri (Sort) - differentiate between necessary and the unnecessary things from a work area and removing the unnecessary ones.

Useful things to be different from those unnecessary work area, and to eliminate unnecessary things presented in table 2.

Results obtained after applying a sorting step: It established a rule for identifying unnecessary things existing when is made a workplace analysis.

The rule of thumb is to remove, after sorting the useful and useless things, everything that is not used in the next 30 days. It established a ceiling for the number of articles required.

It has eliminated unnecessary things and useful things were kept.

Seiton (Set in order) - orderly arrangement of all the items that remain after sorting. Useful things are placed in an orderly manner to be easily accessed, table 3.

Table 1. 5 S Application program

LOCATION: Role Sorting Workshop			
Stage	**Measures**	**Period**	**Responsible**
Sort	-Check the condition of the control devices, changing worn parts and delivery, device defects repaired. -Removal of documents and the filing deadline passed.	1.02.2010 29.04.2010	Sort Coordinator
Set in order	Ordering devices and checkers Ordering deleted material		Sort Coordinator
Shine	DCP-sized cleaning, inspection tables.		Maintenance Representative
Sustain	- Designation weekly, each with a grader on each hand, to coordinate activities in the area in terms of cleanliness. Permanent monitoring of clean, wearing equipment, completing paperwork, etc.	01.05.2010 01.08.2010	CTC Coordinator
Standardize	It will display the minimum rules of operation.	01.08.2010 01.09.2010	Sort Coordinator
Future targets	Restoration maintenance area	10. 2010	Maintenance Coordinator

Table 2. Sort

	Existing things	**Useful things**	**Useless things**	**Destination of useless things**	**Observations**
Step 1 SORT	Control tables	x			
	Chairs	x			
	Transportatorting tables	x			
	Banks	x			
	Equipments	x			
	Technical documentation	x			
	Procedures / guidelines / standards	x			
	Passive Control Devices	x			
	Documentation enclosures	x			
	Tools enclosures	x			
	Militeslametre	x			
	Containers for compliance	x			

	Bins	x			
	Telephone	x			
	Percentage of total useful things things			100%	

Table 3.Set in order

Step 2 SET IN ORDER	**Classification of useful things depending on the frequency of use**		
	Useful things	Frequency of use	Observations
	Control tables	Daily	
	Chairs	Daily	
	Transportatorting tables	Daily	
	Banks	Daily	
	Equipments	Daily	
	Technical documentation	Daily	
	Procedures / guidelines / standards	Daily	
	Passive Control Devices	Daily	
	Documentation enclosures	Daily	
	Tools enclosures	Daily	
	Militeslametre	Daily	
	Containers for compliance / nonconforming products	Daily	
	Bins	Daily	
	Telephone	Daily	

Results obtained after applying the step 2: Useful things remained in this area were classified according to frequency of use, and then were placed in a controlled manner, so that she would be easily accessible.

Storage products for processing was done in areas designated for: products for processing, processed products compliant products, scrap, reprocessed products.

Relevant documents were placed in a prominent and easily accessible.

Seiso (Shine) - equipment and working environment is clean and kept clean. Clean everything: work, equipment and accessories and remove sources of dirt and discomfort, table 4

Table 4 Shine

Step 3 SHINE	**Evaluation of workplace issues**		
	Workplace issues	Score	Date
	Order tables control		
	DCP order		
	Documentation		
	Protective equipment		
	Clean		

Results obtained after applying the step 3Shine: Areas of activity (floors, tables, windows) are maintained in a sanitary condition. Cleaning these areas is done periodically, work equipment and machinery are cleaned and maintained daily. Documents necessary to the activity is kept neat and orderly manner. Shall wear protective equipment to work and care are maintained.

Seiketsu (Sustain) - extending the concept of self cleaning and continuous practice the three steps described above,table 5.

Table 5.Sustain

Step 4 SUSTAIN	**Daily evaluation of workplace issues**		
	Workplace issues	Score	Date
	Order tables control		
	DCP order		
	Documentation		
	Protective equipment		
	Order		

Results obtained after applying step 4 conditions for implementation are provided under the previous steps, cleaning concept is extended to the self according to table 6.

Shitsuke (Standardization) - obtaining self-discipline and habit of engaging in the 5S by applying the standards, table 7.

Table 6. Responsible for cleaning and order in according to sorting 5S program

No	Week	Shift work	The person appointed	Average scores workplace issues
1	01.06 – 05.06.2010	1	X1	7.4
		2	X2	
2	08.06 – 12.06.2010	1	X2	8
		2	X1	
3	15.06 – 19.06.2010	1	X3	8.8
		2	X4	
4	22.06 – 26.06.2010	1	X4	8.8
		2	X1	
5	29.06 – 02.07.2010	1	X5	9.2
		2	X6	
6	06.07 – 10.07.2010	1	X7	9.4
		2	X8	

Table7. Standardization

Step 5 STANDARDIZE	Set the rule / standard	
	The rule	
	Final evaluation:	
	Percent of total useful things	
	Workplace issues score	
	Another criterion	
Future targets		

It was shown in work zones established rules, permanent .

Standards / rules include methods to assess the progress made following the implementation of 5 S.

Assessment methods include: self-evaluation, assessment made by an expert consultant, the assessment made by a supervisor, the combination of the three, the competition between the teams work. Evaluation can be done after the model in table 8.

Table 8.Model of 5S Evaluation

Level	Sort
1	Necessary and unnecessary items are mixed together in the work area.
2	Necessary and unnecessary items are separated
3	All unnecessary items have been removed from the work area.
4	Documented method to maintain work area free of unnecessary items.
5	Waste is immediately visible and triggers a planned response with root cause analysis and corrective action.
Level	**Set in Order**
1	Tools, supplies and materials are randomly located.
2	Designated location established for all items as needed.
3	Designated locations are marked to make organization more visible
4	Documented method of visual sweep to identify items out of place or exceeding quantity limits.
5	Defined process to evaluate and improve movement and motion.
Level	**Shine**
1	No visuals are in place.
2	Visual display of data.
3	Visual controls are in place.
4	Real time metrics and visual management are in place.
5	Abnormal is immediately visible and triggers a planned response with root cause analysis .

Level	Sustain
1	Minimal attention is spent on 5S.
2	5S is a scheduled event.
3	5S practices are evaluated on a regular basis.
4	Documented methods have been put into place to ensure adherence to 5S.
5	Employees continually seek improvement opportunities.
Level	**Standardize**
1	No attempt is being made to document or improve current processes.
2	Current process is known, but not documented.
3	Current state is documented as Standard Work performed the same by all employees.
4	Future state is documented. Implementation plan is actively worked.
5	Improvements are based on data and tracked for actual results.

Table 9. Questionnaire evaluation

Questions	Average responded points out of 4, with 4 being the "a lot difference" and 1 being "not at all"
Do you think it worth implementing 5S Method in the sorting workshop?	3.3
Did you learn workplace organisation after implementing 5S Method in the sorting workshop?	3.4

4. DIRECTIONS FOR FUTURE RESEARCHS

Research presented can be improved by analyzing a new element, namely workplace security to workshop sort of rolls. The literature already presented several models for the analysis of this component. Security element analysis can be done in the sorting workshop as if in the model presented in figure 4.

Level of Excellence				
1	2	3	4	5

To check the efficiency of this method

was applied in sorting workshop one evaluation questionnaire.

In this questionnaire, answered all department employees sorting workshop and the results are presented in table 9.

Did you see a difference before and after implementing 5S Method in the sorting workshop?	3.5
Did you see a difference before and 3 months after implementing 5S Method in the sorting workshop?	3.4
Did you see a difference before and 6 months after implementing 5S Method in the sorting workshop?	3

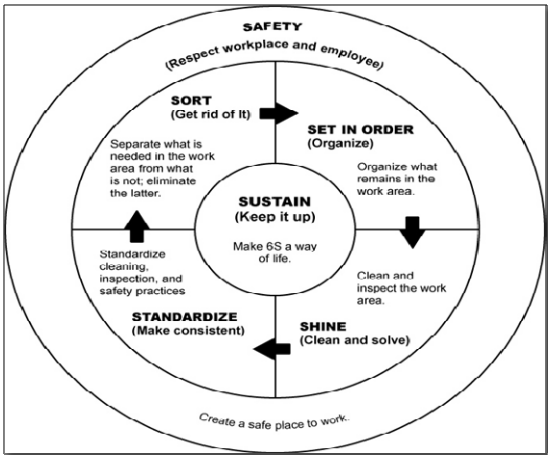

Figure 4. Security workplace[5]

5. CONCLUSIONS

Researches were conducted after a program developed and standardized forms after each step. 5s method efficiency has been demonstrated, both by presenting the results, after applying each step, and through an evaluation questionnaire.

The impact of applying 5S method is

demonstrated by the following :

- the employees were disciplined
- the number of objects used effectively in the workplace declined
- fell senseless movement

6. ACKNOWLEDGEMENTS

This paper was realized with the support of BRAIN "Doctoral scholarships as an investment in intelligence" project, financed by the European Social Found and Romanian Government.

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PROCESSING AND EVALUATION OF MEASUREMENT RESULTS A CAMBER GEARS USING KIMOS

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Abstract: *Software to the coordinate measuring machine Klingelnberg P 65 can do the following:*
- Toothing measurement segmented division of the intervals between teeth or missing teeth (the teeth of wheels part of the job) is determined by the characteristics of the input system of gears and are omitted from the control division;
- Topography;
- Determination of the inner circle and outer circle gears including comparing the values of tolerance and the issue of measuring the profile sheet and sidewalls.
Key words: *measurement, Klingelnberg P 65, control system, processing and evaluation system, camber gears.*

1. INTRODUCTION

The whole "measuring machine" include machine components, control system and system for processing and evaluation. The design of the machine is formed by a frame, rigid and compact build, which has elements of the settlement with the attenuation characteristics of the oscillations. Training for the workpiece (C), rigidly connected to the frame, is easily accessible and comfortable, both front and rear loading piece so far on the machine is possible without any difficulty.

The support provides features to achieve optimal workpiece mounting of vertical alignment between the peaks.

The basis for achieving a precision measuring machine stock contact form linear guides, respectively rotary bearings, extremely accurate and free of play, the measurement of axis X, Y, Z and C. [2]

Each axis is equipped, in addition, and lengths measured by a system that angular values measured with high resolution. Training is done in all cases, the actuators are directly coupled through the respective systems.

Optimally adapted to the measurement of toothing is the new measuring system probes in several axes. Measurement axes have a large range of measurement (+ / - 1 mm) and an over-long race. Capturing value is measured by a digital measurement system. Using a rotation system, meaning the measurement plan can be adjusted continuously measuring X / Z. In this way exploration is manageable in the normal section plane, such as gears of the front propeller angle worm sea.

Through software is also adapted such force that the measurement axis of measurement features each part.

Additional measurement axis Y direction allows, for example, direct exploration of the

circle both outside and inside of the front of the teeth of gears. Fully automated control system of measurement (Command PPP) adjusted, the machine checked all functions that are necessary to ensure the conduct of verification operations.

The system consists, in addition to conventional control elements, and a CNC, equipped with a 4-axis controller. [6]

Control algorithms are realized through software. Controller software works, as is the entire CNC software on a high-performance personal computer, which, together with a digital controller and interface card type, located on a bus (VME bus) industrial hardware form The CNC control system. Standard hardware, produced in a very large number of units, boasts high reliability and becomes, thanks to its collaboration with the optimal measurement software specially developed for this purpose, an automatic control system for highly efficient A device for toothing measuring. In combination with direct drive and measuring systems of CNC axes, high measurement speeds are achievable.

In total it is possible to adjust the simultaneous combination of four axes (x, y, z and c), so it is possible to execute any curved paths in space. [3]

Register deviations K3D stylus system, existing on the workpiece in the direction of a certain spatial coordinates. The stylus can be switched on three-dimensional measurement system in a two-dimensional. Processing of measured values by comparing them with the reference geometry of the parts is done on a computer for processing and evaluation, which is a high performance personal computer equipped with a Pentium processor. Computer processing and evaluation shall, in addition, PPP control system necessary information relating to space curves, to be described, corresponding measurement program preselected for the respective workpiece. CNC control system is inside a control cabinet, designed by ergonomic criteria and the machine is installed in such a way as to ensure maximum space saving. A service unit with an integrated industrial PC, playing the role of a computer for processing and evaluation, equipped with a keyboard and joysticks, are mounted on the machine. The high speed control system allows you to explore PPP a large number of measurement values, even in the measurement of short races. [5]

PPC control system provides for an erroneous maneuvers of service or when a component, details of the functional defect or deficiency occurred, information which, in turn, serve as the basis of a diagnostic system.

This ensures high reliability under all components, reduction of machine downtime due to failures to a minimum. The possibility of remote diagnosis via a modem, the technical level corresponds to current practice. To continue with the development of internet and intranet, remote diagnosis possible, using new techniques is entirely feasible.

The main component of the system, fully automated, processing and evaluation of measurement results, consists of a powerful personal computer equipped with a Pentium processor, combined with a large LCD display and working with Windows 2000.

In combination with integrated hard drive, which offers a large storage capacity, this system meets the following functions: program management, measurement, through KLINGELNBERG Application Manager (KAM). Storing data processed for different parts of measurement programs, generating control instructions to the control system PPC. Calculation of measured values from information received from the measuring feeler, and the measurement axes. Evaluation and representation of measured results on display, including monitoring compliance with prescribed tolerances. [1]

Storing the results of the measurements to other processing and evaluation (for statistical purposes).

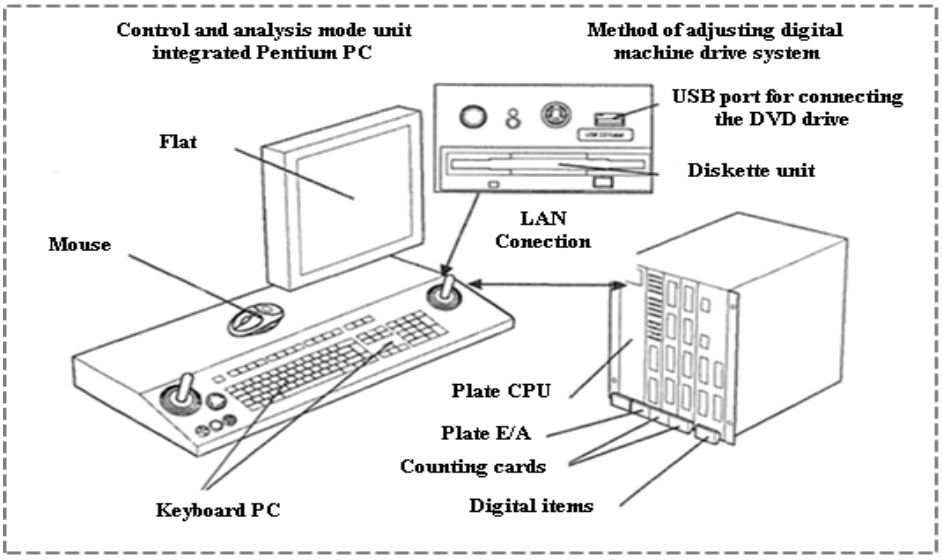

Figure 1. The main components of the system, fully automated, processing and evaluation of measurement results

2. APPARATUS AND METHODS USED IN EXPERIMENTAL RESEARCH

To measure the camber gears to coordinate measuring machine used KLINGELNBERG P65. KIMoS method is used (KLINGELNBERG Integration Manager of Spiral bevel gears) to provide reference data for manufacturing flank topography of bevel gears helical data while using the program as reference data for subsequent measurement of those gears.

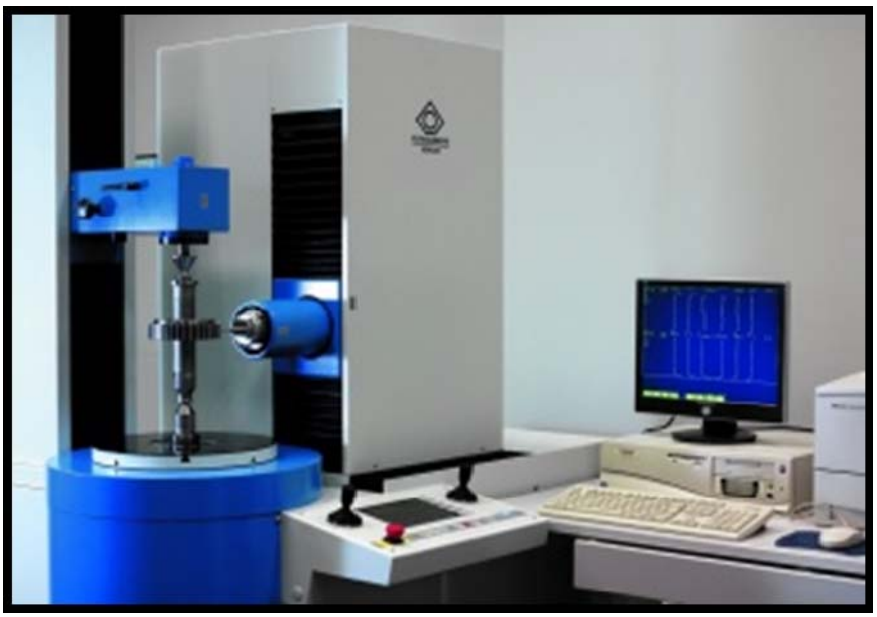

Figure 2. General appearance KLINGELNBERG P65 machine [1]

2.1. Spare parts

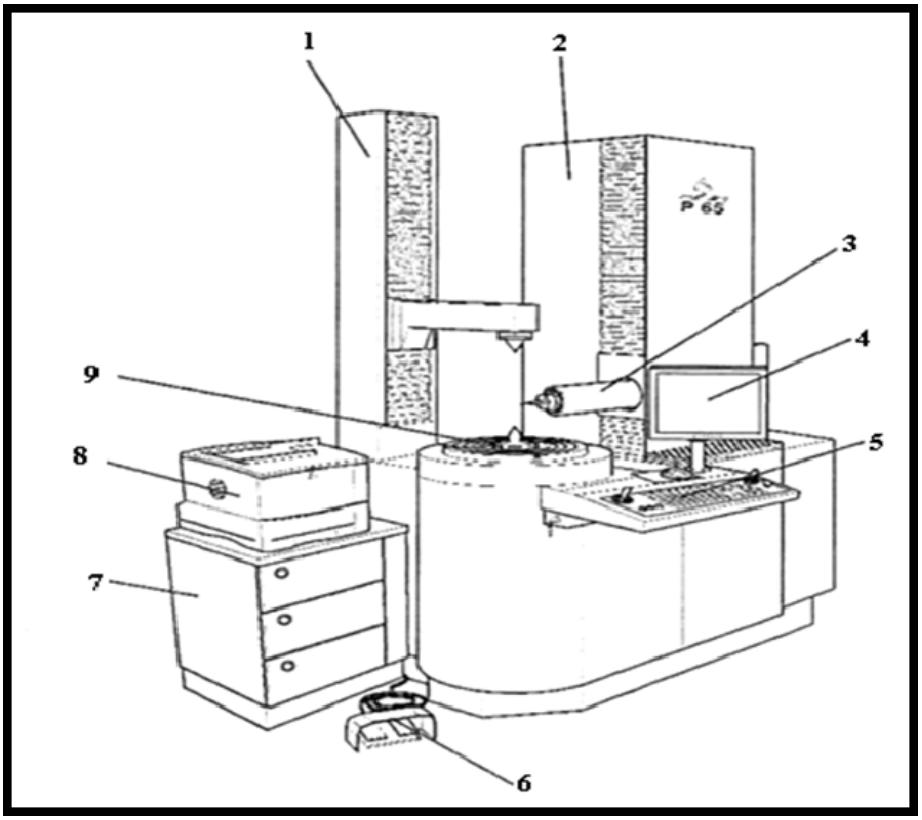

Figure 3. Spare parts [1]

Explanation of figure:
1) The peak centering clamping;
2) Perpendicular guide;
3) Measuring feeler with replaceable lining;
4) Monitor;
5) Control console;
6) Switch, foot operated, for motor movement catcher console to peak centering;
7) Container;
8) Printer;
9) Rotating table centering tip.

3. EXPERIMENTAL RESEARCH

3.1. Object of research

An objective of this paper is to examine the principles of processing and evaluation of measurement results using gears with camber KIMoS (KLINGELNBERG Integration Manager of Spiral bevel gears).

3.2. Results

Of modern production systems running in an increasingly more important, the exchange of data between different components of the production equipment through a network. Pentium computer, which is equipped with equipment to verify gear produced by the company KLINGELNBERG working with the operating system allows the interconnection comfortable Windows 2000 and LAN (Local Area Network) Ethernet protocol. It is necessary for that purpose, to draw a distinction of principle between the content network interconnection (programs) and network interconnection objects (computers).

The interconnect network can, for example, online, between them, measuring programs, which are run on computers with a similar equipment. The interconnection network uses this first exchange of data related to input data for parts to be measured, to be controlled for the first time on the system. On the other hand, can and store the results of measurements performed on a centralized

basis, for further processing (for statistical purposes).

Input data to complete the verification process of objects, which controls for the first time the facility, constitute the main part of the working of service staff. By placing their centralized data simultaneously for several measurement systems, so you can get for a wide range of machined parts, a substantial reduction in training time measurements. Beyond this, however, is possible and interconnection of different programs, such a measurement program with a program for calculating the adjustment of a machine data processing. As a significant example of this process can be called, led by computer, the manufacture of gears. The adjustment to derive KIMoS (KLINGELNBERG Integration Manager of Spiral bevel gears) provide particulars of the topography of the flank to manufacture spiral bevel gears, while using data as reference data for subsequent measurement program for those gears.

After measurement, the actual data measured topography of the flank are sent to turn the program for calculating data adjustment for it to calculate the correction to adjust these data processing machine. Exchanging data between programs mentioned leads in this case, the optimization of production process.

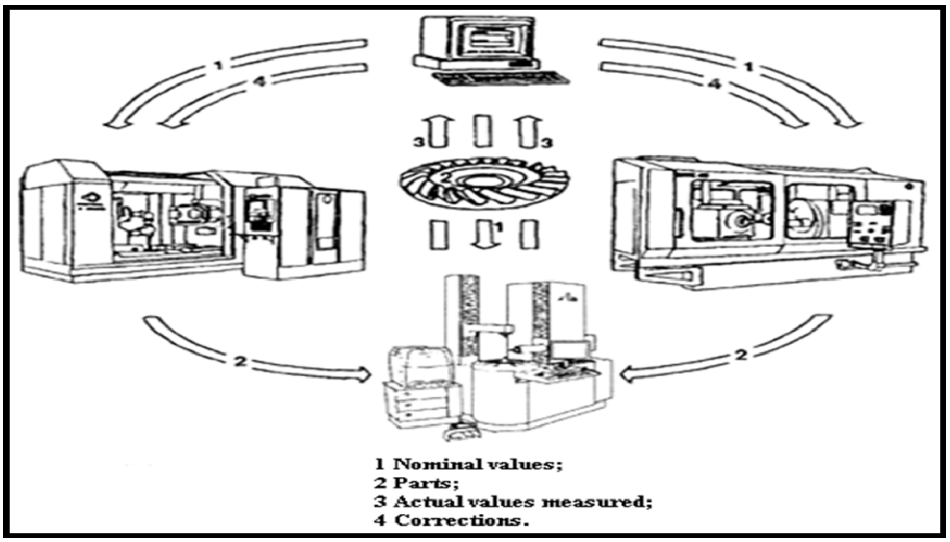

Figure 4. Process for manufacturing gear

It can interconnect in a network, each car checked, and checked the machines Gear cutting machines, in the latter case, however, all machines must be ensured a common database. It can be done and networking with a dedicated computer. Computers equipped with the same operating system can interconnect smoothly with each other in a network. Networking of computers, working with another operating system, it is also possible, as far as is possible to transmit data from one element to another network through a LAN, the internet protocol and there are also to provide an interface for data exchange program.

In principle, LAN equipment is open and it's interconnection with the host computer or customer of the latter. The service is set for a modem, which will use the general location of the causes of defects or functional deficiencies in the execution site update software on the system retrofit or amendment.

Thus are the foundations of a computer system management through the production process.

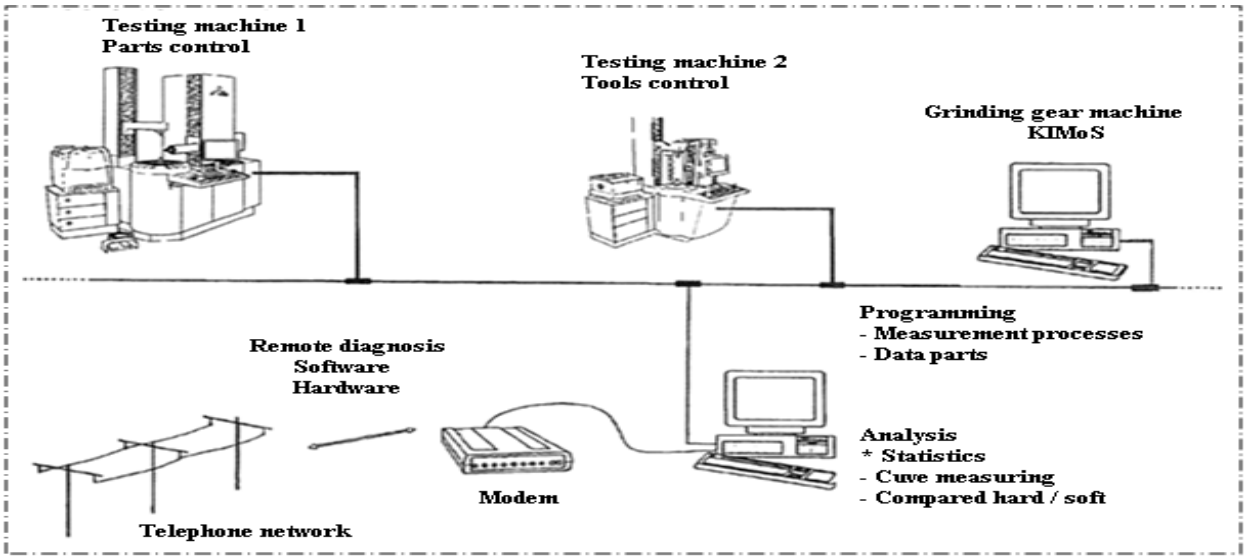

Figure 5. Computer system management through the production process

4. CONCLUSIONS

The data for calculating the adjustment KIMoS (KLINGELNBERG Integration Manager of Spiral bevel gears) provide particulars of the topography of the flank to manufacture spiral bevel gears, while using data as reference data for subsequent measurement program for those gears.

After measurement, the actual data measured topography of the flank are sent to turn the program for calculating data adjustment for it to calculate the correction to adjust these data processing machine. Exchanging data between
programs mentioned leads in this case, the optimization of production process.

5. ACKNOWLEDGEMENTS

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THE PARAMETRIC CORRELATION OF THE WOOD CABLE MOULDING AT THE KINEMATICS PROCESS WITH CONSTANT PITCH

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Abstract:*This paper aim is to achieve a relation between the geometric elements of the cable moulding (design) with constant pitch and kinematics parameters, participants in the industrial system for data processing, when using specialized machine tools.*
The kinematics parameters must be "controlled" and adjusted to the values that would ensure the proposed geometric shape and the surface quality resulting from processing, can thus be made both in the roughing stage and in the final stages processing of the surfaces, in correlation with the type of finish that will be applied to surfaces (the type of lacquer, the preparation module of surface, the specific consumption of lacquer or primer, etc.).
The correlation of the kinematics parameters should be performed through *morphology of the machine tools which must include specific structural components (reducers, mechanical variators, frequency converters, etc.).*

Keywords: *cable moulding, normal pitch, front pitch, axial pitch, cutting speed, feed speed*

1. INTRODUCTION IN THE CABLE MOULDINGS GEOMETRY with CONSTANT PICH

The cable mouldings with constant pitch are special ornaments that decorate furniture pieces, being specific , in generally, to Renaissance styles both from the continental (Italy, France, Spain, Germany) and island area (United Kingdom).

The ornament of cable moulding with constant pitch type is performed on cylindrical elements from the furniture structure (table legs, moulding, pillar for canopy beds, support columns for lamps, flower supports, etc.). The ornament is presented as a helical rib wrapped on a cylinder. In the perpendicularly section, the rib has various forms: semicircular, ogive, trapezoidal, complex profiles (Fig. 1)

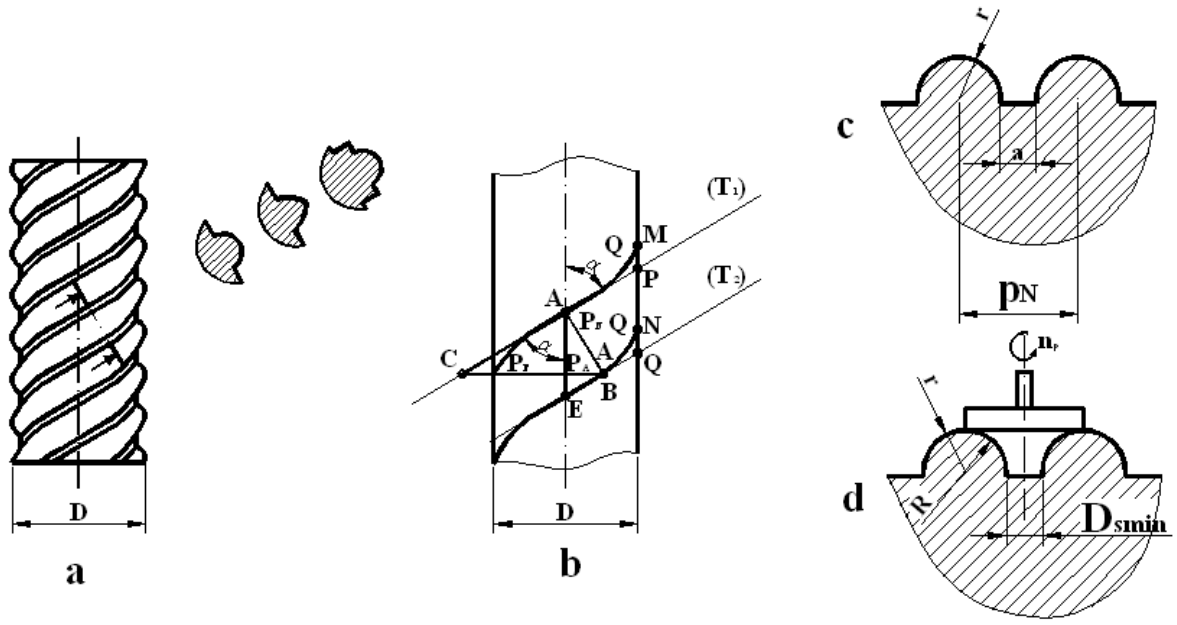

Fig.1.
The cable mouldings geometry elements

The design of the cable mouldings with constant pitch, for operation in industrial systems, on specialized machinery, must ensure the following:

- to respect the proportionality in the product decoration, falling within the mandatory rules of the product aesthetics;
- to ensure resistance in the product structure;
- to can only be processed mechanically.

The design of the cable mouldings with constant pitch must follow a binding algorithm:

- sizing the element (which is to be decorated) in terms of resistance, depending on which requests will be subject to the product, resulted the base diameter "*D*";
- Establishment from aesthetic conditions point of view of:
  - the shape and size of ribs (for a semicircular shape resulting size "*r*")
  - the space between two adjacent ribs (required by the size "*a*");
  - the angle of inclination of the cable moulding in relation with the geometric axis marker (required by the angle α), an element that "gives the motion" to the ornament, so a big α angle suggests: peace, stability, calmness, while a small α angle suggests dynamism, rigor, and restlessness.

With these elements determined by calculation of resistance or adopted in terms of aesthetics it proceeds to calculate (Fig.1):

- normal pitch: $p_N = 2r + a$
  (Fig.1.c.)
  (1)

- frontal pitch: $p_F = \frac{p_N}{\cos\alpha}$
  (Fig.1.b din ΔABC)
  (2)

- axial pitch: $p_A = \frac{p_N}{\sin\alpha}$
  (Fig.1.b din ΔABE)
  (3)

The pitch values: normal, frontal and axial, can be calculated, analyzed and interpreted by relating with similar elements from the mechanical threads.

- Number Sizing of the parallel windings (see the beginnings number of the mechanical threads):

$$Z_c = \frac{\pi \cdot D}{p_F} = \frac{\pi \cdot D \cdot \cos\alpha}{2r + a} \quad (4)$$

The Z_c value resulting from the calculation, is not always a rigorously integer number and therefore the number is rounded to the nearest integer value of Z_i. With this rounded value the elements which can ensure the geometric correlation of the cable moulding characteristics are recalculated.

Recalculation can be applied generally upon three elements:

- resulting normal pitch:

$$p_{Nr} = \frac{\pi \cdot D \cdot \cos\alpha}{Z_i} \text{ (mm)} \quad (5)$$

It should be noted that upon this element it can intervene more difficult because it involves the choice of other tools characterized by an "r" and $D_{smin} = a$ (see Fig.1.d.) which if there is not it must be executed. Initially when it started the calculation the choice of the „r" and „a" values in terms of aesthetics was based on an existing tool.

- angle of the cable moulding:

$$\alpha_r = \arccos\left[\frac{Z_i \cdot (2r + a)}{\pi \cdot \cos\alpha}\right] \text{ (mm)} \quad (6)$$

- disposition diameter of the cable moulding $D_r = \frac{Z_i \cdot (2r + a)}{\pi \cdot \cos\alpha}$ (mm) (7)

The recalculation is done only on one of the elements, in most of the cases intervening on the diameter because the angle changing can affects the aesthetics "movement" of the cable moulding.

The final items taken and recalculated are standing at the base of processing definition.

2. CABLE MOULDINGS KINEMATICS PROCESSING WITH CONSTANT PITCH

The Determination of the kinematics parameters required for cable moulding processing with constant pitch and also the interdependence value between them can be achieved according to the scheme presented in Fig. 2.

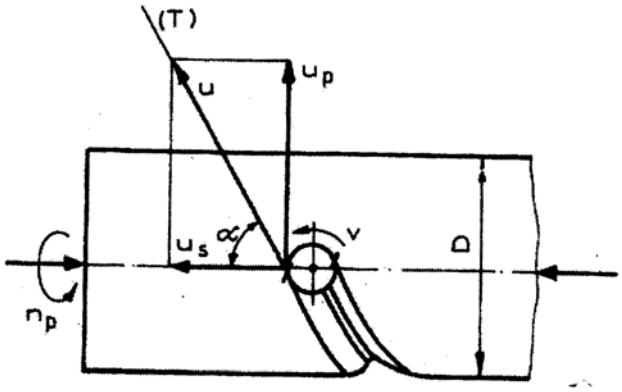

Fig.2.
The scheme for calculating the kinematics parameters required to generate the cable moulding with constant pitch

Generating a certain helical trajectories characterized by a normal pitch, an axial pitch and one front pitch, ordered after the propeller angle α and wound on a cylindrical surface with a defined value of the diameter (D) is possible by combining movements with values constant defined as:

• cylindrical work piece rotation n_p;

• manufacturing tool rotation for wood cutting, v;

• linear feed tool motion along the work piece.

These movements must have values well correlated with each other, as follows:

• the n_p work piece rotation should be correlated with the advance movement of the u_s tool so that at a work piece rotation the tool to move with an axial pitch;

• the work piece rotation together with the tool feed speed should provide a "virtual travel" speed of tool on the "u" processing path able to ensure the quality desired;

•the tool rotation speed must be related to its advance speed along the "u'' trajectory so that the processing advance on a knife „u_z" to ensure the desired level of quality of processed surface.

Based on these observations and considering the scheme in Fig. 2 can be written as a kinematics condition:

$$u = \sqrt{\left(u_s^2 + u_p^2\right)} \text{ , (m/min)} \tag{8}$$

From the value correlation condition it can write:

$$u_s = u \cdot \cos\alpha \text{ , (m/min)} \tag{9}$$

and from the quality condition it can write:

$$u = \frac{u_z \cdot Z_s \cdot n_s}{1000} \text{ , (m/min)} \tag{10}$$

Combining relations (9) and (10) it can write:

$$u_s = \frac{u_z \cdot Z_s \cdot n_s}{1000} \cdot \cos\alpha \text{ , (m/min)} \tag{11}$$

Where:

- u_s – is the tool advance feed speed along the work piece (m/min);
- u – is the displacement speed of the tool on the processing trajectory as defined in the quality condition (10);
- u_z – is the advance on the blade at processing with the cutting tool, which is chosen according with the quality grade that must result from the flanks milling (mm);
- Z_s –is the cutting tool number of blades (pieces);
- n_s – is the processing tool speed (rot/min).

The feed speed u_s can be ranged between a maximum and a minimum value according to the quality grade and other participant parameters from the relation so that can be defined as:

$$u_{s\min} = \frac{u_{z\min} \cdot Z_s \cdot n_s}{1000} \cdot \cos\alpha_{\max} \text{ , for the maximum quality}$$

$$u_{s\max} = \frac{u_{z\max} \cdot Z_s \cdot n_s}{1000} \cdot \cos\alpha_{\min} \text{ , for the roughing}$$

Defined like this the value range takes into consideration that the processing tool has a constant number of knives and a constant rotation speed.

Otherwise in the structure of the machine tools should be an element that can adjust the advance tool u_s values between the minimum and maximum.

If the tool displacement after the u_s direction is achieved by a screw motion characterized by an well defined $p_{Aş}$ axial pitch, then, the range of $n_ş$ speed rotation adjustment screw will be:

$$u_{s\min} = p_{As} \cdot n_{s\min} \Rightarrow n_{s\min} = \frac{u_{s\min}}{p_{As}} \text{ , (rot/min)}$$

$$u_{s\max} = p_{As} \cdot n_{s\max} \Rightarrow n_{s\max} = \frac{u_{s\max}}{p_{As}} \text{ , (rot/min)}$$

So the element of the machine structure that will adjust feed speed u_s, will actually adjust the screw speed in the range of motion $n_{s\min} \rightarrow n_{s\max}$.

To match the advance of the tool with the work piece speed it starts from the scheme in Fig. 2, where it observes:

$$u_p = u \cdot \sin\alpha \text{ , (m/min)} \quad (14)$$

If it takes into account that „u_p" is actually the peripheral speed at the work piece surface given by:

$$u_p = \frac{\pi \cdot D \cdot n_p}{1000} \text{ , (m/min)} \quad (15)$$

Where:

- D is the diameter of the piece that is cable moulding processed,
- n_p – is the work piece speed rotation

Then, it can write (according to relations 14 and 15):

$$n_p = \frac{1000 \cdot u}{\pi \cdot D} \cdot \sin\alpha \text{ , (rot/min)} \quad (16)$$

If it is envisaged that for a certain quality "u" should be constant then it can say that work piece speed rotation should modify in the minimum-maximum range according to the values resulted by using the relations:

$$n_{p\min} = \frac{1000 \cdot u}{\pi \cdot D_{\max}} \cdot \sin\alpha_{\min} \text{ , (rot/min)}$$

$$n_{p\max} = \frac{1000 \cdot u}{\pi \cdot D_{\min}} \cdot \sin\alpha_{\max} \text{ , (rot/min)}$$

So the drive system of the piece must be provided with an element able to change the work piece speed rotation in the range $n_{p\min} \rightarrow n_{p\max}$, an element that must be reflected in the morphology of the tool-machine

To achieve the correlation between the work piece n_p speed rotation and u_s the linear advance of the tool is required as between the two rotation axes of the screw motion - piece to be a direct link through an element which takes into account the correlation between the screw motion speed and work piece speed rotation, so that at one work piece rotation, the tool moves with one axial pitch along the piece part of the cable moulding.

The functional link of parameters correlation is made through the relation

$$n_s \cdot p_{As} = n_p \cdot p_A \quad (18)$$

where:

n_s – is the screw speed rotation;

p_{As} – is the axial pitch of the screw motion

n_p – is the work piece speed rotation

p_A – is the axial pitch of the cable moulding

If the equation (18) is differently organized, results:

$$\frac{n_s}{n_p} = \frac{p_A}{p_{As}} = i \quad (19)$$

Where:

i - is the gear ratio that must be achieved between the two axes - the rotation of the screw motion and rotation of the work piece. If it is envisaged that prior it said that tool and work piece speeds rotation

may change in the minimum - maximum range then results:

$$i_{\max} = \frac{n_{s\max}}{n_{p\min}}$$

$$i_{\min} = \frac{n_{s\min}}{n_{p\max}}$$

So the element of machine tool structure located between the two axes of rotation (screw motion - work piece) should have an adjustable gear ratio in the minimum - maximum range, so an adjusting report:

$$R = \frac{i_{\max}}{i_{\min}} \qquad (21)$$

Based on the presented issues it can conceive a general morphology of a cable moudling processing tool machine with the form given in Fig.3. from which it can be devise a scheme for a machine tool kinematics as that shown in Fig.4.

3. TOOLS MACHINE MORPHOLOGY

Morphology of tools- machinery that can provide the necessary processing kinematic parameters should include both moving sources and elements capable to transfer and modify the motion parameters of the required performance level.

A block diagram with the needed morphology of a tools- machine that could provide the cable moulding processing with constant pitch is presented in Fig.3

From the analysis of the structural elements of the general scheme shown in Fig.3, results the functional role of each one in the kinematic parameters insurance necessary for the cable moulding processing with constant pitch as follows:

1. is the motion source for the tool advance generation of the movement and rotation of the work piece subjected processing;
2. is what makes the characteristics of motion between the motion source and the axis of rotation of the motion screw (4), such as a mechanical variator;
3. is the transfer element of the movement with or without transformation between the structure elements (taking into account that the source of movement and variator generally are attached to the foundation and the screw motion around processing level);
4. motion screw that ensures „u_s" the advance movement of the manufacturing tool;
5. processing tool profile cutters type, with tail;
6. mobile table (support tool) of the machine;
7. motion source for the tool driving and to ensure the cutting speed in correlation with the tool diameter for wood milling cutting (may have a fixed or adjustable speed);
8. wood work piece subjected of processing;
9. transformation element of motion characteristics at the level of the screw axis n_s at the work piece level n_p based on a well established transmission ratio $\left(i = \frac{p_A}{p_{As}}\right)$
10. Inverting element - to change the direction of rotation of the work piece when it comes to processing cable mouldings with angle of inclination to the right or left.
11. index element – for cable mouldings working with multiple windings

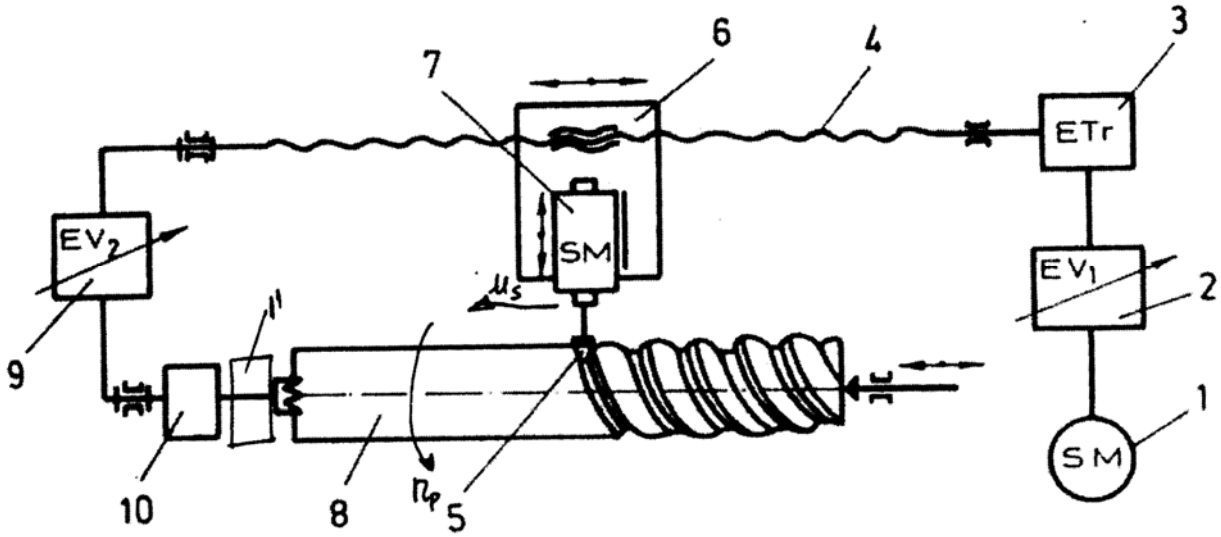

Fig.3.
The block scheme of the cable moulding processing machine with constant pitch

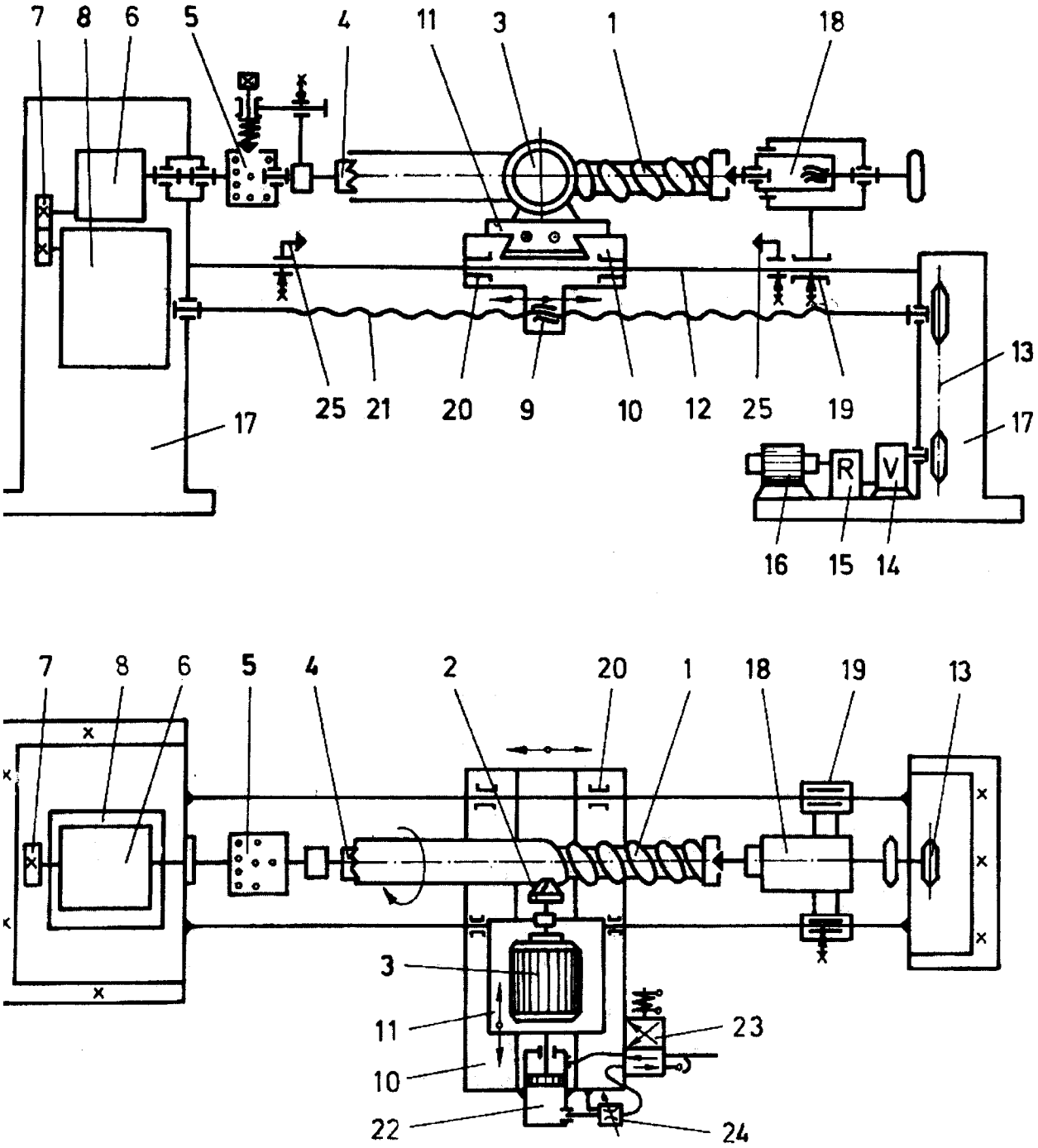

Fig.4.
The block scheme of the cable moulding processing machine with constant pitch (Var.II)

1 - piece that is processed, 2 - tool, 3 - electric motor, 4 - mounting and drive system, 5-division and indexing system, 6-reversing mechanism, 7-gear transmission, 8 - gear mechanism exchange (or gearbox), 9 - nut, 10 - work system support plate, 11 - tool support plate, 12 - cylindrical guide (rods) bar, 13 - chain drive, 14-continuously mechanical variable , 15 - reducer, 16 - electric motor, 17 - frame, 18 - fixing system, 19, 20 - Cylindrical guides; 21 - screw motion, 22 - pneumatic motor, 23 - distributor; 24 - throttle, 25 - end stops, 26 - pneumatic pipelines.

It should be mentioned that the 2 (EV1) elements has the decisive role in establishing the quality of processing. This element provides travel speed change *"u"* of the tool on helical path of the work piece, the element 9 (EV2) controls ($p_A = i \cdot p_{As}$)the size of axial pitch of cable moulding.

The block diagram shown in Fig.3 was translated into a more explicit kinematics scheme, shown in Fig.4. more suggestive and very close to reality, thus justifying the need for structural elements involved in the transfer or change of motion.

4. CONCLUSIONS

Type cable moudling ornaments processing with constant pitch impose a range of technical and technological conditions, namely:

- correlation with the values of geometric design (D, α, $Z_{\hat{i}}$, p_N, p_A, p_F);
- ensure kinematics correlation between:
  - tool feed speed u_s, along the work piece and work piece speed rotation n_p;
  - tool feed speed u_s, along the work piece and speed peripheral of work piece „u_p" to get the speed *"u"* on the trajectory that defines the angle α and the surface quality
  - speed rotation screw motion n_s and speed rotation work piece that defines the axial pitch value of the cable moudling winding;
  - speed rotation screw motion n_s and feed speed u_s along the work piece tool;
  - cutting tool speed rotation and its cutting speed through the minimum diameter of tool („a").

Ensure of dimensional correlation of geometry elements by referencing kinematics elements requires careful and laborious study and functional and well-defined structures of machine tools in terms of features and control areas of each structural element.

Element 9 (EV2) of general structure (Fig. 3) should be able to control the transmission ratio between the axis of rotation of the screw axis motion and rotation adjustment work piece but the ratio adjustment must remain strictly constant throughout processing of that cable moudling.

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THE CALCULATION OF PNEUMATIC CONVEYORS

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Abstract: *The calculation of pneumatic conveyors comes down to the determination of: conveying speed, conveying pipeline diameter, necessary air flow and load losses (pressure) on the conveying track, elements which lead to the determination of air pump parameters. The conveying speed is a multiple of the floating speed, the floating speed being the speed of a vertically steered air current (upwards) in which a particle remains in balance.*

The air speed within the v_a conveying pipeline should not only be a multiple of the floating speed, but also as higher, as the pipeline equivalent length L_{echiv} is longer. The equivalent length is the length of a horizontal pipeline which shows the same pressure loss (opposes the same resistance) as the real pipeline. Conveying installations are built with constant cross-section throughout the length of the conveying pipeline, in which case the speed varies inside the pipeline in inverted ratio to the pressure.

Keywords: *conveyors, pneumatic, speed, pipeline, floating, flow, air, pressure.*

The calculation of pneumatic conveyors comes down to the determination of: conveying speed, conveying pipeline diameter, necessary air flow and load losses (pressure) on the conveying track, elements which lead to the determination of air pump parameters.

The conveying speed is a multiple of the floating speed, the floating speed being the speed of a vertically steered air current (upwards) in which a particle remains in balance.

The force with which an air current acts upon a particle is:

$$F_a = \psi \rho_a A (v_a - v_m)^2 \qquad (4.1)$$

in which:

A is the particle load-bearing surface (the surface of particle projection, perpendicular on the direction of the air current), in m^2;

Ψ – load-bearing coefficient which considers the form and nature of the particle load-bearing surface;

ρ_a – air density $\left(\rho_a = \frac{\gamma_a}{g}\right)$, in N/m^3;

γ_a – specific air weight, in N/m^3;

v_a – air speed, in m/s;

v_m – particle speed , in m/s.

Considering a spheric particle with the diameter d and specific weight γ_m, under floating conditions with $v_m = 0$, the condition of floating shall be expressed by the equation:

$$\frac{\pi d^3}{6}\gamma_m = \psi\frac{\gamma_a}{g}\frac{\pi d^2}{4}v^2{}_p$$

of which:

$$v_p = \sqrt{\frac{2d\gamma_m g}{3\psi\gamma_a}} \text{ [m/s].}$$

To a spheric particle $\psi = 0,23$, therefore:

$$v_p = \sqrt{\frac{28,4d\gamma_m}{\gamma_a}} \text{ [m/s].} \qquad (4.2)$$

for a particle of random shape, the equation (4.2) has the following form:

$$v_p = k\sqrt{\frac{28,4d'\gamma_m}{\gamma_a}} \text{ [m/s],} \qquad (4.3)$$

in which:
d' is the particle equivalent diameter (diameter of the sphere which has the same volume as the particle) and
k – shape coefficient (tabelul 4.1)

Tabelul 4.1

Particle shape	k
- sphere	1,0
- round shape with irregular surface	0,64
- elongated shape with irregular surface	0,57
- flattened shape	0,45

The air speed in the conveying pipeline v_a should be not only a multiple of the floating speed, but as higher, as the pipeline equivalent length L_{echiv} is longer. The use of an empirical equation such as:

$$v_a = d\sqrt{\gamma_m} + \alpha BL^2{}_{echiv} \qquad (4.4)$$

in which:
α is a coefficient which has the value 17...20 for cereal seeds and for finer granulated materials (flours) α = 22...25 is recommended;
γ_m – average particle weight, in t/m^3;
B – coefficient with values ranging between $2\cdot10^{-5}$ and $5\cdot10^{-5}$ (increases by granulation size);

L_{echiv} – equivalent length of conveying pipeline.
The equivalent length is the length of a horizontal pipeline which has the same pressure loss (opposes the same resistance) as the real pipeline.

The diameter of conveying pipeline shall be determined by using the equation which expresses the mix concentration μ (in weight) as being the ratio between the material weight (load) and the weight of air which passes through a pipeline point in the same unit of time:

$$\mu = \frac{Q}{3,6Av_a\gamma_a} \qquad (4.5)$$

in which:
Q is the installation flow, in t/h;
A – pipeline cross-section, in m^2;
v_a- air speed, in m/s;
γ_a – specific air weight (γ_a = ~1,2 kg/m^3).
From the equation (4.5) we can infer:

$$A = \frac{Q}{3,6v_a\gamma_a\mu},$$

because the conveying pipelines are of circular cross-section we can write:

$$\frac{\pi d^2{}_i}{4} = \frac{Q}{3,6v_a\gamma_a\mu}$$

of which

$$d_i = 0,6\sqrt{\frac{Q}{\mu v_a\gamma_a}} \text{ [m]} \qquad (4.6)$$

we can note that the speed v_a and specific weight γ_a are to be considered at the beginning of the pipeline for aspiration installations and at the end of the pipeline for discharge installations.

Conveying installations are mostly built with constant cross-section throughout the length of conveying pipeline, in which case the speed varies inside the pipeline in inverted ratio to the pressure (the conversions are deemed isothermal, therefore the product p·V is constant).

In this case, considering a random point in the conveying track with the paramenters p,v, γ and the atmospheric pressure point p_a,v_a,γ_a we can write the ratios:

$$\frac{v}{v_a} = \frac{p_a}{p} = \frac{\gamma_a}{\gamma}$$

therefore:

$$v = v_a \frac{p_a}{p} = v_a \frac{\gamma_a}{\gamma} \qquad (4.7)$$

the choice of the mix concentration value is made considering the nature of material and type of installation.

The air flow necessary for the conveyor is also infered from the concentration equation:

$$Q_a = Av_a = \frac{Q}{3{,}6\mu\gamma_a},$$

or by replacing the value γ_a:

$$Q_a = \frac{Q}{4{,}3\mu} \qquad (4.8)$$

in which: Q_a is the air flow considered for the air pressure.

The pressure loss (pressure drop) is calculated considering the track configuration, for example:

$$h_{tot} = h_d + h_v + h_H + h_s + h_c \text{ [mm } H_2O\text{]}$$

in which:

h_d is the dynamic pressure drop due to the mix acceleration from the null speed to the conveying speed;

h_v – static pressure drop due to level difference (on vertical areas);

h_H – pressure drop on horizontal segments;

h_s – pressure drop on separator level;

h_c – pressure drop on cyclon level.

It is customary that h_{tot} to be increased with additional pressure losses which represents 15...25% on discharge installations and 5...10% on suction installations.

The power absorbed by the discharge conveying installation can be determined considering the elementary mechanical work done by an Av air flow passing through the conveying pipeline from pressure p to pressure p + dp:

$$dL = Av\,dp$$

the total mechanical work, equivalent to the passing from pressure p_0 to p is:

$$L = \int_{p_0}^{p} Av\,dp$$

and considering the equation (4.7) : $v = v_a \frac{p_a}{p}$

resulted:

$$L = Av_a p_a \int_{p_0}^{p} \frac{dp}{p} = Q_a p_a \ln\frac{p}{p_a}$$

because p_a=~10000daN/m^2, resulted:

$$L = 10000 Q_a \ln \frac{10000 + h_{tot}}{10000} \text{ [daNm/s]} \quad (4.9)$$

in which: Q_a is the air flow (to air pressure) used for conveying.

In case of suction installation, we obtain by analog procedure:

$$L = 10000 v_a \ln \frac{10000}{10000 - h_{tot}} \text{ [daNm/s]} \quad (4.10)$$

the power of pump driving motor is:

$$P = \frac{kL}{10^2 \eta} \text{ [kW]} \qquad (4.11)$$

in which: η is the pump output;
k=1,1 – a coefficient which considers the losses by non-sealing.

CONCLUSIONS

The conveying pipeline diameter shall be determined using the equation which expresses the μ mix concentration (in weight) as the ratio between weight material (load) and air weight which passes through a pipeline point at the same time unit. The speed v_a and specific weight γ_a are to be considered at the beginning of the pipeline for aspiration installations and at the end of the pipeline for discharge installations.

Conveying installations are mostly built with constant cross-section throughout the length of conveying pipeline, in which case the speed varies inside the pipeline in inverted ratio to the pressure (the conversions are deemed isothermal, therefore the product p·V is constant).

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THE OPTIMIZATION OF ADVANCED PRODUCT SYSTEMS USED THE FUZZY ALGORITHM

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Abstract: *Most of the complex problems which appear in the manufacturing domain and the management of manufacturing systems are optimizing problems. Mathematical modeling of optimizing problems offers the opportunity to find the optimal solution, with immediate consequences for the system's economical efficiency increasing. In this paper is presented the model of optimizing advanced product systems. The fuzzy logic is used during the first stages of the flexible manufacturing systems (FMS) designing where more variables and variants don't may be precisely described having in view the high degree of incertitude, unpredictable character of FMS. This is a hierarchic system, featured by different detailing degrees of the information, suited to the use of the fuzzy multitude theory methods and techniques, in the informational analysis of the system and simulation.The functioning algorithm of the system presented hereby, lays on the grounds of editing the simulation program of the flexible manufacturing system for round shafts processing.*

Key words: *flexible manufacturing systems, fuzzy techniques, scheduling*

1. INTRODUCTION

A flexible manufacturing systems (FMS) is production systems consisting of identical multipurpose numerically controlled machines (workstations), automated material handling system, tool, and load and unload stations, inspection stations, storage areas and a hierarchical control system [5]. In the design of a "controller" that takes care of scheduling, several issues must be considered: the multiple objective natures of the problem, the large variability among plants, and the NP-hard nature of the scheduling problem. This makes classical operation research methods generally inadequate and a common way of realizing the controller is by using heuristic rules.

A relatively new approach to the scheduling problem comes from the emerging field of "intelligent manufacturing". Attempts towards intelligent manufacturing show that "human reasoning" is necessary to achieve good scheduling.

It is the authors' opinion that the importance of "common sense" and "human experts" in scheduling, together with fuzzy logic ability to mimic human reasoning, along with the ease of dealing with linguistic variables makes it a suitable and powerful scheduling tool.

Among all the possible scheduling rules the following are considered: sequencing, selection of a piece among those waiting to receive service from a machine (job selection),

and routing decisions concerning the next required workstation.

Two fuzzy logic systems [3] have been used for sequencing and job selection, while a fuzzy multiple attribute decision making technique has been used for the routing problem, thus forming a fuzzy scheduler as explained in Section 2. This scheduler is optimized using a reinforcement-learning paradigm that seeks to maximize a performance index.

In Section 3 is presented the functioning algorithm fuzzy of the flexible manufacturing systems of round shafts processing, [2]. Section 4 contains the conclusions of this work.

Working assumptions. The flexible manufacturing system has been modeled according to the following assumptions. Tool management is not considered. Orders arrive to the FMS as Poisson processes with a fixed mean inter-arrival time. Production of orders occurs in batches, and the movement of the whole batch is considered, so that batch dimensions are not considered. Setup times are independent of the order in which operations are executed, i.e., they are constant and embodied in the operation, therefore every order is random and directly defined for a workstation not for the operation, therefore every operation corresponds directly to the workstation that will execute it. There can be multiple routing choices, i.e., a job can be equivalently sent to different workstations.

Loading, unloading and processing times are random. Due dates are assigned according to the total processing time. Each workstation can work only one job at a time. The transport system is comprised of automated guided vehicles (AGV) that can transport only one job at a time. Every workstation has one input buffer and no output buffer.

2. FUZZY SCHEDULING

The first two rules (sequencing and job selection) set priorities for jobs waiting in a queue (loading station buffer or workstations input buffers), while the third rule (routing) involves a decision between different routing plans (in case of alternatives). The "priority setting" problems (sequencing and job selection) have been approached using two fuzzy logic systems.

Both of these fuzzy logic systems are characterized by: singleton fuzzification, max-product inference (product t-norm and max t-co norm), max rule composition, two antecedents for each rule, one consequent, three triangular membership functions for every antecedent and consequent and modified-height defuzzification. Both fuzzy logic systems (FLS) assign the priority to jobs in queues, [3]. The antecedents for the sequencing FLS are total processing time and due date minus time. The antecedents for the job selection FLS are processing time in the corresponding workstation and slack. Each FLS is completely defined once its rules and membership functions are. The routing problem has been approached using a fuzzy multiple attribute decision-making technique. When a piece has been processed and an AGV is available, the routing controller decides to which workstation the piece must go, [5]. The choice is made considering three workstation and low distance of the workstation from the actual piece position. Fuzzy measures of the (degree of) satisfaction of each one of the three objectives are taken for each feasible alternative. These measures are weighted according to the importance of each criterion, obtaining a "score" for the given alternative.

This "score" represents the degree of satisfaction of the overall objective by a certain alternative, and is given by:

$$\mu_0(x_k) = [\mu_{c_1}(x_{k_1})]^{\alpha_1} \cdot [\mu_{c_2}(x_{k_2})]^{\alpha_2} \cdot [\mu_{c_3}(x_{k_3})]^{\alpha_3} \quad (1)$$

In (1) $\mu_0(x_k)$ is the overall objective degree of satisfaction corresponding to the k-th alternative, $\mu_{c_i}(x_{k_i})$ is the degree of satisfaction of the i^{-th} objective (relatively to the k^{-th} alternative) and α_I its weight. The alternative corresponding to the highest overall objective degree of satisfaction is chosen.

The importance of each criterion is given by the weights obtained from a pair wise comparison matrix through the λ_{max} technique. The pair wise comparison matrix (in this case

3 x 3) usually contains human expert linguistic estimates of pair wise comparisons between the objectives importance. This decision structure is completely defined once the pair wise comparison matrix and the membership functions for each objective are given.

The membership function for low workload and low processing time, is piecewise linear at first and then exponential, and is completely defined (for any objective) by three parameters.

The membership function for low distance is a discrete one and it is arbitrarily assigned. It will be assumed that experts already specify the pair wise comparison matrix, e.g.

2.1 Fuzzy rule-types

1. *Fuzzy rules for state estimation.* In the case of MISO (Multi Input Single Output) – type systems, the group of rules shows like:

R1: IF X IS A1,…,& Y IS B1 THEN Z IS C1

R2: IF X IS A2,…,& Y IS B2 THEN Z IS C2

⋮

Rn: IF X IS An,…,& Y IS Bn THEN Z IS C1 (2)

where: X, Y, Z are linguistic variables, representing the system state. Ai, Bi, Ci are linguistic values of the linguistic variables x, y and z.

A more general shape is that, where consequences are represented by a function having as variables the process states:

Rt: IF X IS At,…,& Y IS Bt THEN $Z = f_t(x,..,y)$ (3)

and t represents the evolution of the system at different moments.

2. *Fuzzy rules for object estimation.* These rules derive from the experience of the human operator and refer to the fuzzy control rules of the object:

Rt: IF X IS At,…,& Y IS Bt THEN $Z = f_t(x,..,y)$ (4)

In such a situation the decision met with regard to the phenomenon analyzed or the controlling command of such a process represent a satisfaction of the requirements. U command takes numeric values and x and y is performance indexes needed for the 1st rule evaluation; values taken by these indexes are of the type: *good* or *bad*. In expert systems based on knowledge a fuzzy rule has syntax:

→ IF (antecedente) → THEN →(consecințe) →

2.2 Fuzzy interference process

Interference (argument) is defined as a process passing from premises to conclusions (Figure 1), so that, if premises are true, conclusions also true, or very probable true. In the LF case both premises and conclusions are expressed within the rules in a canonic form.

There are two rule-types used for this type of interference, i.e. *GMB (General Modus Ponens)* and *GMT (General Modus Tollens)*, which may be written such as:

GMP
Premise 1: X IS A1
Premise 2 : IF X IS A THEN Y IS B
Consequence: Y IS B1

GMT
Premise 1: Y IS B1
Premise 2 : IF X IS A THEN Y IS B

Consequence: X IS A1 (5)

where: A, A1, B, B1 are fuzzy multitudes and x and y classic numeric values. GMT is reduced to *Modus Tollens* when B1 = notB and A1 = notA, frequent situation in interference processes used in expert systems (for example, in establishing a process diagnosis).

Further on the *Operator Rule – Mamdani* minimum is presented, related to the above mentioned but permitting a clearer representation of the decisional process. Two rules are taken into consideration:

R1: IF X IS A1 AND Y IS B1 THEN Z IS C1

R2: IF X IS A2 AND Y IS B2 THEN Z IS C2 (6)

In a process, the fuzzy states are playing an important part in fixing the final decision, reason imposing the conversion of input data (fuzzy multitudes) into classic values of singleton size form. In this case the estimation for a R_i rule shows like:

$$\mu_{Ci}(w) = \alpha_i \wedge \mu_{Ci}(w) \quad (7)$$

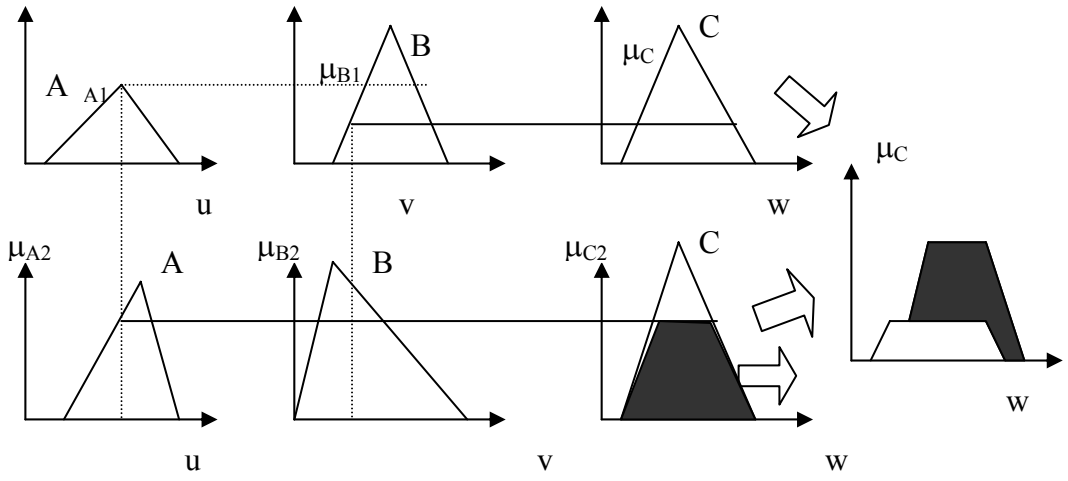

Fig. 1. Fuzzy interference process

where: αi represents the measure of the i rule's contribution to the decisional process. In the case of the two rules as above, the minimal *Mamdani's operator* appears as:

$$\alpha_1 = \mu_{A1}(x_0) \wedge \mu_{B1}(y_0)$$
$$\alpha_2 = \mu_{A2}(x_0) \wedge \mu_{B2}(y_0) \quad (8)$$

where $\mu_{A1}(x_o)$ and $\mu_{B1}(y_o)$ show the degree of recovering the data used for in the data base. Under these terms the consequence belonging function c becomes:

$$\mu_c(w) = [\alpha_1 \wedge \mu_{C1}(w)] \vee [\alpha_2 \wedge \mu_{C2}(w)] \quad (9)$$

3. THE FLEXIBLE MANUFACTURING SYSTEM FUNCTIONING FUZZY ALGORITHM

A specific algorithm of treating the information [4] features the fuzzy modeling. In Figure 2 the working manners in controlling systems based on analogical methods, respectively on fuzzy concepts are presented comparatively.

Fuzzy systems are processing information according to an own philosophy, carrying out of principle on grounds of the following flow:

{input variables} ⇒ (fuzification) ⇒ (interference) ⇒ (composition) ⇒ (defuzification) ⇒{output variables}

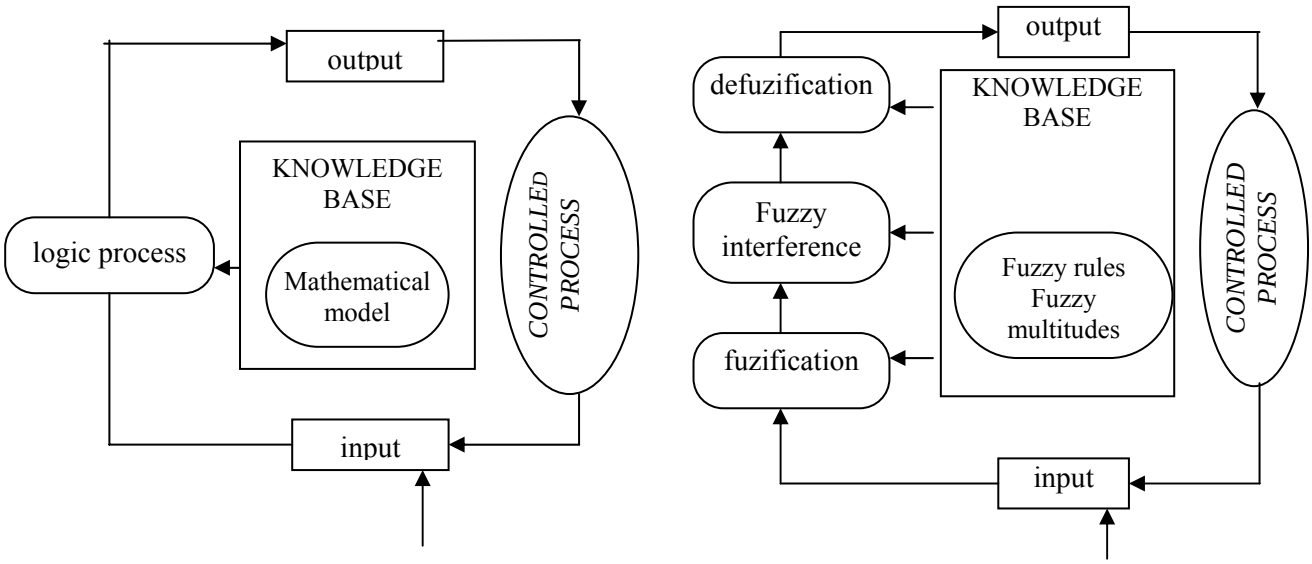

Fig. 2. Processing information in fuzzy systems

In view of structural analysis of a FMS for round shafts processing, former [2] the decomposition of the system into component sub-systems was carried out, connections among these and the transfer function were established. On grounds of the structural decomposition draft the fuzzy model may be elaborated [2], which shall contain a linguistic equation group (group of rules), model that is used in achieving the functioning algorithm. Finally for the connected sub-systems within the FMS for round shafts processing, the final group of rules shall be generated, out of which the system outputs may be extracted. The program is written as a set of the rules due to each sub-system (work stations, robots, conveyors, stocks).

The fuzzy model is elaborated on macro-level, for connections between adjacent sub-systems. Fuzzy logic is a general conclusion of the classic, bivalent logic, replacing its discrete character in (0, 1) with one of continuous nature. The fundamental fuzzy logic is made of the multivalent logic. So as for the deterministic bivalent logic "1" is associated to TRUE and "0" is labeled FALS, in the fuzzy logic for a deterministic positive real number variable, the associated linguistic variable may have linguistic degrees: BIG, AVERAGE, SMALL. Because of the expression by linguistic variables, mathematical modeling by fuzzy logic may be easily approached within the complex structure study, such as FMS for round shafts processing.

A fuzzy rule appears when it exist a premise concerning the event, which implies a certain logic consequence (conclusion):

IF (conditions, restrictions) THEN (effect / consequences) ELSE (consequences / risks).

The fuzzy rule base is built up by putting fuzzy multitudes associates to output variables, in logic contact with fuzzy multitudes of the input variables [1].

The fuzzy rule group modeling as linguistic equations the FMS for round shaft processing function is presented further on. This set of rules was written on grounds of the functional connections between sub-systems (inputs – x_{pi} and outputs – y_{qi}) established within the decomposition draft and coupling matrixes between sub-systems, former elaborated [2].

The set of rules was drawn up for processing three round shaft families: FR_1 (compact round shaft family) – of high complexity; FR_5 (threaded shaft family) – average complexity and FR_4 (family of axles and spindles) – law complexity. The set of rules for system stockings also was elaborated [2].

Further on selectively, sequences of the functioning algorithm of the analyzed system for processing a more complex item family – FR_1, are presented, similarly being elaborated also the algorithm for the other five item families FR_2 ... FR_6 processed within the flexible manufacturing system of round shafts processing.

For example, the rule group for processing the item family FR_1 – compact round shafts is as follows:

T001 IF $\exists R_1$ ANDx_{33} $=y_{21}\&K_{23}=1$AND $x_{31} = y_1\&K_{18} =1$ THEN $y_{33}= 1R_1$ ELSE $y_{33} =1$ R_2 OR $y_{33} = 1R_3$

T002 IF $x_{45} = y_{33}$ & $K_{34} = 1$ AND $x_{46} = y_{32}$ & $K_{34} = 1$ AND $x_{41} = y_{12}$ & $K_{14} = 1$ AND $x_{42} = y_{53}$ & $K_{54} = 0$ AND $x_{43} = y_{52}$ & $K_{54} = 0$ AND $x_{44} = y_{13,8}$ & $K_{13,4} = 0$ THEN $y_{43} = 1$

T003 IF $x_{53} = y_{43}$ & $K_{45} = 1$ AND $x_{52} = y_{42}$ & $K_{45} = 1$ AND $x_{51} = y_{13}$ & $K_{15} = 1$ THEN m_{FC1} OR m_{FC2} OR … OR $m_{FCp} = 1$

T004 IF $T_o = \Delta t = 1s$ AND $x_{51} = y_{13}$ & $K_{15} = 1$ AND m_{FC1} OR m_{FC2} OR … OR $m_{FCp} = 0$ THEN $y_{52} = 1$

T005 IF $x_{42} = y_{53}$ & $K_{54} = 1$ AND $x_{43} = y_{52}$ & $K_{54} = 1$ AND $x_{41} = y_{12}$ & $K_{14} = 1$ AND $x_{46} = y_{32}\&K_{34} = 1$ AND $x_{45} = y_{33}$ & $K_{34} = 0$ AND $x_{44} = y_{13,8}$ & $K_{13,4} = 0$ THEN $y_{44} = 1$

⋮

T051 IF $x_{52,1} = y_{1,41}$ & $K_{1,52} = 1$ AND $x_{52,2} =y_{50,4}$ &$K_{50,52}= 1$AND $x_{52,3} = y_{50,3}$ & $K_{50,52} = 1$THEN $y_{52,3}=1$

In Figure 3 is presented the structural decomposition draft of FMS analyzed.

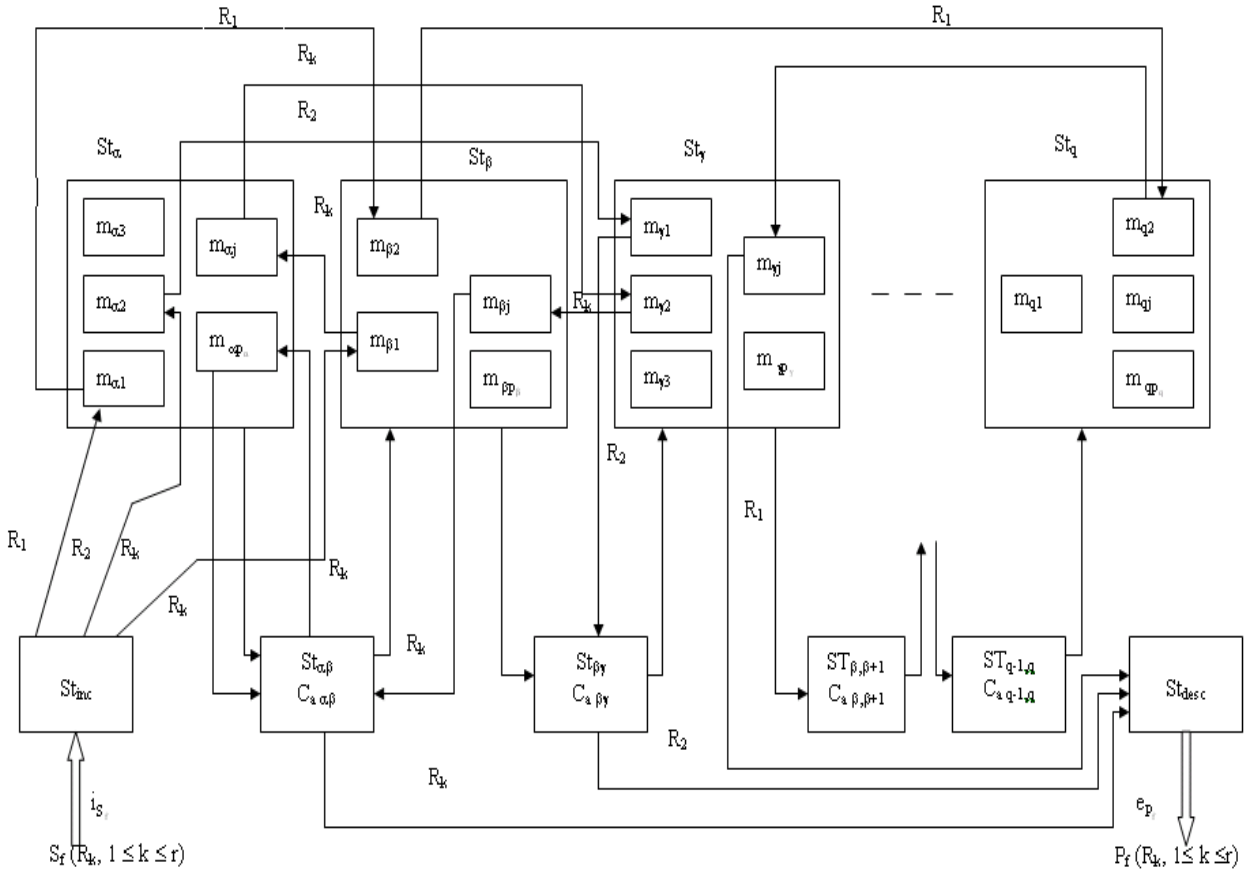

Fig. 3. The structural draft of FMS

4. CONCLUSION

This paper addresses the short-term control of flexible manufacturing systems proposing a fuzzy scheduler and a reinforcement-learning approach to tune its parameters. The learning procedure is based on evolutionary programming techniques and uses a performance index containing the degree of satisfaction of multiple and possibly conflicting objectives. Performance comparison with commonly used heuristics shows some improvement due to fuzzy techniques in scheduling, along with slower performance degradation for decreasing orders inter-arrival time.

The fuzzy logic enjoys of a modern informational support. The functioning algorithm of the system presented hereby, lays on the grounds of editing the simulation program of the flexible manufacturing system for round shafts processing.

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EXPERIMENTAL RESEARCH CONCERNING THE POWER CONSUMTION DURING THE SANDING PROCESS OF BIRCH WOOD

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Abstract: *The paper presents the results of some experimental research studies concerning the power consumption during the sanding process of birch wood with grit sizes of 60, 80, 100 and 120 respecting three processing directions (parallel, perpendicular and at 45º angle to the wood structure orientation). The industrial experiments were performed at NIKMOB Company from Nehoiu, on the wide belt sander machine using an electronic device and a data acquisition logger in order to record the power consumption. The factorial experiment with two variables (feed speed and cutting depth) was used. All data were processed with Delphi and DataFit software using the nonlinear regression. The analysis upon the power consumption during the sanding process with respect to the three processing directions, confirmed its increase with the increase of feed speed and cutting depth, respectively.*

Keywords: *birch, sanding, feed speed, cutting depth, power consumption*

1. INTRODUCTION

The technological process of sanding has the purpose to flatten all the previous processing irregularities and to confer a suitable surface quality for the finishing operations. Sanding is the last one out of the cutting operations applied to wooden surfaces.

Most of researchers performed during time various studies upon the sanding process.

The importance of the sanding schedule parameters was intensively analysed by the specialists from the wood processing department. It was established that the grit size has a decisive role within the sanding process upon the surface quality, as well as the fact that the technological factors (speeds, pressures, oscillations) do not present critical influence upon quality [7] and they are to be selected depending on the expected productivity, the generalization of wide belt sanders [1,11] and the cutting schedule personalized for each wood species being recommended.

After Carrano [2] and Saloni [8] the increse of material removal rate as well as power consumption with the increase of sanding pressure were confirmed. Even if the wood industry is not the highest power consumer, it is considered an important

consumer and out of all the processing processes, sanding seems to consume the most. Within this research area Saloni [9] is representative, its studies indicating that the power consumed during sanding increases with the belt speed and feed speed while the cutting depth presents a lower influence. Generally, the higher the grit size is, the higher the power is, recording different values when processing parallel and perpendicular to the grain direction [5,10] showed that the wood species has the lowest influence upon the power consumption, but the pressing force, the cutting direction to the fibres and the sanding speed had an overwhelming influence upon the cutting power and force implicitely.

The paper objective consists on the analysis of power consumed during the sanding process of birch wood, on the wide belt sander machine, using grit sizes of 60, 80, 100 and 180, on three processing directions (parallel, perpendicular and at 45º angle to the wood structure orientation) based on a factorial experiment with two variables (feed speed and cutting depth). The obtained results are processed with the help of Delphi and DataFit software through the method of nonlinear regression.

2. MATERIAL AND METHOD

Samples made of birch wood (*Betula pendula*) rarely used within the wood processing department from our country were used for the experiments.

The samples dimensions were 300 x 95 x 16 mm and their moisture content of about 8%. Pieces were processed by sanding at NICKMOB Company from Nehoiu, on the SANDING MASTER wide belt sander endowed with two working heads (Fig. 1). The second head with pressure bar used for the finishing process of solid wood surfaces was selected for processing.

Fig. 1. SANDING MASTER wide belt sander

The sanding machine is endowed with pneumatic oscillation system and belt self-cleaning system. The sander technical characteristics (pressure bar unit) are presented within Table 1.

Table 1. Main technical characteristics of the SANDING MASTER wide belt sander (pressure bar unit)

No	Characteristic	UM	Value
1	Working width	mm	1100
2	Abrasive belt dimensions	mm	1900x1130
3	Sanding speed (against the feed direction)	m/s	16
4	Power of main motor	kW	15
5	Power of conveyor motor	kW	2,2
6	Feed speed	m/min	4-20

The schedule parameters used for sanding are presented in Table 2.

Table 2. Processing parameters during sanding

Schedule parameters	Values
Sanding speed, m/s	v = 16
Pressure, bar	p = 4,5
Feed speed, m/min	u = 4; 8; 12; 16; 20
Cutting depth, mm	h = 0.1; 0.2; 0.3; 0.4; 0.5

The factorial experiment [6] with two variables (feed speed and cutting depth) was used. 16 sets, each one of 13 samples, for the three processing directions (parallel, perpendicular and at 45º angle to the wood structure orientation) were prepared. All

samples were codified, weighted before and after each sanding process and wetted on half of their surfaces before sanding, in order to subsequently analyses the wetting influence upon the roughness of sanded surfaces (Fig. 2 a). In order to respect the processing direction when feeding the sander (parallel, perpendicular and at 45º angle to the wood structure orientation), special devices made of fir wood (Fig.2 b şi c) were used.

16 sanding programs obtained from the combination of 5 grit sizes (80, 100, 120, 150 and 180) were used, the samples being firstly calibrated with the grit size of 60 on the same sanding machine. Out of these programs, that ones comprising the grit sizes of 60, 80, 100 and 120 were selected for the present study and they are presented in Table 3. All abrasive papers used for sanding are made of corundum granules and they are produced by HERMES Company.

a

b

c

Fig.2 Codification of samples (a) and devices used for sanding birch wood with respect to the three processing directions (b and c)(3)

Table 3. Codification of sanding programs using 60, 80, 100 and 120 grit sizes

Sanding program	Grit sizes
P 3	60 + 80 + 100
P 4	60 + 80 + 120
P 7	60 + 100
P 8	60 + 100 + 120
P 11	60 + 120

In order to record the power consumed during sanding and feeding (at millisecond) an electronic device and an acquisition board were used (Fig. 3). PICOLOG program allows to display data as tables and charts as presented in Fig. 4.

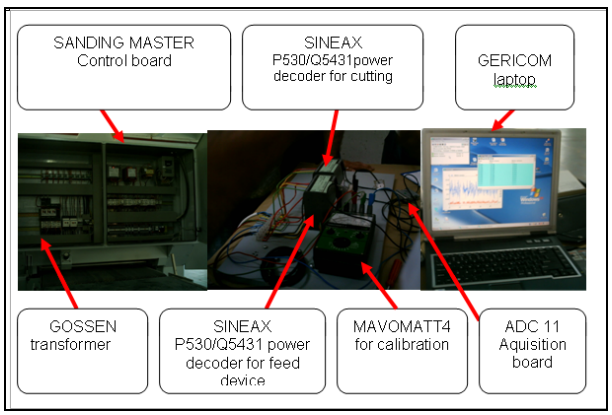


Fig. 3. SANDING MASTER and the record device for power [3,4]

The effective sanding power was calculated as difference between the power recorded during sanding and the power during idle running, determined for each one of the samples. Data were processed with Delphi through the regression method, using a nonlinear model expressed by the following function $Y=a+bx_1+cx_2+dx_1x_2+ex_1^2+fx_2^2$ and DataFit was selected in order to verify the model which had a coefficient of determination (R2) of about 0.87-0.91, indicating the correct regression function.

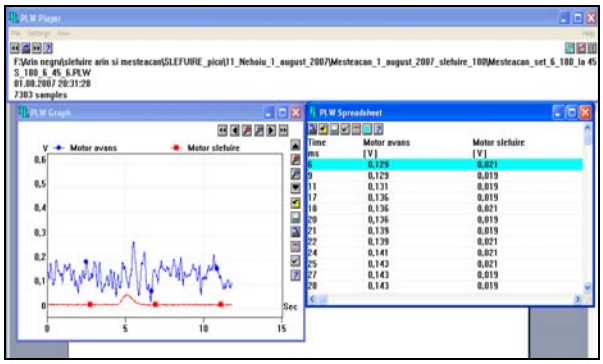


Fig.4 PICOLOG display (recorders presented as table and chart)

3. RESULTS AND DISCUSSIONS

Influence of processing program (feed speed and depth of cut) to power consumption was graphically represented for each one of the sanding programs on the three processing directions (parallel - a, perpendicular - b and at 45º angle to the wood structure orientation - c) (Fig.5, Fig.6).

3.1.Processing sets 3 and 7

The two sets ends their sanding at 100 grit, for the 7 set, directly after calibration with 60 grit size and the 3 set, after an intermediate sanding prior 80 grit before final sanding with 100 grit. The study showed the increase of the power consumption simultaneous with the increase of the feed speed at the same depth of cut, but increasing the depth of cutting at the same feed speed for all three directions of processing [3].

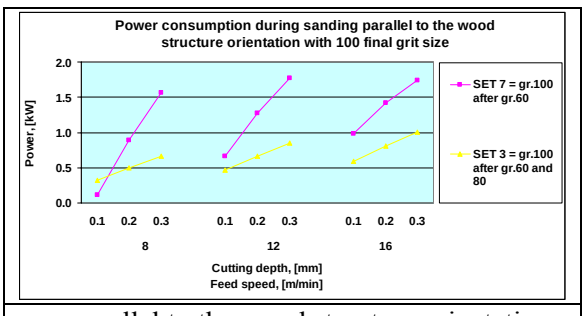
When the sanding process is performed at 45º angle to the wood structure orientation is found a parabolic increase of the power consumption, increased feed speed deeper in the set 7 (60, 100) than the set 3 (60, 80, 100) and also a linear increase with the same slope, with the increase of the depth cutting for the set 7 (60, 100) and a slower variation for the set 3 (60, 80, 100), which also produces the lowest power consumption (0.098 kW) at feed speed 8 m/min and 0.1 mm depth of cut. At constant feed speed, the cutting power to both sets grows relatively linear with the increase of the depth cutting.

At the parallel processing of the same sets, a increase of the power cutting was observed simultaneous with the feed speed and the depth of cut for all the regimes used, greater on the 7 set (60, 100) than for the 3 set (60, 80, 100). The minimum value of cutting power (0.111 kW) on the parallel processing was reported for the set 7 (60, 100) advance at a speed of 8 m/min and 0.1 mm depth of cut.

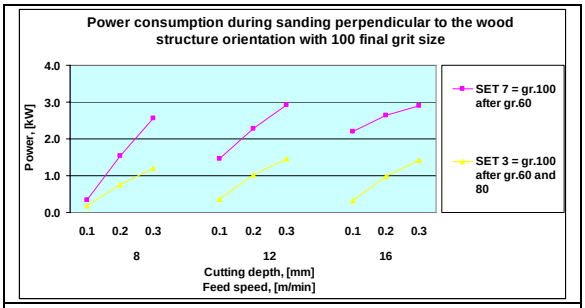
When the sanding process was performed perpendicular to the wood structure orientation a increase of the power cutting was observed simultaneous with the feed speed and the depth of cut, for both sets the minimum value of power (0.188 kW) is indicated for the set 3 (60, 80, 100) to speed advance of 8 m/min and 0.1 mm depth of cut.

3.2.Processing sets 4, 8 and 11

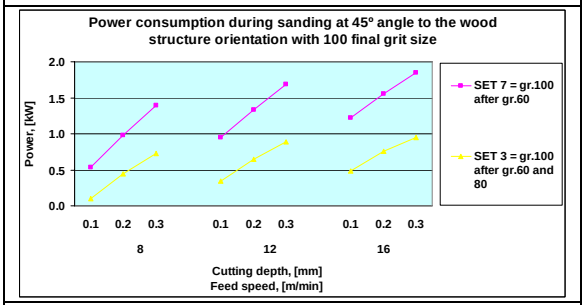
These three sets have been sanded with the final grit size 120, but differs from previous sanding grit size, respectively for the 4 set, sanding with the final grit size 120 is achieved after 60 and 80 grit sizes, for the 8 set, is made after 60 and 100 grit sizes, and for the 11 set, the final sanding with 120 grit size is achieved after 60 grit size.



a - parallel to the wood structure orientation



b - perpendicular to the wood structure orientation

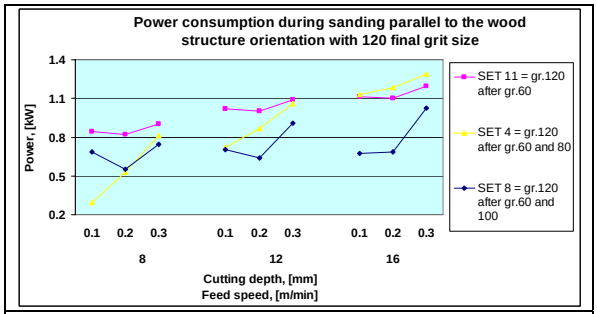


c - at 45° angle to the wood structure orientation

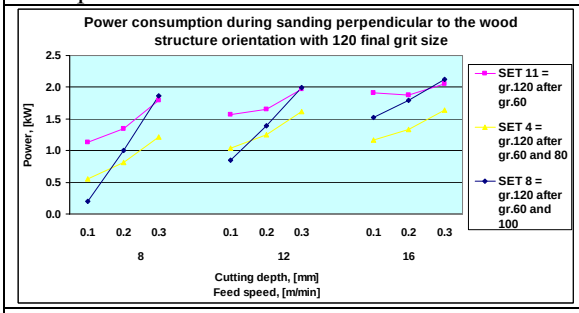
Fig. 5. Variation of power consumption during sanding the birch wood using the sanding program no. 3 with 60, 80 and 100 grit sizes compared with program no. 7 with 60 and 100, depending on the feed speed and cutting depth

When the sanding process was performed at 45° angle to the wood structure orientation, it's observe a increase of the cutting power, once with the increase of the feed speed and of the depth cutting for all three sets under study, the minimum value of the power cutting were achieved for the 8 set (60, 100, 120), having the value 0.479 kW, for the processing regime with 16 m / min of the feed speed and with cutting depth of 0.1 mm.

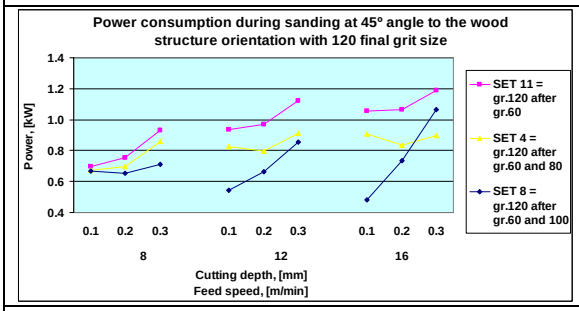
In parallel processing, for the 4 set (60, 80, 120) it's observed a significant increase acceleration of the cutting power, for both the feed speed and cutting depth, and minimum power consumption was also recorded for the 4 set (0.296 kW) at a feed speed of 8 m/min and a depth cut of 0.1 mm.



a - parallel to the wood structure orientation



b - perpendicular to the wood structure orientation



c - at 45° angle to the wood structure orientation

Fig. 6. Variation of power consumption during sanding the birch wood using the sanding program no. 4 with 60, 80 and 120 grit sizes compared with program no. 11 with 60 and 120 and program no. 8 with 60, 100 and 120 grit sizes, depending on the feed speed and cutting depth

At the perpendicular processing the lowest value of the cutting power (0.199 kW) was reported for the 8 set (60, 100 and 120) sanding at the feed speed of 8 m/min and the depth cutting of 0.1 mm. The trend of increasing power consumption with increasing

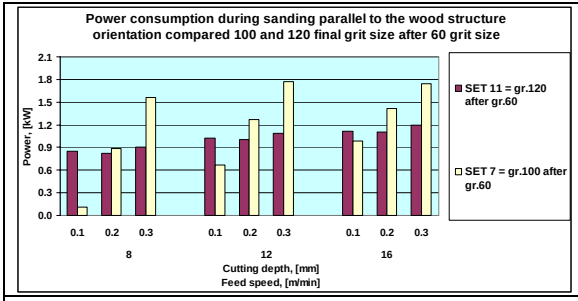
depth of processing was more intense for set 8, compared with the other sets.

3. CONCLUSIONS & ACKNOWLEDGMENT

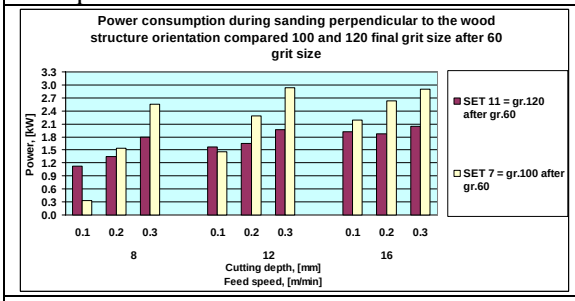
By analyzing the charts in Fig.7 can say that in all cases, the power consumed during the sanding process was higher in grit sanding with 100 grit size after 60, while Fig.8 shows that the highest power consumption was recorded for grit by sanding with 120 grit size after 60 and 80 grit sizes.

Regarding the cutting power to the processing of the sets 3 and 4, was recorded where they made three successive sanding the first two identical, it is noted that in most cases, the sanding with 120 grit size generated higher values of the cutting power than sanding with 100 grit size.

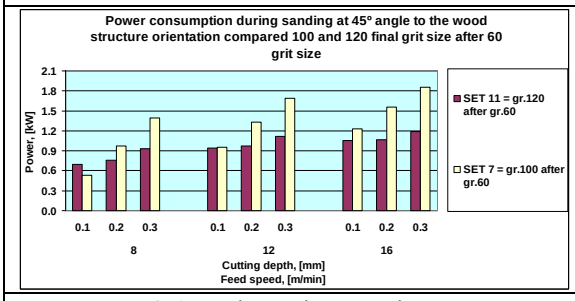
The analysis shows that this table is preferred, regardless the direction of the processing, feed speed of 8 m / min and 0.1 mm depth of cut, emphasizing that the regime has generated to the processing power sanded minimum the sanding programs and sets studied.



a - parallel to the wood structure orientation

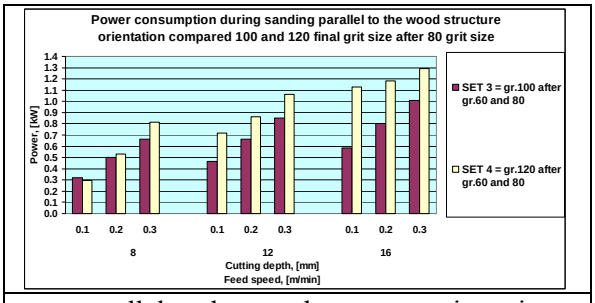


b - perpendicular to the wood structure orientation

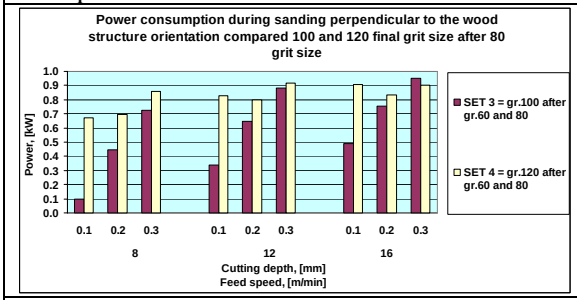


c - at 45º angle to the wood structure orientation

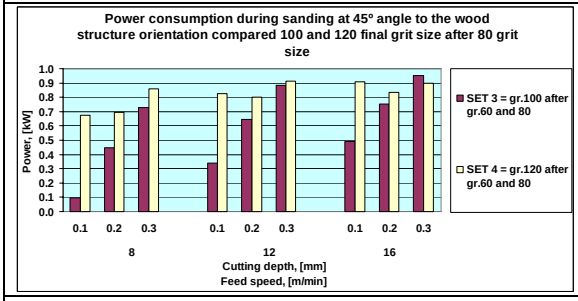
Fig. 7. Variation of power consumption during sanding the birch wood when compared the sanding programs no.7 (60, 100 grit sizes) with 11 (60, 120 grit sizes) depending on the feed speed and cutting depth, with respect to the three processing directions (a, b, c)



a - parallel to the wood structure orientation



b - perpendicular to the wood structure orientation



c - at 45º angle to the wood structure orientation

Fig. 8. Variation of power consumption during sanding the birch wood when compared the sanding programs programs no.3 (60, 80, 100 grit sizes) with 4 (60, 80, 120 grit sizes), depending on the feed speed and cutting depth, with respect to the three processing directions (a, b, c)

As a result of these dependences, it is obvious that the highest power consumption was achieved when processing perpendicular to the grain, for all the three grit sizes used.

Table 4. Table synthesis of choice sets the minimum power criterion

The compared sets after the final grit size		**Processing direction according to the wood structure**		
		at 45 angle	**parallel**	**perpendicular**
Programs 3 and 7 (100) - **3** at the final grit size 100 after 60 and 80 grit sizes - **7** at the final grit size 100 after 60 grit size	Set	**3**	**7**	**3**
	P, **kW**	**0,098**	**0,111**	**0,239**
	u, m/min	8	8	8
	h,mm	0,1	0,1	0,1
Programs 4, 8, 11 (120) - **4** at the final grit size 120 after 60 and 80 grit sizes - **8** at the final grit size 120 after 60 and 100 grit sizes - **11** at the final grit size 120 after 60 grit size	Set	**8**	**4**	**8**
	P, **kW**	**0,479**	**0,296**	**0,199**
	u, m/min	16	8	8
	h,mm	0,1	0,1	0,1

This type of sanding is not recommended in production, because under the same working conditions, the specific productivity represents 30-100% of the sanding process performed parallel to the grain, besides the disadvantage that most of wooden fibres are flattened and the power consumption is very high, but in some situations it can not be avoided.

Therefore it is economic to use the sanding program no.3 (60, 80, 100), than to apply directly the sanding program no.7 (60 and 100), when processing birch wood both parallel and at 45º angle to the wood structure orientation.

Similarly, the sanding program no. 8 (60, 100, 120 grit sizes) was selected to produce lower power consumption during sanding birch wood perpendicular and at 45º angle to the wood structure orientation.

For the parallel sanding processing to the wood structure orientation, was selected to produce lower power consumption the sanding program no.4 (60, 80, 120 grit sizes)

The optimum regime choosing will be done after the quality evaluating of machined surfaces correlating the power consumption with the quality of surfaces

The results of the present study can contribute to the promotion of birch wood, rarely used in our country, but with a real potential for the wood industry in Romania.

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STUDY CONCERNING THE INFLUENCE OF MILLING PARAMETERS UPON THE SURFACE QUALITY OF THE BIRCH AND PEAR WOOD

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Abstract: *This paper presents a comparative study concerning the surface quality resulted after processing birch and pear wood in longitudinal direction by means of two cutters with removable plates from SMC (sintered metal carbide), with different diameters: D80 mm, D120 mm. The variable parameters of the processing regime were: cutter diameter, speed, feed speed, cutting depth and cutting width. The samples were processed by milling using the two cutters, on the vertical milling machine type MNF10, endowed with a mechanical feed device. The study was based on assessing the quality of the processed surfaces by comparative analysis of the roughness parameters Ra, Rk and Rpk, resultant from roughness measurements along the cutting direction, by using an optical profilometer FRT (Fries Research Technology) made in Germany. After conducting the experimental research, it could be concluded that the best surfaces are obtained when using cutters with removable plates and larger diameters, through milling in longitudinal direction. The results of this research were used to formulate optimised processing regimes, through which very good surfaces can be obtained. In this way, the attitude of specialists from the wood industry regarding two species studied, can be changed, by promoting its use on extensive scale and so offering the possibility of broadening the raw material range of our country.*

So according with obtained study's results it can be observed differences between these two species. The values of the roughness parameter Rpk as the obtained results, after the longitudinal cutting of the birch wood, are double to those remarked for the pear wood. Consequently, the final conclusion is: pear wood has better surface quality than the birch wood

Keywords: *birch, pear, longitudinal milling, roughness parameters, cutter diameter, removable plates.*

INTRODUCTION

Considering the current global crisis, it is increasingly necessary to develop the basis of wooden raw materials, both globally and especially nationally. This determined more and more researchers during the last years to study the processing of species with limited area of distribution, but which nevertheless present a real use potential

Birch is part of the species with small area of spread in our country, but because it is a rapidly growing species, within naturally regenerated forests, with no special requirements for the soil, climate and forestry works, it deserves the attention of the wood processing specialists with a view to enlarge its use in the production of furniture and finished wood products.

Pear wood, is also part of the category of species with small area of distribution in our country, but requires a long time to increase compared with birch. It has a low share quantitative in our country but its wood is hard to break, is hard, elastic and easily bent. Wood of pear dries well and can be easily processed by the sculpture and lathing and planing, milling and sanding. Compared with beech, which is in a high percentage in our country, pear wood does not change size over time.

In this respect, manufacturers need clear and precise information on optimal

milling regimes for this wood species, capable to lead to the production of furniture with good quality surfaces.

It is known that the milling operation was and remains probably the most important wood machining operation that captured the attention of all specialists in the wood industry, being rightly considered the „queen" of shape and size processing.

For this reason, many Romanian and foreign researchers focused their studies on wood machinability (Dogaru 2003, Iskra 2005) tools and machinery for milling wood (Ispas 2000), optimization of processing procedures (Costes 2002, Brenci 2006, Fotin 2009a, Fotin & other 2009b, Salca & other 2008,), in order to obtain high quality surfaces (Kilic 2005, Vega 2005, Moura 2007, Usta 2006, Keturakis 2007), all aiming to establish optimum parameters of the working regime.

The analysis of the surface quality obtained by milling was done by different methods of scanning the topography of the wood surface, through methods with and without contact, and by analyzing the different roughness parameters which are considered representative for wood: *Ra, Rz, Rk, Rpk, Rvk* (Sandak 2005).

Some researchers (Fujiwara 2004, Gurău 2004), believe that for the study of the surface quality of wood, the parameters *Rk* and *Rpk* are those who provide most information about the influence of processing upon the surface quality.

The objective of this work is oriented towards the influence of the variable parameters of the processing regime upon the surface roughness obtained by milling birch and pear wood with cutters with removable plates, of different diameter, seeking to establish optimal processing parameters, for the both species.

MATERIAL AND METHOD

The machining was performed on both species specimens with 8% humidity, with 700 mm in length and variable width, for the processing in longitudinal direction (Fig. 1a).

a. Samples for processing in longitudinal direction.

b. Samples for processing in transverse direction.

Fig. 1.
The samples used within the experiments

The edges of the samples were processed by milling in longitudinal direction, with two cutters with removable SMC-plates, with different diameters MNF10 (Fotin 2009a, Marty 2010), provided with an attachable mechanical advance system (Fig.3).

Milling cutter with removable SMC-plates: D=80; B=50; d=30

Milling cutter with removable SMC-plates: D=120; B=50; d=40

D -outer diameter in mm
B - processing width in mm
d - bore diameter of the cutter in mm.

Fig. 2.
Milling cutters with removable CMS plates used within the experiments.

Fig. 3.
Vertical milling machine type MNF10 with mechanical feed device.

The variable parameters of the processing regimes for straight milling of the edges are presented in Table 1.

Table 1

Milling schedule parameters

Rotation speed, rot/min	6620, 9732
Feed speed, (u) m/min	9; 13,5; 18;
Cutting depth, (h) mm	1; 2; 3
Cutting width, (b) mm	30

After each milling, the processed areas of the specimens were cut into lamellas. The items obtained were used to measure the roughness parameters.

The lamellas were coded, packaged and stored for preservation until the roughness measurement was performed (Fig.4).

Fig. 4.
Cutting, coding and packaging of the samples obtained by milling.

To establish the experimental working principle, the program module PROGR was used (Laurenzi 2000), which was based on the factorial experiment method, for the three variables, namely: feed speed (*u*), cutting depth (*h*) and width of milling (*b*).

To measure the roughness of the processed surfaces, a MicroProf FRT milling device (Fig.5), was used, from the endowment of the Laboratory for Testing the Manufacturing Precision in Wood Industry - LTPFIL (with RENAR accreditation No. LI 665/2008) – from the Faculty of Wood Industry. This device is a standard measurement tool for assessing optical non-contact surface roughness (Fotin & other 2009b, Marthy 2010).

Fig. 5.
MicroProf FRT optical device

The roughness was measured parallel to the processing direction, the test-pieces being placed in a device to keep the same measurement position (Fig.5). On each test specimen, two measurements were performed, on different areas. The estimation of the roughness parameters was achieved by averaging the two measurements. The scanning parameters of the MicroProf FRT device are presented in Table 2.

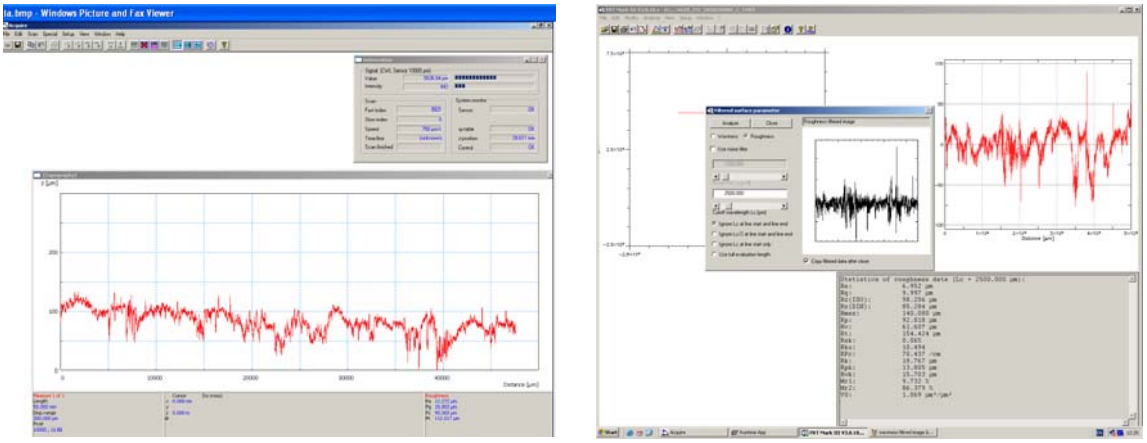
Table 2

Scanning parameters of the device MicroProf FRT

Parameter name	Modul 2D
Scanning speed	750 µm/s
Number of points per	10.000 points
Number of measuring	1
Evaluation length	50 mm
Sampling length	2,5 mm
Resolution	5 µm
Direction of measurement	Along the processing direction

The ACQUIRE software for data recording allowed the data rescue as *frt* and *txt* type files, but also the view of the surface topography under study, as shown in Fig. 5a. The roughness profile analysis was performed by calling the MARK III analysis software (Fig. 5b), which allowed saving the processed data as *log* type files. The roughness profile was obtained after a pre-filtering of the data with a Gaussian filter, which was automatically applied by the software when calling the analysis. The resulted *txt* type files were processed with conversion software, created in DELPHI (Fotin 2009a). After averaging the two measurements for each specimen, the experimental data were

modelled using the software developed in DELPHI and called ***Modelare_simulare_date*** (Modeling_simulation_data), a program which used the mathematical regression method, with a non-linear II-nd degree model, expressed by the function: $Y = a+bx_1+cx_2+dx_3+ex_1x_2+fx_1x_3+gx_2x_3+hx_1^2+ix_2^2+jx_3^2$ - for that **three variables**, respectively *u, h* and *b* (Fotin & other 2010).



a - ACQUIRE window for data recording

b –MARK III window for data analysis

Fig. 6.
Soft windows of FRT profilometer.

Out of the parameters defined by SR EN ISO 4287:2003/AC:2009 only *Ra* was used in this study and out of those defined by SR EN ISO 13565-2:1999, *Rk* and *Rpk* were selected for analysis.

RESULTS AND DISCUSSIONS

This paper is a comparative study of the values of roughness parameters *Ra, Rk* and *Rpk*, obtained after from the surface quality measurements of birch and pear wood samples, processed by milling a longitudinal direction with cutters of two different diameters: D80mm and D120 mm, with SMC removable plates.

The comparative study on the values of roughness parameters obtained from the milling of the two species was achieved by milling width b = 30 mm, for three depths of cut and three feed speed (Fotin & other 2010).

In order achieve comparative study to drawn the families of curves for the three roughness parameters analyzed on the same graph for each experiment, the milling width of 30 mm for the both species.(Fig.7 and Fig.8);

The code presented in the title of each graph represents: cutter diameter measuring direction plate type rotation speed (rot/min) milling width (mm) and species that has been processed (Fig.7 and Fig.8).

Roughness parameters have been analyzed and different trends depending on cutter diameter, rotation speed, feed speed and cutting depth, for which they were determined.

In the case of birch wood milling the following results were obtained:

- For longitudinal processing at low speed rotation, D80 diameter cutter generated surfaces with: $Ra_{min}=2.90\ \mu m$, $Rk_{min}=6.69\mu m$, $Rpk_{min}=7.78\mu m$, while D120mm diameter cutter generated surfaces with $Ra_{min}=3.89\mu m$, $Rk_{min}=11.06\mu m$, $Rpk_{min}=6.28\ \mu m$ (for example it was considered processing regime with cutting depth h=1 mm and feed speed u=18m/min for a milling width b=30mm). The cutting depth of 2 mm, the two milling surfaces with roughness generated almost identical. In terms of raised grain characterization parameter (*Rpk*) better results were obtained by milling with larger diameter cutter (D120 mm) (Fig.9).
- The longitudinal processing, values of roughness parameters, which normally decreases with increasing diameter cutter, this time shows an increase at the same level of processing, becoming an inconclusive election cutter on the criterion of minimum roughness.
- For high speed rotation processing of the longitudinal direction, D80 diameter cutter generated surfaces with: $Ra_{min}=4.74\ \mu m$, $Rk_{min}=13.02\ \mu m$, $Rpk_{min}=8.48\ \mu m$, while D120mm diameter cutter generated surface with $Ra_{min}=4.73\ \mu m$, $Rk_{min}=13.84\ \mu m$, $Rpk_{min}=5.10\ \mu m$ (for cutting processing procedure with h=1 mm depth cut and feed speed u=18m/min)). The presence of raised grain it's noted at processed surfaces with D80mm the smallest diameter milling cutter, the value of *Rpk* is significantly higher than at processing with largest diameter milling cutter. The other two parameters were very close values (Fig.9).

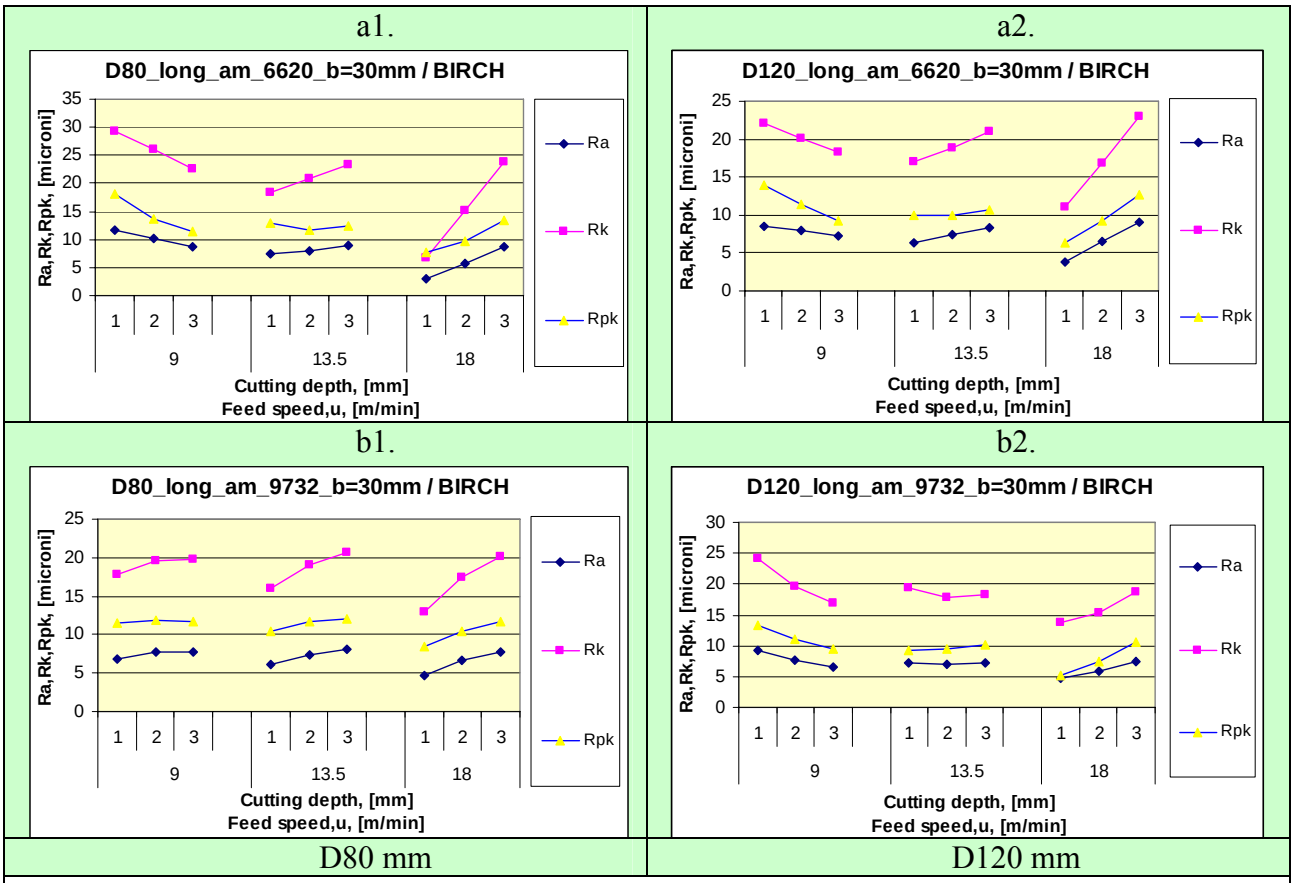


Fig. 7. Variation of roughness parameters Ra, Rk şi Rpk (µm), at the longitudinal milling of birch wood by means of cutters with removable plates, with diameter: D80mm (a1 and b1), and D120mm (a2 and b2)

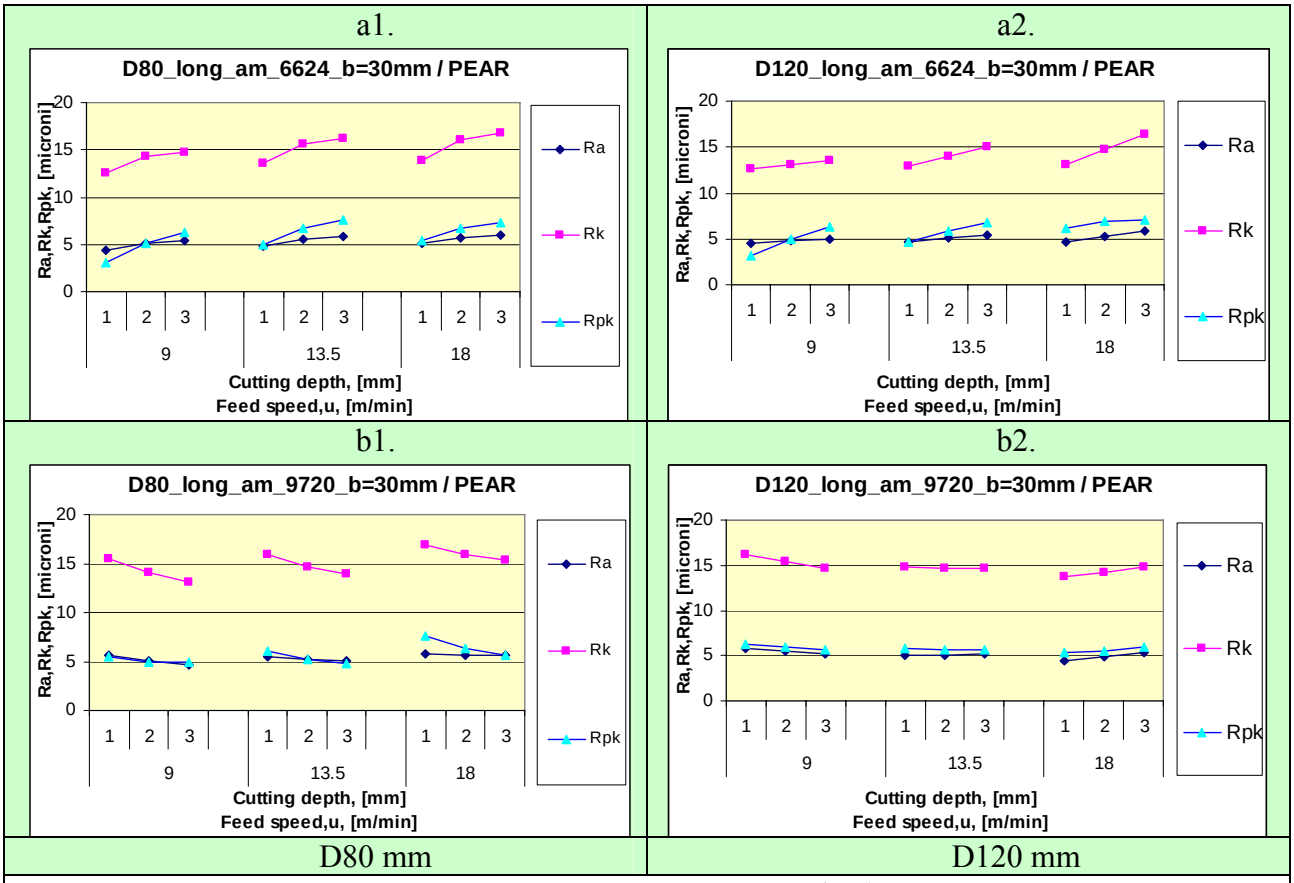


Fig. 8. Variation of roughness parameters Ra, Rk and Rpk (μm), at the longitudinal milling of pear wood by means of cutters with removable plates, with diameter: D80mm (a1 and b1), and D120mm (a2 and b2)

In the case of pear wood milling the following results were obtained:

- For low speed rotation longitudinal processing, the two mills have generated surfaces with very close minimum values of roughness parameters, the differences for processing regime were insignificant h=1mm depth of cut and feed speed u=9m/min (D80mm/D120) (Ra_{min} = 4.32µm/4.51µm, Rk_{min} = 12.52µm/12.69µm and Rpk_{min}=*3.06 µm/3.10 µm)*
- At the high speed rotation longitudinal processing were found large differences in terms of processing regime between the two mills for obtained minimum values were, respectively: D80 mm cutter surfaces generated with minimum values (Ra_{min}=*4.69 µm,* Rk_{min}=*13.06 µm,* Rpk_{min}=*4.76 µm)* to low feed speed processing (u = 9 m / min) and large cutting depth (h = 3mm), while D120mm cutter, generated surfaces with close minimum values (Ra_{min}=*4.50 µm,* Rk_{min}=*13.68 µm,* Rpk_{min}=*5.31 µm* but for high feed speed (u = 18 m / min) and small cut depth (h = 1mm) (Fig. 9).
- Consequently, because the minimum values of roughness parameters are very similar, the differences were insignificant, even in *Rpk* parameter (parameter that signifies the presence of raised grain) implies inconclusive mill choice according with minimum roughness criterion at the high speed processing.

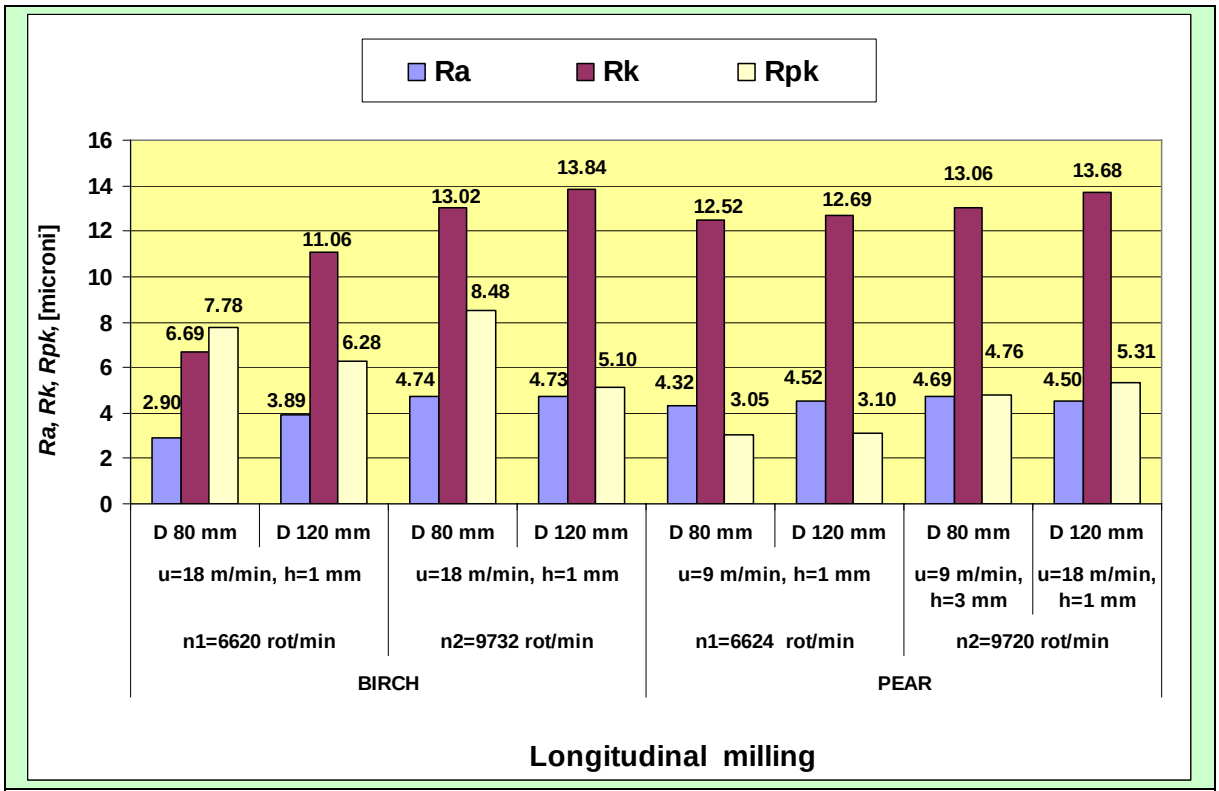


Fig. 9

The minimum values of roughness parameters *Ra, Rk* and *Rpk (µm)*, at the longitudinal milling birch and pear wood with removable plates of milling cutter with diameters: D80 mm and D120 mm at n1=6620 rot/min and n2=9732 rotation speeds, for milling width of 30 mm.

CONCLUSIONS

The conclusions on the influence diameter of cutter and cutting regime on the quality of processed surface of birch and pear wood, with removable plate from SMC mills with the diameters D80 mm and D120 mm, are:

- in case birch of wood, at the longitudinal processing the minimum value of roughness parameters were obtained, the processing at large feed speed and small cutting depths, for both mills at low speed rotation (6620 rpm) (Fig. 9);
- As regards the presence or absence of raised grain from processing birch wood with the two mills, the best results were obtained when processing with large diameter cutter (D 120mm) at high speed rotation (n2 = 9732 rpm);
- At longitudinal pear wood processing were obtained minimum values of roughness parameters on both milling feed speeds processing and small depths of cut (u = 9m/min h = 1mm) for speed rotation n1. At n2 speed rotation, the minimum values were obtained differently for the two mills, at D80mm milling process, processing regime was u=9m/min; h=1mm and for D120mm milling process regime was as birch to, high feed speed (u = 18m/min) and depth of cut h = 1 mm (Fig. 9);
- the minimum values of roughness parameters *Ra* and *Rk* were lower at birch wood in comparison with the minimum values obtained to the same degree of processing for the pear wood;
- regarding the *Rpk* parameter values (high value of the parameter signifies the presence of raised grain), the best results (lowest values) were obtained in all cases at the woodworking of the pear;
- at the pear wood processing, the best results were obtained, for both mills, at n1=6620 rot/min speed, the difference being insignificant (*Rpk*=3.05 μm for D80 mm mill processing and *Rpk*=3.10 μm for D120 mm mill processing) and for birch wood processing the lowest *Rpk* parameter values were doubled as of the pear wood processing, the best being obtained with large cutter diameter (D 120mm) at high speed rotation (n2);
- High quality of pear wooden surfaces compared to those of birch wood is due to the density influence of processing, birch being with a lower density (640 kg/m3) as pear (710 Kg/m3);

In conclusion, at longitudinal processing with low speed rotation, having regard the results obtained with the two mills are relatively close, it can choose smaller cutter diameter, D80 mm, thus reducing tools cost. When processing at high speed rotation even if supposed costs increase, it is choice preferred the large diameter milling , D120 mm, because the resulted surfaces presented fewer defects and raised grain after processing (Fig.9).

Results of study in design work can be based working arrangements Machining surfaces of birch and pear wood, taking as a criterion of optimization results in surface quality processing parameter of importance in terms of consumption of labour and energy consumption for subsequent technological operations of milling.

By using two working mills with diameters of 80 and 120 mm and two drive speeds actually obtained an analysis of influence of cutting speed (introduced in rose-wood contact area), of the resulting surface quality, knowing that with increasing cutting speed, the phenomenon of "stiffening" of wood fiber occurs much more conclusive can clearly influence the process of formation and detachment of the chip.

By offering industry study, optimal conditions for achieving industrial system processing by milling the wood of birch and pear, conditions can be analyzed in the field of wood processing companies.

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Geometrical Product Specification (GPS). Surface texture: Profil method; Surface having stratified functional properties. Part 2: Height characterization using the linear material ratio curve

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CONCERNS REGARDING THE STUDY OF IMPACT BETWEEN AN AIRCRAFT AERODYNAMICAL SURFACE AND A FOREIGN OBJECT

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Abstract: The purpose of this study is to analyze a fast dynamic phenomena (the impact between objects) using "Finite Element Method" with direct applications for flight occurrences investigation.

The impact between a foreign object (a hard object which isn't or was not part of the aircraft) with an aerodynamical surface having a major roll in ensuring the aircraft aerodynamical stability during the flight is studied.

The point of interest in beginning the study was an aerodynamical surface generated by a flight occurrence, which keeps the marks of such impact. The practical interest of this study, although there are many variables, is to identify the impact circumstances that can cause a similar effect on the aerodynamical surface structure.

The interest reason, from a flight occurrence investigation point of view, is to issue theories regarding a possible loss of the aircraft aerodynamical stability, due to a collision at low altitude evolution. In such situation is difficult to identify the generating cause between the impact occurrence and a wrongful maneuver of the crew based only on the flight parameters (acceleration, velocity, trajectory, etc.) registered on aircraft Flight Data Recorder system.

Keywords: *impact study, aerodynamical surface, finite element method.*

1. INTRODUCTION

The aerodynamical surface chosen for the present study is an horizontal empennage from a Puma helicopter. As a result of a flight occurrence, the recovered empennage was damaged so that the aerodynamically features was serious affected. The empennage ripped shape indicates that the impact was from top to bottom (fig. no 1).

The empennage is fixed on the top left helicopter tail on the opposite side of the tail rotor. It is trapezoidal shaped and fixed on two points on the device. The setting angle value between empennage and helicopter tail is 2^0. This angle is adjusted in the factory and can not be changed.

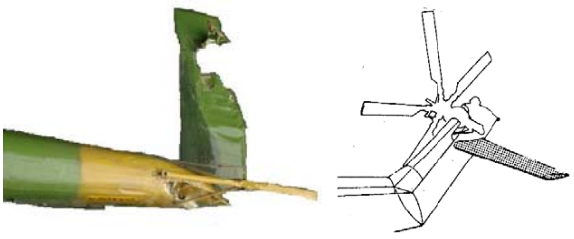

Fig. no 1 - The empennage ripped shape and the empennage normal shape

The interaction between the foreign object (named „projectile" in specific literature) and the aerodynamical surface (often named „target surface") is one of the complex phenomena in mechanical structure, which is very difficult to be mathematical modeled due to the following causes:

- the stress is impulsive during a very short time (microseconds);
- the strength of impulsive force is very high, producing irreversible changes in the structure of the target surface and projectile;
- the behavior of the materials (for target surface and projectile) during the impulsive stress is very different from static stress behavior.

Taking into account those physics considerations that characterize the impact phenomena, it is necessary to use a mathematical model which can take account of the following particularities:

- because at the projectile – target impact the elastic limit of the projectile and target bodies material is exceeded, a physical nonlinearity will occur
- displacements in the target's body (aerodynamic surface) on the impact direction being bigger than the displacements in the perpendicular plans on the impact direction, results into a geometrical nonlinearity of the problem

the action of the projectile over the target being variable in time, it is necessary an analyze of the dynamic answer of the target structure following the impact with the projectile

2. RESEARCH WORK

2.1 Finite element modelation. For analyzing and solving, with "Finite Element Method", an impact problem, generated by a real flight occurrence, between an aerodynamical surface and a foreign object is necessary to determine the stresses and the displacements in aerodynamical structure. Before that a few necessary assumptions must be done and also the studied bodies (aerodynamical surface and foreign object) must be modeled with finite elements, so that the repartition of stresses and displacements to present a comprehensive image of the structure behavior.

For creating the empennage model with finite elements there were used shell elements for its covering, wing spars, bracing ribs and beam elements for rib parts (fig.no 2). Taken into consideration the studied phenomena, the chosen material model is the elastic-plastic model.

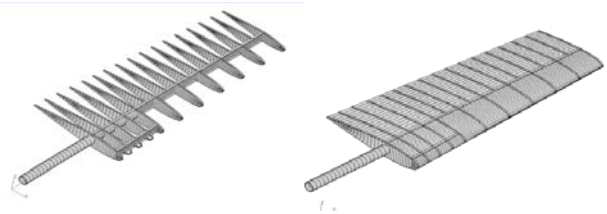

Fig. no 2- Empennage model with finite elements.

For simulate the phenomena, the necessary material properties are: the minimum breaking stress (σ_b), the minimum creep stress (σ_c), the breaking elongation (ε_b), the density (ρ), the coefficient of longitudinal elasticity (E), the Poisson coefficient of transversal contraction (μ).

The approximation for Hooke's material characteristical curve is presented in the fig. no 3.

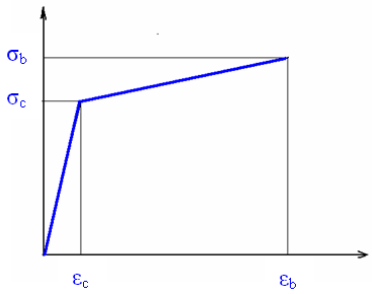

Fig. no 3 – The Hooke's material characteristical curve

The specific creep elongation (ε_c) is calculated with the following formula:

$$\varepsilon_c = \frac{\sigma_c}{E} \qquad (1)$$

The downgrade tangency (E_{tan}) for plastic area is calculated with the following formula:

$$E_{\tan} = \frac{\sigma_b - \sigma_c}{\varepsilon_b - \varepsilon_c} \qquad (2)$$

The interest situation for beginning this analyze is that a hard object hits the aircraft horizontal empennage when its velocity is 70 m/s. It is considered that the direction impact is from the upper to lower side, perpendicular on the horizontal plan. The object is considered hard because this represents the most detrimental case for the aircraft aerodynamical structure. The hard (foreign) body velocity is variable in all studied cases from 20 m/s to 80 m/s, having a section area of 120x120 mm.

A nonlinear, dynamic analyze was concluded. The equations are solved explicitly. For each impact case the computing time is chosen so that the impact effect over the empennage to be determinate. The time increment is automatically calculated depending on the minimum distance between two nodes of the modeled structure, density and rigidity.

2.2 Results case no 1. The impact between empennage and 1 kilo hard body with 20 m/s velocity.

The effect over the structure is insignificant. A plastic deformation occurs (contact mark) on the wing extrados. The kinetic energy that is transferred to the empennage disperses itself under elastic waves form (fig. no 4).

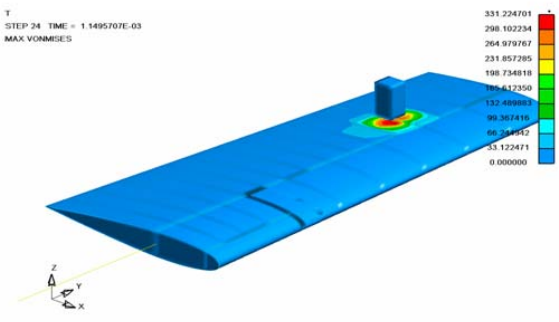

Fig. no 4 - Results case no 1

2.3 Results case no 2. The impact between empennage and 1 kilo hard body with 40 m/s velocity.

The covering of the extrados wing is ripped on an approximately 40x40 mm area (fig. no 5).

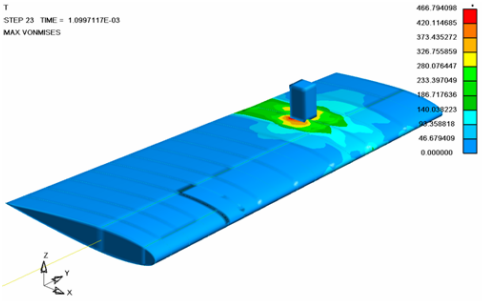

Fig. no 5 - Results case no 2

2.4 Results case no 3. The impact between empennage and 1 kilo hard body with 60 m/s velocity.

The covering of the extrados wing and the 13th bracing rib is ripped on an approximately 220x80 mm area (fig. no 6).

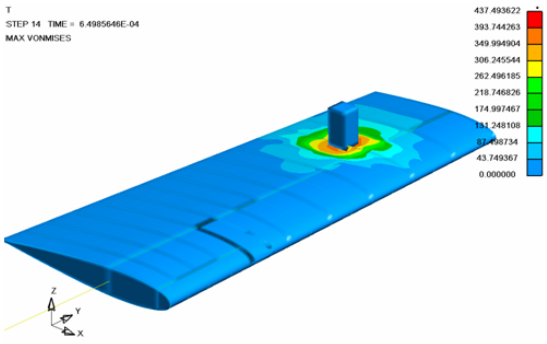

Fig. no 6 - Results case no 3

2.5 Results case no 4. The impact between empennage and 1 kilo hard body with 80 m/s velocity.

The empennage is perforated during the impact. The covering of the extrados wing, the bracing rib and the covering of the intrados wing are ripped. The effect is greater on the

extrados. The ripped area width is approximately equal to the body width.

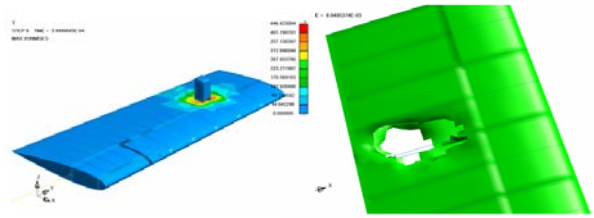

Fig. no 7 - Results case no 4

2.6 Results case no 5. The impact between empennage and 1 kilo hard body with 80m/s velocity. To obtain a ripped area, the body is shifted on OX axis towards empennage trailing edge with 100 mm.

The empennage is perforated during the impact and the empennage trailing edge is ripped. The covering of the extrados wing, the bracing rib and the covering of the intrados wing are ripped.

Fig. no 8 - Results case no 5

2.7 Results case no 6. The impact between empennage and 1 kilo hard body with 80m/s velocity. For studying the rupture area changes, the body is shifted backward with 100 mm and rotated with 90^0, having a contact section area of 240x120 mm.

The empennage is perforated during the impact, but the empennage trailing edge is not ripped, because the energy is better dissipated in the empennage structure. The covering of the extrados wing, the bracing rib and the the covering of the intrados wing are ripped. The rupture gets bigger, the ripped area width is approximately equal to the body width.

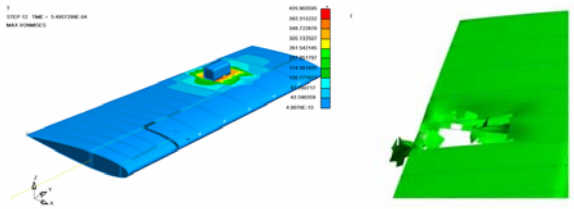

Fig. no 9 - Results case no 6

2.8 Results case no 7. The impact with a viscous-elastic-plastic body (biological tissue consistency) with a 5 kilo wight (maximum weight for biological body considered in this paper), and 40m/s impact velocity. This velocity is considered to be the maximum of a nose diving bird.

The effect over the structure is insignificant. Only a plastic deformation of the structure occurs. Due to the impact conditions and material properties, the body transfers towards the structure only a small amount of energy. This energy is taken and dissipated in the elastic waves form.

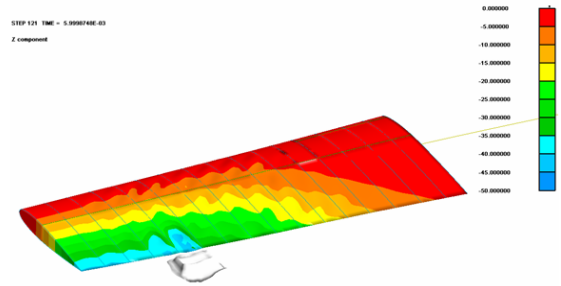

Fig. no 10- Results case no 7

3. CONCLUSIONS & ACKNOWLEDGMENT

Simulations prove that, during the impact with a biological tissue consistency body, the only occurrence is a small plastic deformation of the structure. Due to the impact conditions and material properties, the body transfers towards the structure only a small amount of energy, which is taken and dissipated in the elastic waves form. The impact with a hard body is the most detrimental case. These conclusions, for serious ruptures, lead to impact simulations only with hard bodies.

Along with the increase of the impact velocity, the destructive effects over the empennage structure increase. The frontal area and the shape of the body significantly influence the rupture area and the energy dissipated in the structure. In the impact case when the body is oriented with the small section on the impact direction, the kinetic energy transfer area is small and the rupture produces on a width comparable area with the width of the body.

By shifting the body backward and rotating it by 90^0, so that the contact is on the maximum section, the rupture increases in wing span, but decreases on the chord of wing (at the same body weight).

A conclusion of the numerical simulation performed is the fact that fast dynamic phenomena, or even the ultra fast ones, become accessible and can be sequential handled through numerical simulation, thus being able to view the development process. Once the structure model is valid, sequential representation of the simulation, at different time steps, somehow eliminates the usage of other expensive viewing methods, such as high speed cinema and shooting in X-ray spectrum.

The purpose of numerical simulation methods is not to eliminate the experimental study of the phenomena. The cohabitation of both methods in studying the fast dynamic phenomena is the right solution, the experimental data transferred to simulation are practically returned under the form of useful optimizations in experimental field.

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GLOBAL FLOW RATE MODELING WITH LOCAL HEATING TRANSITORY REGIME

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Abstract: *This paper represents a theoretical approach of a measurement problem regarding a gas flow in special conditions.*

The modeling problem that will be presented in this paper was generated by the idea of measuring the flow in a transitory regime and without alterating the flow section.

Theoretically speaking, we have a problem regarding the heat and mass transport, more precisely a laminar convective transport, in which over the diffusional transport is interfering the property carries because of the fluid flow.

So, for this matter, in this paper, some theoretical aspects regarding the above mentioned subject will be shown and also, if possible, the results of the simulations that are currently done – if all the work will be finished in due time; if not, in the worst case scenario, some theoretical suppositions and forecasts regarding the evolution of the fluid temperature will be shown, underlining the direct relation between the heat transport and the length of the sensor (starting from the generation point of the heat pulse and ending after the receiving point) and also the traveling speed of gas.

Also, there was established a set of equations which describes the behavior of the gas temperature in the superficial layer after the thermal impulse, and the thermal balance in the transient stage, all for the determination of the correlation between the temperature and the gas flow.

Keywords: *gas flow measurement, heat impulse, thermal flow meter*

1. INTRODUCTION

Coming with the last years, the industrial domain got a more and more alert development rhythm because of the bigger and bigger demands on the specific market. Because of that, the authors of this paper are proposing a new sensor for measuring flows of different types of gases that are used in numerous industrial processes.

Most of the existing flow meters on the market these days have the tendency to disturb the pipe section through which the fluid flows, thus resulting a measurement of a local flow that is different from the total gas volume traveling along the pipe. Therefore, for determining the global flow of the fluid, a soft correction is necessary to be applied, causing some small errors regarding the wanted measurements.

The solution proposed by the authors of this paper is to develop a new sensor that can measure the gas flow in a transitory regime, without the disturbance of the flow section, by using a very easy and simple working

principle: thermal pulses. For that reason, this paper will present a first mathematical approach regarding the functionality of the desired flow measuring sensor.

2. PROBLEM DEFINITION

The thermal impulse sensor can be assimilated with a thermal nozzle like in the next figure, in which the growth of the gas

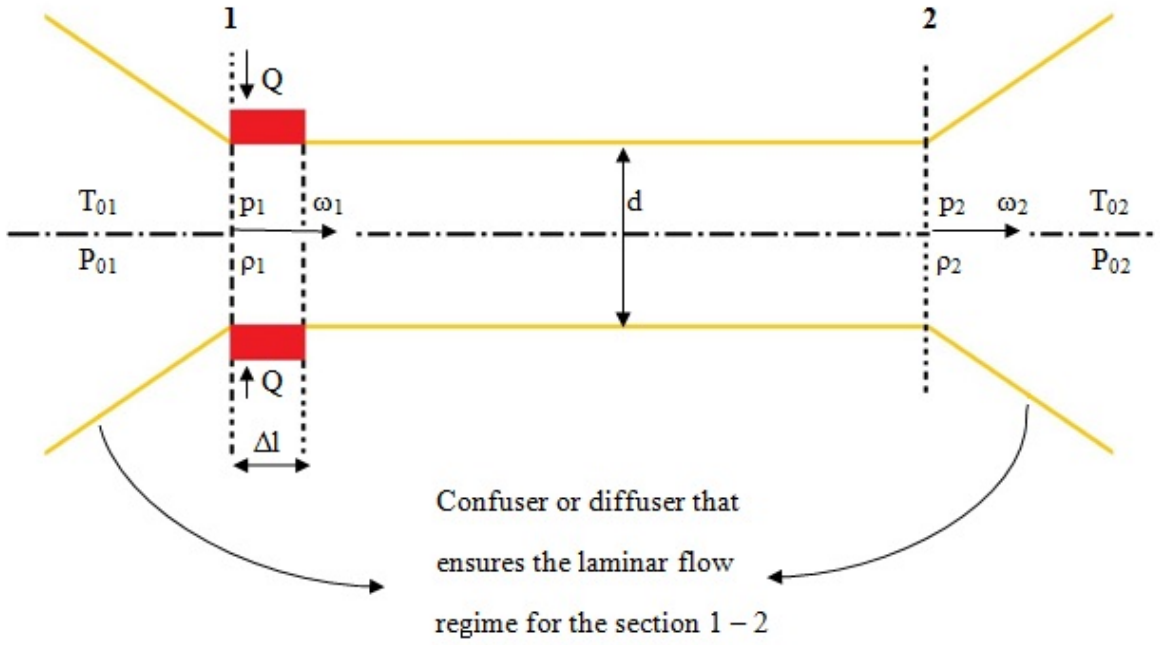

Fig. 1. Schematics of the thermal pulse gas flow measuring sensor

speed regarding the 1 – 2 section is related to a gas heating on a specific length Δl. The presented situation differs from a classical thermal nozzle because the heating does not occur on the whole length of the sensor, but only on a limited length of it, Δl.

As a following of the heating process, the density of the gas will decrease ($\rho_2 > \rho_1$) and the traveling speed of the gas along the pipe will increase. Both of the above mentioned modifications caused by the heating will make the momentary pressure to fall down ($p_2 < p_1$).

On the whole length of the pulse sensor, the flow will be subsonic, meaning that M << 1 so $M_1 < 1$ and also $M_2 < 1$.

Because the flow section of the pipe is constant (A = constant), the continuity equation is written:

$$\rho_1\omega_1 = \rho_2\omega_2 = \text{constant} \quad (1)$$

The equation regarding the applied impulse to the gas mass between section 1 – 2 on the flow direction, disregarding the friction, is:

$$p_1 - p_2 = \rho_1\omega_1 * (\omega_2 - \omega_1) \quad (2)$$

The Bernoulli equation regarding the total loss of pressure for the same section 1 – 2 is:

$$P_{01} - P_{02} = (p_1 - p_2) + \left(\frac{\rho_2\omega_2^2}{2} - \frac{\rho_1\omega_1^2}{2}\right) \quad (3)$$

Where p_1 and p_2 are:

$$p_1 = P_{01} - \frac{\rho_1\omega_1^2}{2}$$

$$p_2 = P_{02} - \frac{\rho_2\omega_2^2}{2} \quad (4)$$

The impulse equation can be written also:

$$p_1 - p_2 = \rho_1\omega_1\omega_2 - \rho_1\omega_1^2 \quad (5)$$

Because $\omega_1 = \rho_2\omega_2/\rho_1$ from the continuity equation, replacing this in the last relation (5), the impulse equation will become:

$$p_1 - p_2 = 2 * \left(\frac{\rho_2\omega_2^2}{2} - \frac{\rho_1\omega_1^2}{2}\right) \quad (6)$$

This transformation was made for rewriting the equation that describes the total loss of pressure (relation 3) under a more convenient form:

$$P_{01} - P_{02} = \frac{\rho_1 w_1^2}{2} * \left(\frac{\rho_1}{\rho_2} - 1\right) \quad (7)$$

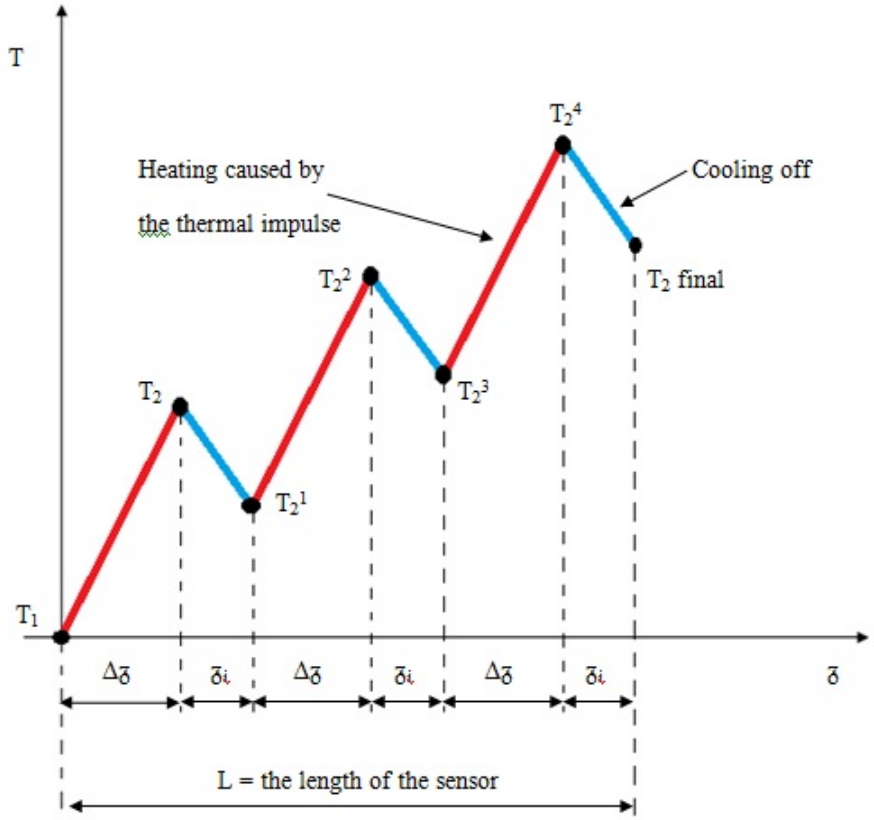

Fig. 2. Evolution of the gas temperature due the sequential impulse

Relation 7 represents the analytical proof that the decreasing of the momentary pressure ($p_2 < p_1$) depends on the growing of the gas temperature, fact which influences the densities ratio ($\rho_2 > \rho_1$). Because for a specific gas, the densities ρ_1 and ρ_2 are depending only on the temperature, the last equation can be written also like:

$$P_{01} - P_{02} = E_c * \left[\rho_1 \left(\frac{\rho_1}{\rho_2} - 1\right)\right] = E_c * f(\rho) \quad (8)$$

Where $E_c = \omega_1^2/2$ represent the kinetic energy of the gas. In this case, it is possible to draw a variation of the gas kinetic energy depending on the values regarding the gas densities, on various sections of the flow sensor.

Because on the whole Δl segment of the section 1 – 2 a heat impulse transfer takes place (on the whole pipe periphery) in a specific Δ□ time interval, afterwards continuing with a time break □i, the gas will

behave as following: after receiving the pulse and having reached its maximum temperature, the heated gas will cool down without reaching its initial temperature (previous of the thermal impulse); the cycle described before is a repetitive one, thus resulting a step heating of the gas from temperature T_1 until the final temperature T_2, like shown in Figure 2.

Because from the beginning it was accepted the fact that M << 1, from the continuity equation (relation 1) a simplifying hypothesis that doesn`t introduce significant errors to the model can be written as follows:

$$\frac{\omega_1}{\omega_2} = \frac{\rho_2}{\rho_1} \approx \frac{T_1}{T_2} \approx \frac{T_{01}}{T_{02}} \qquad (9)$$

This hypothesis is allowing the assumption that $P_{01} - P_{02} \cong 0$ meaning that the Bernoulli equation (relation 3) becomes:

$$0 = (p_1 - p_2) + \left(\frac{\rho_1\omega_1^2}{2} - \frac{\rho_2\omega_2^2}{2}\right) \qquad (10)$$

The expression for the pressure fall on the pipe is $\Delta p = P_{01} - p_2$. Keeping into account relations no. 4 and 5 and simplifying the new equation as much as possible, the final expression of the pressure fall on the pipe will be:

$$\Delta p = P_{01} - p_2 = \\ = \frac{\rho_1\omega_1^2}{2} * \left(2 * \frac{\omega_2}{\omega_1} - 1\right) \qquad (11)$$

The gas volume that flows through the pipe section 1 – 2 is $D = \rho_1 * \omega_1 * A$, where A represents the flow section (A is the interior diameter of the pipe through which the gas flows and is constant all along).

The relation between the gas flow and the temperature of the gas is as follows:

$$D = \frac{2*\Delta p}{\omega_2} * \frac{1}{2*\frac{T_2}{T_1} - 1} \qquad (12)$$

For introducing in the calculations also the thermal flux received by the flowing gas through the pipe, for characterizing the flow described by the last relation (12), the equations regarding the braked enthalpies must be written:

$$h_{01} = h_1 + \frac{\omega_1^2}{2}$$
$$h_{02} = h_2 + \frac{\omega_2^2}{2} \qquad (13)$$

The thermal flux received by the gas mass unit in the specific time interval is q = Q / D, where Q is the heat quantity, which implies the assumption of the simplifying hypothesis that $C_p = C_{p1} = C_{p2} = \ldots$, thus resulting:

$$q = C_p * (T_{02} - T_{01}) = \\ = C_p(T_2 - T_1) + (\omega_2^2 - \omega_1^2)/2 \qquad (14)$$

As a final result of this part of the mathematical model regarding the thermal pulse gas flow measuring sensor, a four equation system with four unknown variables will be presented:

$$\rho_1\omega_1 = \rho_2\omega_2$$
$$p_1 - p_2 = \rho 1 \omega 1(\omega 2 - \omega_1)$$
$$\frac{p_1}{\rho_1 T_1} = \frac{p_2}{\rho_2 T_2} \qquad (15)$$
$$C_p(T_2 - T_1) + \frac{(\omega_2^2 - \omega_1^2)}{2} = \frac{Q}{\frac{2*\Delta p}{\omega_2 * (2*\frac{T_2}{T_1} - 1)}}$$

The first equation of the above system is relation 1 – the continuity equation, and the second one is the expression of relation no. 5 where a common factor was applied.

The third relation of the system is an expression of the perfect gases equation and the last equation was obtained by combining the relations no. 12 and 14.

The presented system has four unknown variables, all of them being gas parameters after the thermal pulse has been generated and the heat exchange took place: T_2, p_2, ρ_2 and ω_2. All the other variables are input factors, well known as value and are regarding the initial condition of the gas (before the appearance of the thermal pulse): T_1, p_1, ρ_1, ω_1, Q and C_p.

3. FUTURE WORK

All the variables calculated from the previous four equation system are needed as inputs for the next step of the mathematical model concerning this thermal pulse gas flow sensor.

The next stage is to determine the heat transfer that occurs inside this flow sensor because of the thermal pulse by using the method of the thermal balance in transient regime of the elementary cube.

At the end of that part, the desired results should be two relations. First of them should show the dependence between the travelling speed of the gas in the pipeline and its temperature in the moment of heating and in the second one, the relation between the travelling speed of the gas in the pipeline and the gas temperature in the moment of the cooling should be seen.

Afterwards, by knowing these dependences some graphs and some simulations can be done, thus resulting the theoretical approach for measuring gas flows with the help of thermal impulses.

As expected, every theoretical aspect obtained from the mathematical modeling will be verified and compared with the practical results of the experiments that will be done in the near future.

4. CONCLUSIONS

After finishing all the simulations (work in progress) of the above described system with all the working hypothesis and conditions, the obtained results are to be satisfactory and conclusive, according to the original expectations. The next step will be to start the development of an experimental booth that will help to put to practice all the theoretical aspects presented along this paper, and to start practical work for determining the frequency for the repeatable cycle: generating the thermal impulse, thus heating and then cooling and receiving all the needed data for determining the gas flow in a transitory working regime without alternating the flow section.

5. ACKNOWLEDGMENT

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ABOUT SMOOTHING FUNCTIONS USED IN SPH METHOD

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ABSTRACT. A fundamental issue of Smoothed Particle Hydrodynamics (SPH) theory is the smoothing function, often called smoothing kernel function, or smoothing kernel or simply kernel.
The kernel function determines the pattern of the function approximation, determines the consistency, the accuracy of the results. So, a maximum attention must be paid to the smoothing function, because by a right choosing (when this is possible) we can improve the results.
This paper presents some theoretical consideration upon smoothing functions, some requirements for these and how this issue is implemented and available in Ls-Dyna program. Also, some examples are presented, which represent fundamentals of the final conclusions.

KEYWORDS: Smoothed Particle Hydrodynamics, kernel function, smoothing length.

1. INTRODUCTION

Smoothed particle hydrodynamics (SPH) is a meshfree Lagrangian particle method having a short history comparatively with finite difference method (FDM) or finite element method (FEM). Its begining can be found in 1977, when it was used to solve astrophysical problems in three-dimensional open space.

Nowadays the SPH method is being used in many engineering fields. Between these, the numerical modeling of fluid flows is one of a great succes, but not many years ago, SPH was also used in applied mechanics.

Many special softwares were created and others well known powerfull numerical programs implemented this new method, SPH.

In our country this method is less used despite its advantages in solving of the problems involving large deformation, free surface etc. Our paper offers some specific information for an easier understanding and even using of SPH method.

2. INTEGRAL REPRESENTATION OF A FUNCTION

The theoretical fundamentals of the SPH method can be approched in two steps. The first is the integral representation or kernel approximation of the field functions.

The second one is the approximation of particle parameters (mass, velocity, etc.).

Integral representation of a function $f(x)$, used in the SPH method starts from the following identity:

$$f(x)=\int_{\Omega} f(x')\delta(x-x')dx' \quad (1)$$

where f is a function of a position vector x, which can be an one-, two- or three-dimensional one; $\delta(x-x')$ is a Dirac function, having the properties:

$$\delta(x-x') = \begin{cases} 1 \to x = x' \\ 0 \to x \neq x' \end{cases} \quad (2)$$

In equation (1), Ω is the function domain, which can be a volume, that contains the x, and where $f(x)$ is defined and continuous.

By replacing the Dirac function with a smoothing function $W(x-x',h)$ the integral representation of $f(x)$ becomes:

$$f(x) = \int_{\Omega} f(x')W(x-x',h)dx' \quad (3)$$

where W is the smoothing kernel function, or smoothing function, or kernel function.

The parameter h, of the smoothing function W, is the smoothing length, by which the influence area of the smoothing function W is defined (Figure 1-a and 1-b).

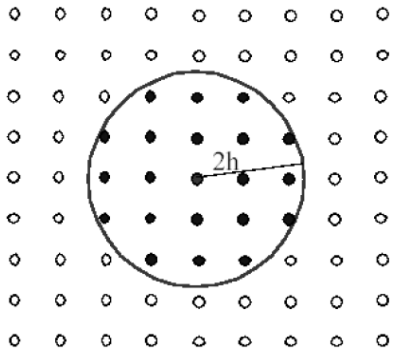


Fig. 1-a Support domain of W

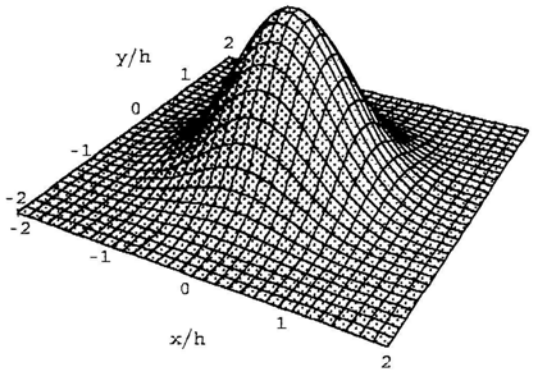


Fig. 1-b Graphical representation of 2D-Kernel function

As long as Dirac delta function is used, the integral representation, described by equation (1), is an exact (rigorous) one, but using the smoothing function W instead of Dirac function, the integral representation can only be an approximation. This is the reason for the name of kernel approximation. Using the angle bracket $\langle\ \rangle$ this aspect is underlined and the equation (3) can be rewritten as:

$$\langle f(x)\rangle = \int_{\Omega} f(x')W(x-x',h)dx' \quad (4)$$

The smoothing function W is usually chosen to be an even one, which has to satisfy some conditions.

The first condition, named normalization condition or unity condition is:

$$\int_{\Omega} W(x-x',h)dx' = 1 \quad (5)$$

The second condition is the Delta function property and it occures when the smoothing length approaches zero:

$$\lim_{h\to 0} W(x-x',h) = \delta(x-x') \quad (6)$$

The third condition is the compact condition, expressed by:

$$W(x-x',h) = 0 \qquad \text{when} \qquad |x-x'| > kh \quad (7)$$

where k is a constant related to the smoothing function for point at x, defining the effective non-zero area of the smoothing function as the figure 2 shows.

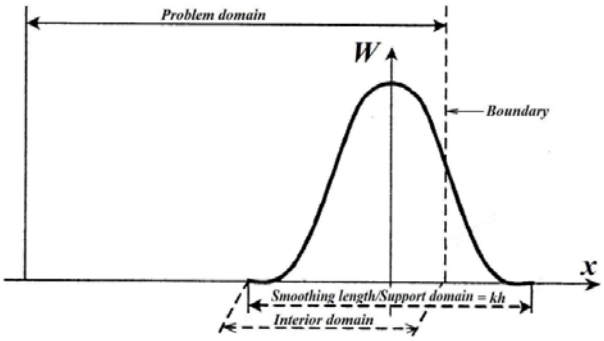


Fig. 2 Smoothing length

As the particle approximation is concerned, the continuous integral aproximation (4) can be converted to a summation of discretized forms, over all particles belonging to the support domain.

Changing the infinitesimal volume dx' with the finite volume of the particle ΔV_j, the mass of the particles m_j can be written,

$$m_j = \Delta V_j \rho_j \tag{8}$$

and finally, relation (3) becomes:

$$f(x) = \sum_{j=1}^{N} \frac{m_j}{\rho_j} f(x_j) W(x - x_j, h) \tag{9}$$

The particle approximation of a parameter described by a function, for particle i can be expressed by,

$$\langle f(x_i) \rangle = \sum_{j=1}^{N} \frac{m_j}{\rho_j} f(x_j) W_{ij} \tag{10}$$

where $W_{ij} = W(x_i - x_j, h)$. (11)

3. PROPERTIES OF THE SMOOTHING FUNCTIONS

In the SPH literature, various requirements of the smoothing function are debated.

The most important of them (the first 7th) are presented below.

- the smoothing function has to be ***normalized*** over its support:

$$\int_{\Omega} W(x - x', h) dx' = 1 \tag{12}$$

- the smoothing function has to be ***compactly supported:***

$$W(x - x', h) = 0 \text{ for } |x - x'| > kh \tag{13}$$

- the smoothing function has to be ***positive*** for any point at x' within the support domain:

$$W(x - x', h) \geq 0 \tag{14}$$

- the smoothing function value has to be ***monotonically decreasing*** with the increase of the distance away from the particle.
- the smoothing function value has to satisfy the ***Dirac delta function*** condition as the smoothing length approaches to zero:

$$\lim_{h \to 0} W(x - x', h) = \delta(x - x') \tag{15}$$

- the smoothing function value has to be an ***even function*** (symetric).
- the smoothing function value has to be sufficiently smooth (smoothness).

4. SMOOTHING FUNCTIONS

Published literature presents different smoothing function (also called smoothing kernel function, smoothing kernel, or kernel).

Theoretically, any function having the properties presented above, can be employed as SPH smoothing function. First time, Lucy (1977) used the following bell-shaped function as the smoothing function:

$$W(s,h)=\frac{\alpha}{h^n}\begin{cases}(1+3s)(1-s^2)^3 \leftarrow s\le 1\\ 0 \leftarrow s>1\end{cases} \quad (16)$$

where α is $\frac{5}{4}$, $\frac{5}{\pi}$ or $\frac{105}{16\pi}$, n is a number representing the space dimension, $s=\frac{|x-x'|}{h}$ or $s==\frac{r}{h}$, r being the distance between two points (particles).

The graphical representation of this smoothing function and its derivatives (first and second) can be seen in the figure 3.

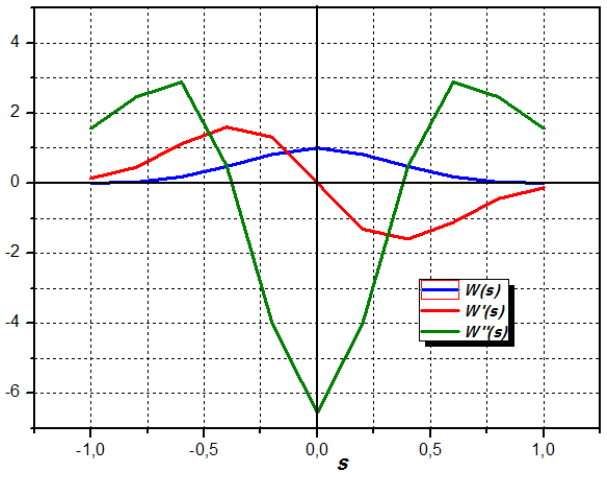


Fig. 3 Smoothing function and its derivates, used by Lucy in 1977

Monaghan in 1992 and Gingold and Monaghan in 1977 assumed the smoothing function to be a Gaussian, expressed by:

$$W(s,h)=\frac{\alpha}{h^n}e^{-s^2} \quad (17)$$

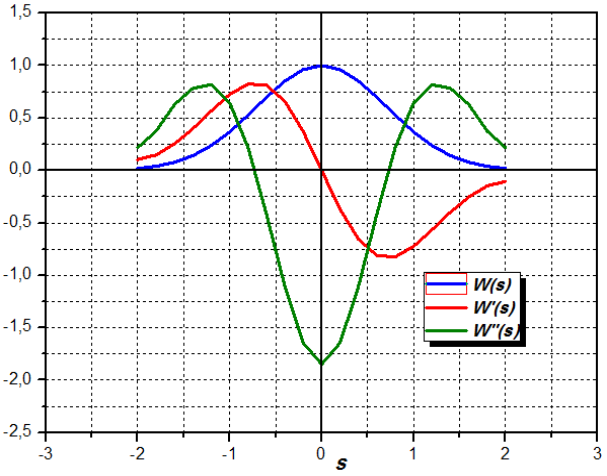


Fig. 4 Smoothing function and its derivates, used in 1977 and 1992 (Ginglod and Monaghan)

Many notations used in relation (16) are the same used in previous type of kernel.

The notation α has the following expression: $\frac{1}{\pi^{0.5}}$, $\frac{1}{\pi}$ or $\frac{1}{\pi^{1.5}}$ in function of the space dimension (1D, 2D or 3D).

The graphical representation of this smoothing function and its derivatives (first and second) can be seen in the figure 4.

Monaghan and Lattanzio, in 1985, used a smoothing function based on the cubic spline function, named B-spline function:

$$W(s,h)=\frac{\alpha}{h^n}\begin{cases}\frac{2}{3}-s^2+\frac{1}{2}s^3 \leftarrow 0\le s<1\\ \frac{1}{6}(2-s)^3 \leftarrow 1\le s<2\\ 0 \leftarrow s\ge 2\end{cases} \quad (18)$$

The constant α has the values 1, $\frac{15}{7\pi}$ or $\frac{3}{2\pi}$ in function of the space dimension (1D, 2D or 3D). This type of smoothing function, so far, it is the most widely used, specially in dedicated software.

The graphical representation of this smoothing function and its derivatives (first and second) can be seen in the figure 5.

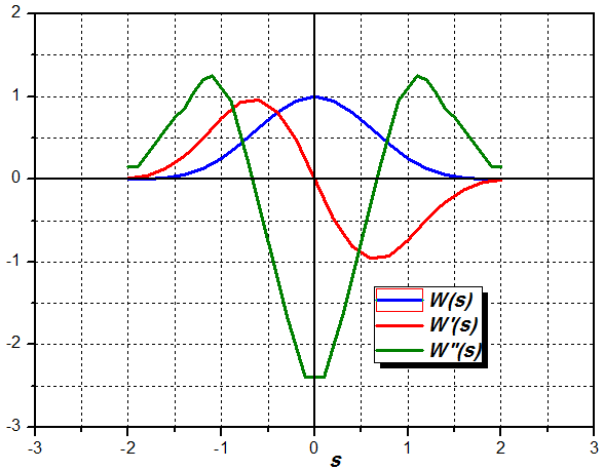


Fig. 5 B-spline smoothing function and its derivates

Spline functions of higher order (quartic and quintic) can be more closely in approximating the Gaussian and they are more stable.

The expression of a quintic spline function (Morris, 1996) is:

$$W(s,h)=\frac{\alpha}{h^n}\begin{cases}(3-s)^5-6(2-s)^5+\\+15(1-s)^5 \leftarrow 0\le s<1\\(3-s)^5-6(2-s)^5\\ for \rightarrow 1\le s<2\\(3-s)^5 \leftarrow 2\le s<3\\0 \leftarrow s>3\end{cases} \quad (19)$$

The graphical representation of this smoothing function and its derivatives (first and second) can be seen in the figure 6.

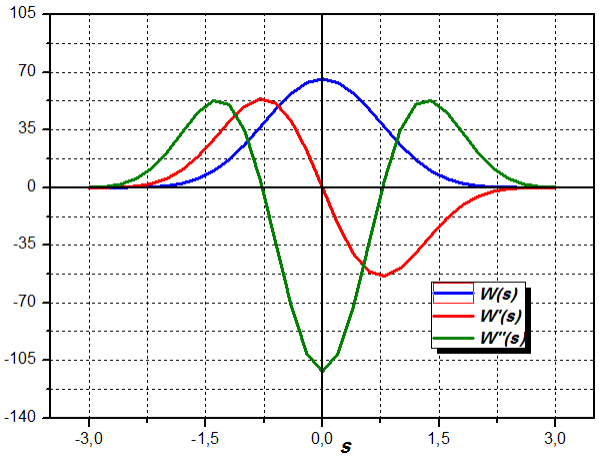


Fig. 6 Quintic spline smoothing function and its derivates

In 1996, Johnson et al. used a quadratic smoothing function to simulate the high velocity impact problem.

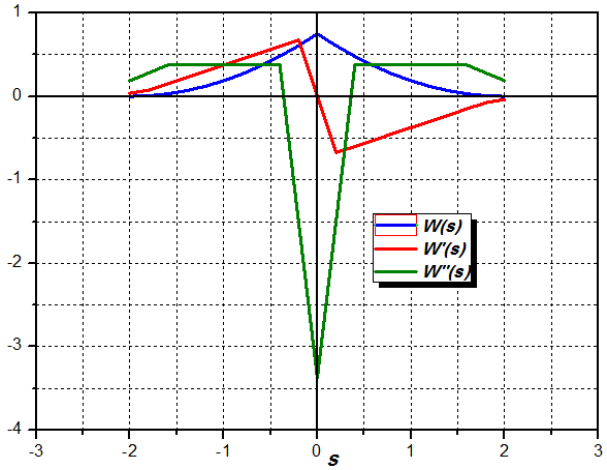


Fig. 7 Quadratic spline smoothing function and its derivates

The graphical representation of this smoothing function and its derivatives (first and second) can be seen in the figure 7.

The expression of the Johnson smoothing function is:

$$W(s,h)=\frac{\alpha}{h^n}\left(\frac{3}{16}s^2-\frac{3}{4}s+\frac{3}{4}\right) \qquad (20)$$

for s being between zero and two ($0 \le s \le 2$).

5. SMOOTHING FUNCTIONS IN LS-DYNA PROGRAM

One of the most powerfull program for simulation of the dynamic problems, which has the SPH method implemented, is Ls-Dyna.

This program uses a cubic B-spline kernel function, described above.

The user can make a choosing regarding to the the particle approximation, having the following options, by FORM parameter (CONTROL_SPH): default formulation (0), renormalization approximation (1), symmetric formulation (2), symmetric renormalized approximation (3), tensor formulation (4), fluid particle approximation (5), or fluid particle with renormalization approximation (6). These options can be made

Others options can be made regarding to the computation or not of the particle approximation between two different SPH parts and regarding to the time integration type for the smoothing length h:

$$\frac{d}{dt}\left(h(t)\right)=\frac{1}{d}h(t)div(v), \qquad (21)$$

or,

$$\frac{d}{dt}\left(h(t)\right)=\frac{1}{d}h(t)\left(div(v)\right)^{1/3} \qquad (22)$$

The smoothing length h, can be calculated by the program, just the calculus begining, if this is permited to be variable during computing simulation, or can has a defined values, established by the user (using parameters CSLH, HMIN and HMAX, of SECTION_SPH).

6. NUMERICAL TESTS

An well known experimental test, Taylor test, is presented by numerical simulations, using Ls-Dyna program. The test consist in the impact between a cilynder with a rigid wall.

A solid cylinder, having a velocity of 200 m/s, with radius of 5 mm and the length of 50 mm, made of 1018 steel was considered.

Two numerical models studied the impact between this metal rod with a rigid wall: FEM and SPH models. Finite element model was made using 2993 nodes and 2560 elements (element size being 1.250x1.077x1.077 mm) and can be seen in the figure 8.

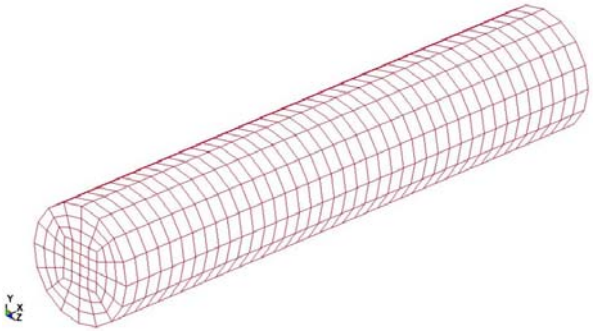
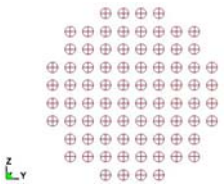


Fig. 8 Finite element model

SPH model consisted in 4000 particles (equal distance between particles 1.00 mm).

Figure 9 (*a* and *b*) presents the SPH model.

a)



b)

Fig. 9 SPH model of the bar

For both models, the fundamental measure units were: for length millimeter [*mm*], for time second [*s*] and for force Newton [*N*].

Analysis time was established at 0.003 seconds, for the stress and displacement field analysis. in a period after the impact, when the velocity changed its sign.

The study of material behavior was based on plastic-kinematic material model.

In the Figure 10, deformed shape and UX-displacement field are presented, for FE and

SPH modeling, for the time of 6e-5 s.

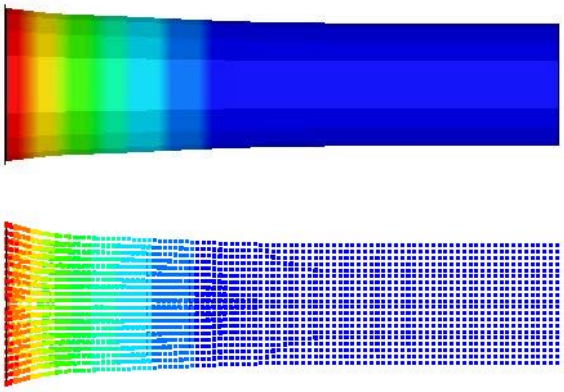


Fig. 10 UX-displacement field

Table 1. Impact effects upon the bar

Models	Bar Head		Bar Tail	
	UX_{max}	VX_{max}	UX_{max}	VX_{max}
	mm	mm/s	mm	mm/s
FEM	43.390	26557	38.404	28720
SPH	43.475	27295	38.172	26891
	Er. 0,2%	*Er. 2,77%*	*Er. -0.6%*	*Er. -6,4%*

Table 1 presents some of the results for the default values of SPH using. In the table 2, the same results are presented for different values of the parameter FORM.

Table 2. The influence of the kernel

	Bar Head		Bar Tail	
	UX_{max}	VX_{max}	UX_{max}	VX_{max}
	mm	mm/s	mm	mm/s
FORM=1	42.592	25176	37.866	27575
Er. [%]	*-1.84*	*-5.20*	*-1.40*	*-3.98*
FORM=2	43.556	25371	38.245	27010
Er. [%]	*0.38*	*-4.46*	*-0.41*	*-5.95*
FORM=3	42.055	24571	37.302	26559
Er. [%]	*-3.10*	*-7.47*	*-2.87*	*-7.52*
FORM=5	43.545	25384	38.235	26997
Er. [%]	*0.36*	*-4.41*	*-0.44*	*-5.99*
FORM=6	42.272	25055	37.546	27687
Er. [%]	*-2.57*	*-5.65*	*-2.23*	*-3.59*

7. CONCLUSIONS

Using of different smoothing functions leads us to different results, which could be far enough from the reality.

The choosing of the smoothing function and the options referring to this as well has a great importance for the calculus results.

The default values offered by Ls-Dyna program leads us to the best results, for classical conditions regarding to the material and its loading.

The choosing possibility of different smoothing functions (or different versions of these) must be studied, because this aspect allow us to do some numerical calibration of the SPH method, as the results to be the best.

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4. * * * LS-DYNA Documentation

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APPROACHES CONCERNING THE OPTIMIZING OF SUPPORTING STEEL FRAME OF A WHEEL LOADER ENGINE BONNET

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***Abstract**: For developing high-quality and cost-efficient products, it is important to evaluate and compare system level performance for different configurations early in the development process. This paper will present the development and optimization for a steel frame system using a combined CAD/FEM program. In this study, a detailed steel frame model is designed and analysed. The issues to be improved are the vibrations of the outer parts of the bonnet. The negative effect consists in acoustical disturbance, mechanical stress, material fatigue and oscillations. 3D model is analysed through finite elements analysis method and confirm a higher displacement at frame's extremities caused by an unstable dynamic behaviour as an effect of different excitation sources (combustion engine, loading, unloading, general balance of the machine). To demonstrate the applicability of the developed models, results of computer simulations are presented.*

***Keywords**: optimization, structures, engine, design, automotive*

1. INTRODUCTION

The bonnet of the engine is a part of the wheel loader car body which is designed to cover the engine and other components placed in the engine compartment. One of the most important functions is to give a good optical impression as much as to protect the under-bonnet area. Noticing the existing technical solution, a very unpleasant effect is stated: the extremities of the bonnet oscillate, causing acoustical disturbance and probably, in the future, material damages. The effect of the vibrations generated by the excitation factors (forced vibrations) are described using a reduced dynamic model. The frame consists of rectangular profiles welding one another. The 3D spatial model (computer modelled) reproduces the real model and it has its characteristics: the density of mass, the geometry, the mechanical and thermal behaviour. After running the analysis procedure of the finite element, the responses of the system will give an image about the amplitudes of different mechanical (vibratory) characteristics. The model is developed using Pro/Engineer® environment. Further, based on the understanding provided by the model, an improved geometry will be presented.

2. THE MODEL

As shown in the Fig. 1, the locations where the oscillations act are indicated by the red arrows. Usually, the engine is placed at the bottom of the vehicles.

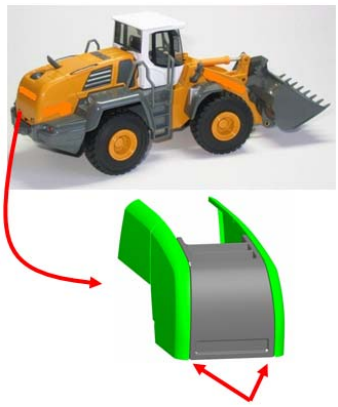

Fig. 1 – Wheel loader engine bonnet

The bonnet is fixed on the supporting steel frame using special bolts which are laminated into the glass fibre reinforced plastics. The conceptual design of the original model of this steel frame looks like in the Fig. 2.

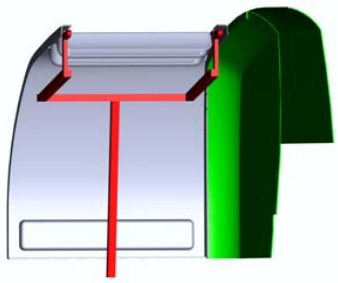

Fig 2 – Original version of steel frame

Further, the modelled assembly looks as in the Fig. 3. For the analysis, three surfaces of the frame will be considered as being fixed.

Fig. 3 – Final design of the steel frame's original version

As it can be observed, the corners of the steel frame are free and they build a lever arm with an increased vibrational behaviour. The reduced 3D model will be prepared for the analysis. As in Fig. 4, a modal analysis will be carried out in order to investigate the existing vibratory system.

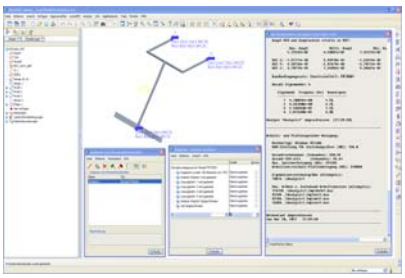

Fig 4 – Modal analysis of the existing frame

3. THEORETICAL ISSUES

The majority of structures can be made to resonate, i.e. to vibrate with excessive oscillatory motion. Resonant vibration is mainly caused by an interaction between the inertial and elastic properties of the materials within a structure. Resonance is often the cause of, or at least, a contributing factor to many of the vibration and noise related problems that occur in structures and operating machinery. To better understand any structural vibration problem, the resonant frequencies of a structure need to be identified and quantified.

In every development of a new or improved mechanical product, structural dynamics testing on product prototypes is used to assess its real dynamic behaviour.

Modes are inherent properties of a structure, and are determined by the material properties (mass, damping, and stiffness), and boundary conditions of the structure. Each mode is defined by a natural (modal or resonant) frequency, modal damping, and a mode shape.

A single-degree-of-freedom system is described by the following equation:

$$m\ddot{x}(t) + c\dot{x}(t) + kx(t) = f(t) \qquad (1)$$

with m the mass, c the damping coefficient, and k the stiffness.

Although very few practical structures could realistically be modeled by a single-degree-of-freedom system, the properties of such a system are important because those of a more complex multiple-degree-of-freedom system can always be represented as the linear superposition of a number of single-degree-of-freedom system characteristics (when the system is linear time-invariant).

Multiple-degree-of-freedom systems are described by the following equation:

$$M\ddot{x}(t) + C\dot{x}(t) + Kx(t) = f(t) \qquad (2)$$

It is not the intent of this paper to deepen the theory of vibration but only to find out for the given system of how is his behaviour after applying a natural frequency analyses. After that, optimization approaches will deliver the new shape of the frames.

Due to the diversification of structural optimization problems, most structural optimization problems can be classified as size, shape and topology optimization. In this case, the main application of optimal design of steel structures is the shape optimization, in order to get a better vibrational stability.

The aim of the structural optimization is to determine the value of the design variable x that minimizes the objective function V(x). The objective function is accompanied by a various number of constraints (here g(x)).

min V(x) with:

$$x_1 \le x \le x_n$$

and

$$g(x) \le 0.$$

Generally, the optimization model consists of the objective and constraint functions and a numerical optimization algorithm that drives the optimization.

4. SIMULATION AND OPTIMIZATION

The existing shape solution of the steel frame is modelled with Pro/ENGINEER®. Material characteristics are assigned to the 3D model. All the unnecessary design details are removed from the model. After that, the FEM software Pro/Mechanica® is launched. In case of simple structures, ordinary calculation can be done manually by the specialised engineers. If the structure comprised a complicated form, the simplification procedure will conduct to a quite inexact model. In this approach the software was used because of the complicated spatially model in order to get a better approximation.

After modelling, the 3D model (existing version) gets a mesh structure. This mesh will be automatically generated by the software, as in Fig. 5:

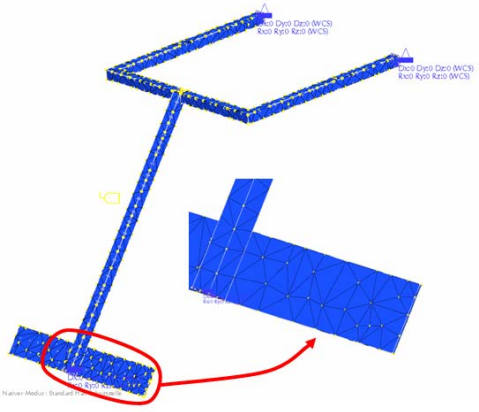

Fig. 5 – Mesh 3D model of the existing version

A modal analysis study is carried out. The window of the results is presented in the Fig. 6. The first and second vibration mode / frequencies (16.59 Hz and 20.27 Hz) are representative for the searched problem.

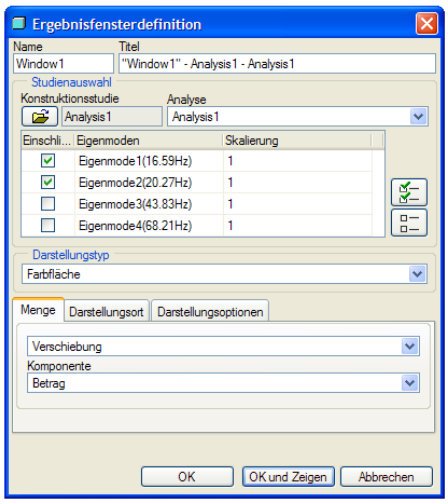

Fig. 6 – The window of the results with first and second vibration modes

The results of these vibratory movements will be exemplified in Fig. 7. Here, the extremities move much more as the rest of the frame.

As we can observe the "red" extremities, maximum displacement is here approx. 1.0009 x 10^{-1} mm.

The optimized shape is a result of the optimized algorithm and a few practical restrictions taking into account the placement of a few new components in the under-bonnet area. The meshed shape is presented in Fig. 8.

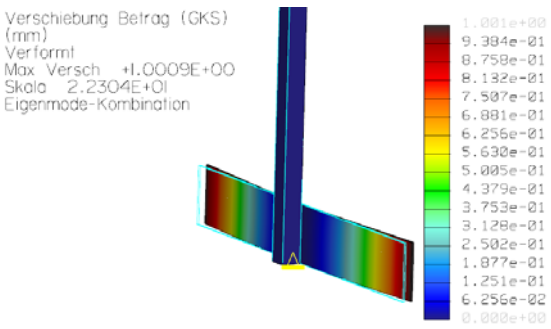

Fig. 7 – Results of modal analyse for the existing model

Fig. 8 – Mesh 3D model of the optimized version

As in the Fig. 9, a new modal analyse is running with Pro/Mechanica® and the results are shown in Fig. 10. Under the first vibratory node and a natural frequency of about 43.44 Hz, the behaviour of the structure in the studied region is much better than the original one. It can also be noticed that the value of the first natural frequencies is about 2.5 times higher as compared to the original version. The maximum displacement is now about 6.25 x 10^{-2} mm, which means that the level of the vibrations and noises is on the lowest level.

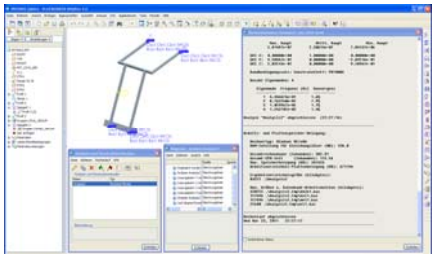

Fig. 9 – Modal analyses of the optimized frame

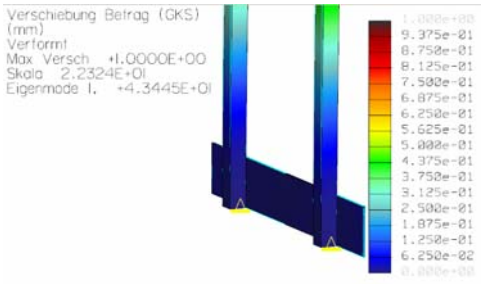

Fig. 10 – Results of modal analyse for the optimized model

5. CONCLUSIONS

Using the FEM and modal analyse, together with a shape optimization algorithm, a new shape can be designed, analysed and optimized. This application can also find applicability in the military field, for example different components of the military vehicles such as the armour plate, the vehicle body and so on, could receive a better design and a low level of noises.

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DESIGN APPROACHES OF A BIOMASS HOT AIR UNIT OPERATING A SMALL AUTOMOTIVE MOBILE MAINTENANCE FACILITY

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***Abstract**: Combustion technologies convert biomass fuels into several forms of useful energy for commercial and/or industrial uses. In a furnace, the biomass fuel converted via combustion process into heat energy. The heat energy is released in form of hot gases to heat exchanger that switches thermal energy from the hot gases to the process medium (steam, hot water or hot air). Biomass and has the advantage that it can be grown, stored and transported and although it does emit carbon dioxide when burnt, it is considered as being close to carbon-neutral because the amount of carbon emitted when it is burnt is the same as that which is absorbed during growth. It is effectively recycling the carbon and preventing consumption of carbon stored in fossil fuels. The principle of functionality is described in detail in the paper with the emphasis on the mechanical and physical aspects. It is remarkable that the absorption process of combustion gas is supported by a ventilator, a method resembling the supercharging of internal combustion engine.*

***Keywords:** Optimization, heating unit, biomass, design, automotive*

1. GENERAL VIEW ABOUT HEATING WITH WOOD CHIPS

For most owners, extremely low fuel cost is the main attraction of burning wood chips, and other biomass fuels such as sawdust and bark. There are other reasons to use biomass for energy as well. Some are the statements of good public policy, some are based on user preference for "green" energy, and others are practical.

This technology promises higher efficiency, better emissions, and easier operation when compared to cogeneration using steam boilers.

District heating is the use of a central heating plant to provide heat to many buildings, using buried pipes to distribute the energy. Wood-fired district heating is an appropriate technology for providing heat to small communities, college campuses, groups of public buildings and also a small automotive mobile maintenance unit. For example, in Scandinavia it is common to use biomass cogeneration in the central plants of community district heating systems, providing both heat for the system and power to the community.

The most common type of biomass used in heating systems is chipped wood, a by product that usually comes from sawmills. Mills have stationery chippers that chip up slabs and other green (un-dried) wood that is not suitable for lumber. Some biomass energy facilities use chips that come from harvesting operations in the woods. Mobile chippers are used to turn diseased and other "cull" logs into chips, while most of the tops and branches stay in the forest to return nutrients to the soil. These chips are blown from the chipper into delivery trucks, which deliver them to pulp and paper mills and to biomass energy users. Because chips from the woods are less uniform than mill residue chips, energy users may prefer mill chips, unless there is a significant price difference.

The third common source of biomass comes from the waste stream of forest products industries, such as furniture manufacturers. These wastes are typically dry, so they include more wood and less water per ton of biomass. Manufacturing wood wastes are often used by the plants that produce them, and are less likely to be available for purchase by energy users.

In Fig. 1 is given a comparison between heating value of different fuels and wood chips:

FUEL TYPE	HEATING VALUE
Propane	50.0 MJ/kg
Kerosene	46.5 MJ/kg
Diesel Oil	45.6 MJ/kg
Fuel Oil	43.0 MJ/kg
Natural Gas	37.3 MJ/kg
Coal	29.2 MJ/kg
Wood Pellets	19.8 MJ/kg

Fig. 1 – Heating value of different fuels

Typical household carbon emissions when using different fuels are shown in the adjoining table (Fig. 2):

Electricity	128 kg
Coal	116 kg
Oil	88 kg
Gas	67 kg
Coal/wood (50%)	58 kg
Wood	0 kg

Fig. 2 – CO_2 emissions of different fuels

Calculation of the net calorific value as received: minimum value to be stated (calculated by taking into account the selected moisture category and the typical variation of the net calorific value of dry matter at constant pressure):

$$q_{p,net,ar} = q_{p,net,d} \times \left(\frac{100 - M_{ar}}{100} \right) - 0{,}02443 \times M_{ar};$$

$q_{p,net,ar}$ = net calorific value as received, (MJ/kg);

$q_{p,net,d}$ = net calorific value (constant pressure) dry basis (MJ/kg);

M_{ar} = total moisture (w - %);

0,02443 is the correction factor of the enthalpy of vaporization (constant pressure) for water (moisture) at 25 °C [MJ/kg per 1 w-% of moisture]. Calculation formula is available in EN 14961-1.

A single cubic metre (m³) of wood chips, depending on its quality, is equivalent to approximately 330 kg of wood chip – which represents the calorific equivalent of 100 litres of heating oil.

2. PRESENTATION OF THE HOT AIR UNIT

The Technology - Wood chips boilers are relatively simple systems that are easily installed and operated. The wood chips are typically stored in a standard outdoor silo. Wood chips are delivered in trucks similar to those that deliver grain. Wood chips fuel is automatically fed to the boiler via auger systems similar to those used for conveying feed and grain on farms. The wood chips are discharged from the silo and conveyed to the boiler using automatically controlled augers set to provide the right amount of fuel based on the building's demand for heat.

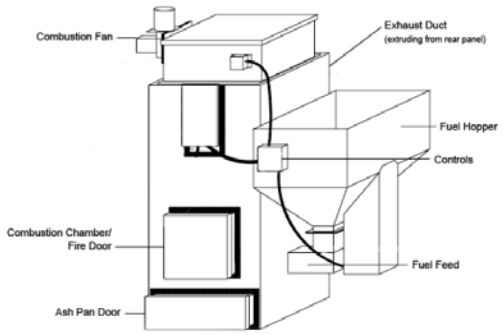

Fig. 3 – Schematic of wood chips furnace

A typical system includes a fuel storage silo with an auger system that delivers the wood chips from the silo to the fuel hopper. The wood chips are fed from the fuel hopper through the fuel feed system into the combustion chamber at a rate determined by the control settings. The combustion fan supplies air to the combustion chamber and the exhaust is ducted to the chimney through a port at the rear of the system. Ash must periodically be removed through the ash pan door.

Explanation of Components - The boiler is usually delivered completely assembled; however, some pieces, like the fuel hopper, may be removed to facilitate the installation of the boiler.

Combustion Chamber/Fire Door - The combustion chamber is where the wood chips are burnt to produce heat. It is accessible for cleaning or maintenance through the fire door.

Combustion Fan - The combustion fan provides air to the fire in the combustion chamber.

Primary Controls - The control unit allows the user to control the flow of wood pellets and combustion air into the boiler based on temperature settings. The unit also gives readings on boiler and exhaust temperatures.

Fuel Storage Silo - Wood chips fuel for the institutional - or commercial - scale market is typically delivered in bulk, where it is stored in the same type of standard outdoor silo used to hold grain or animal feed, or in silos specifically made for fuel pellets.

Fuel Hopper & Feed System - Wood chips are delivered by automatic conveyors from the storage silo into the fuel hopper. From the fuel hopper, the wood chips are delivered into the boiler through the fuel-feed system at a rate determined by the control settings.

Exhaust Duct - The combustion exhaust gases are ducted through a port at the rear of the system, which connects to either a new or existing chimney.

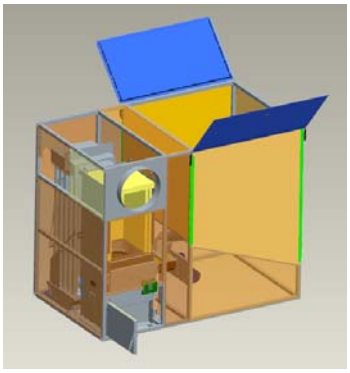

Fig. 4 – 3D model of a mobile wood chips furnace

The container construction and the built-reservoir system are compact, independent and fully automatic. The furnaces are used wherever where warm air is needed for drying processes. The high-performance boiler is produced as a stress-free welded construction. High combustion temperatures and a long furnace duration of the gases is the guarantee for a clean burning process. Furthermore, the hot air burner is for heating of buildings and greenhouses suitable. The next image (Fig. 4) presents the complete 3D model of such a wood chips furnace.

3. APPLICATION FOR THE HOT AIR UNIT

An application concerning heating of buildings is presented in the Fig. 5:

Fig. 5 – Heating of buildings with a biomass (wood chips) mobile air unit

A big fan is used to push the fresh air over the heat exchanging device. After that, warmed up, this air is going through the flexible tube and further to the room to be heated. Another exhaust fan is used to evacuate the burnt gases (CO_2 neutral exhaust gases). The unit is fully automatically controlled and can find out the moisture percentage of the wood chips and set the burning parameters.

The heating of a mobile maintenance service unit can be another application which could be done (Fig. 6). That can be placed somewhere around the world. That is why it is important to have as much as possible a relative fuel autonomy. In many cases wood chips can be provided in huge amounts and at a small price.

Fig. 6 – Heating of mobile automotive maintenance facility (rally camp)

The supply chain of the wood chips can be easily organised as compared to other fuels. For example, a mobile unit can get supplies by also using a tractor (Fig. 7):

Fig. 7 – Simplicity and efficiency of the wood chip supply chain: tractor delivering

Military application – It is known that military exercises take place in various areas, far away from the civilised area. In this case, fuel autonomy can be very useful and environmentally friendly. Fig. 8 shows a tent heating unit (outdoor):

Fig. 8 – Heating of mobile military tent

4. CONCLUSIONS

There are many reasons for using a wood pellet/wood chip boiler to heat a building/mobile maintenance unit. Apart from the fact that such systems are eco-friendly and have proven themselves in technical terms, they constitute an economically viable solution. The carbon dioxide emitted when wood fuel is burnt is the same amount that was absorbed over the previous months and years as the plant was growing. Burning wood can

be a convenient means of disposing of the waste that might otherwise be sent to a landfill site.

Briefly, the advantages of such heating solutions are: carbon neutral - extremely low carbon emissions, high efficiency, advanced control package, reduced fuel costs, compact design and mobility.

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INTEGRATION OF NONDESTRUCTIVE TESTING IN AIRCRAFTS MENTENANCE

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Introduction

In aircraft maintenance programme it is important to inspect the mechanical damage and assess the extent of the repair work. But in schedule maintenance it is a difficult to finding the defects rapidly, as the maintenance of aircraft must be accomplished within scheduled time and same to be released in time for commercial operation.

During aircraft maintenance 'NONDESTRUCTIVE TESTING' (NDT) is the most economical way of performing inspection and this is the only way of discovering defects. In simply we can say, NDT can detect cracks or any other irregularities in the airframe structure and engine components which are obviously not visible to the naked eye.

Structures & different assemblies of aircraft are made from various materials, such as aluminium alloy, steel, titanium and composite materials. To dismantle the aircraft in pieces and then examine each component would take a long time, so the NDT method and equipment selection must be fast and effective.

In the present trend of NDT application on aircraft 70-80% of NDT is performed on the airframe, structure, landing gears and the rest carried out on engine & related components.

In order to maintain the aircraft defects free and ensure a high degree of quality & reliability and as a part of inspection programme, usually following NDT methods are applied: 1)Liquid penetrant 2)Magnetic particle, 3)Eddy current 4)Ultrasonic 5)Radiography 6)Visual/Optical 7)Sonic/Resonance 8)Infrared Thermography.

Different NDT methods

The Nondestructive Test Laboratory from Flight Test Center has been recently RACR certficated in 3 methodes, that are currently integrated (implemented) in the mentenance process of aircrafts:

1. Liquid Penetrant :

Liquid penetrant testing is one of the oldest of modern nondestructive testing methods & widely used in aircraft maintenance. Liquid penetrant testing can be defined as a physical & chemical nondestructive procedure designed to detect & expose surface connected discontinuities in 'nonporous' engineering materials.

The fundamental purpose of penetrant testing is to increase the visible contrast between a discontinuity & its background.

Portable Equipment used: Penetrants materials are available in 'Aerosol spray cans' in small containers for brush or wipe application. With these aerosol can penetrant testing are performed on installed parts on aircraft's, structure.

2. Magnetic Particle :

Magnetic particle testing is a sensetive method of nondestructive testing for surface breaking and some sub-surface discontinuation in 'ferro-magnetic' materials.

The testing method is based on the principle that magnetic flux in a magnetised

object is locally distorted by the presence of discontinuity. This distortion causes some of the magnetic field to exit & re-enter the test object at the discontinuity. This phenomenon is called magnetic flux leakage. Flux leakage is capable of attracting finely divided particles of magnetic materials that in turn form an 'indication' of the discontinuity. Therefore, the test basically consists of three operations : a) Establish a suitable magnetic flux in the test object by circular or longitudinal magnetisation. b) Apply magnetic particles in dry powder of a liquid suspension; and c) Examine the test object under suitable lighting conditions for interpreting & evaluating the indications.

Portable equipment used: Electromagnet yoke (adjustable) : Suitable for inspecting irregular shaped parts for surface defects.

3. Ultrasonic nondestructive test in aircrafts

Ultrasonics plays a critical role in the inservice testing of aerospace structures. The applications can be routine or unique.

Eddy current, liquid penetrant, magnetic particle and other nondestructive test methods may be more appropriate for particular types of quality issues.

For the most part, ultrasound is best when inspecting for planar discontinuities lying parallel to the test surface. If the back surface of the object is also parallel, it simplifies the test. A EPOCH XT nondestructive high performance ultrasonic equipment is used .

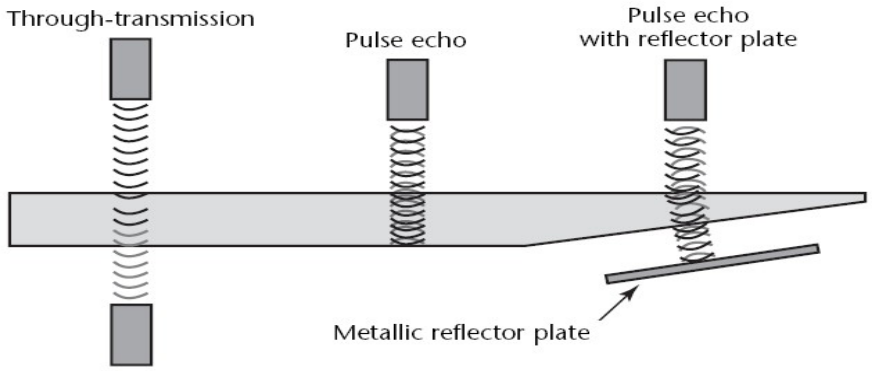


Fig. 1 Basic Ultrasonic test techniques

Therefore, airline operators require that the aircraft manufacturer provide a nondestructive testing manual with information and procedures for determining the condition of these structures. The manual supplies information about the possible locations of cracks and other service induced conditions and recommends applicable techniques for detecting them.

If the anticipated crack is on an accessible surface, test methods such as visual, liquid penetrant, magnetic particle or eddy current testing may be selected for detection. However, numerous locations throughout the structure are made up of multiple layers of detail components joined together by rivets or bolt fasteners. At these locations, it is possible for cracks to be generated in a subsurface member and go undetected until they propagate to a surface. Early detection of subsurface cracks is possible with ultrasonic and radiographic testing.

Reference Standards for Tests of Aircraft

Reference standards help establish instrument calibration and are used to ensure that particular discontinuities are detected with a predetermined sensitivity. Reference standards are used not only to facilitate initial adjustment but also to check periodically on the reproducibility of the measurement.

Testing Procedure :

For a typical ultrasonic test, the following steps are performed.

1. A reference standard is prepared for calibration.
2. The component is prepared for testing by removing loose paint and dirt.

3. The ultrasonic test instrument is set up, and the calibration standard is used to adjust controls and get a discontinuity pattern on the A-scan.
4. An appropriate couplant is selected and applied to the area of interest.
5. The test object is scanned according to detailed instructions specific to the component.
6. All indications of discontinuities are located and identified.
7. After testing, the ultrasonic equipment is withdrawn and the couplant is removed from the test surface.

Cracks detection methods implementation

Ultrasonic testing is often used on aircraft structure to detect discontinuities radiating from attachment holes in fatigue sensitive areas. Anticipated crack areas can be tested using one or more wave modes.

✓ Figures 2 and 3 show an example of a landing gear inspection; Figure 2(c) shows a standard created for this test.

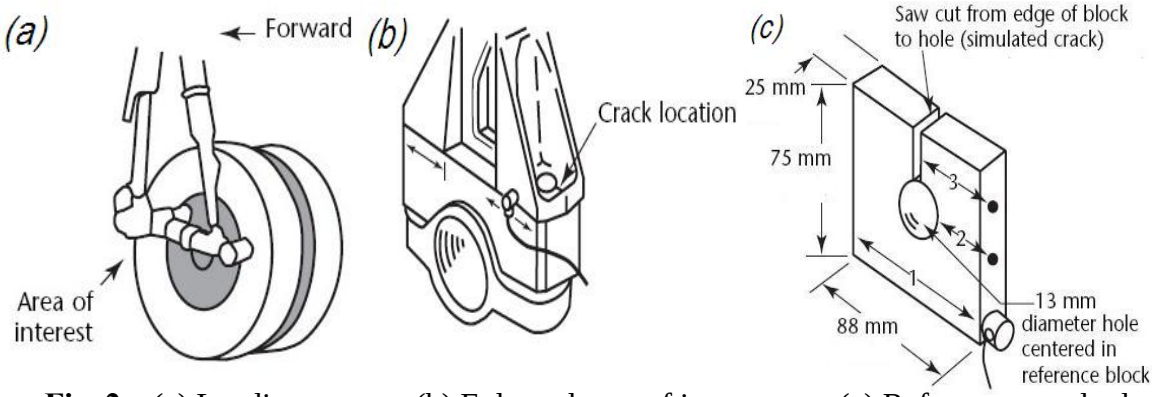


Fig. 2 (a) Landing gear ; (b) Enlarged area of interest ; (c) Reference standard .

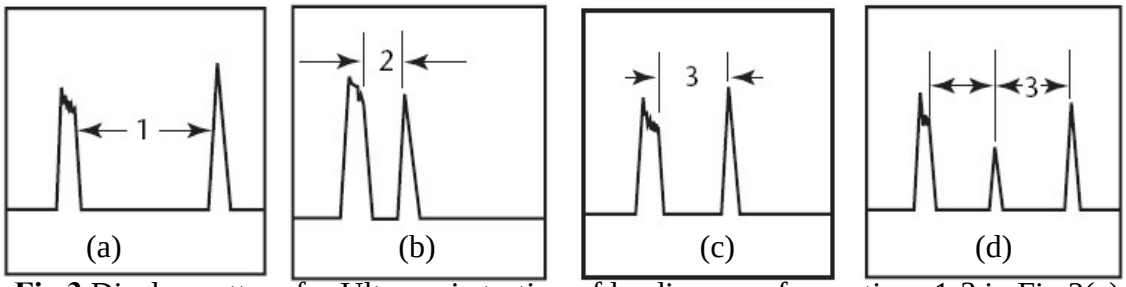


Fig.3 Display pattern for Ultrasonic testing of landing gear for sections 1-3 in Fig 2(c)

✓ Another example of Ultrasonic NDT implementation is the detection of cracks radiating from attachment holes in the curved attached fittings on the horizontal stabilizer, elevator, rudder, flap and aileron in Fig. 4.

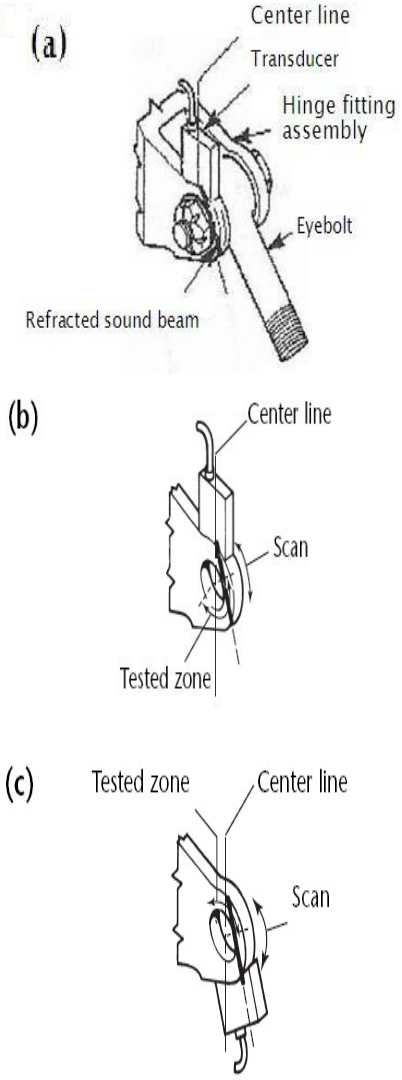
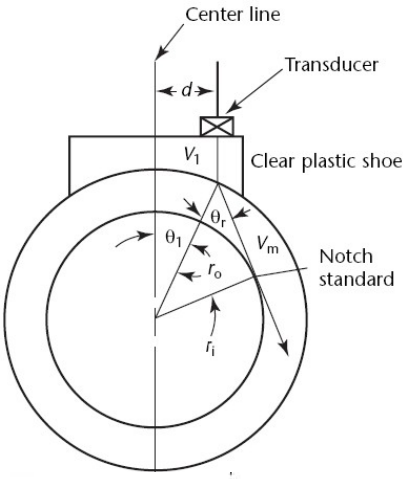


Fig. 4 Ultrasonic detection of cracks in hinge fittings: (a) test of assembly with eyebolt in place; (b) test from above; (c) test from below.

Several techniques may be used to establish the proper angle of the transducer. One of these techniques allows testing holes of different diameters with the same apparatus. The incident beam needs to be perpendicular to the axis of the hole and allow lateral movement of the transducer to achieve a refracted longitudinal wave tangential to the inner curved surface. Figure 5 shows this configuration.

Fig. 5 Transducer offset for longitudinal ultrasonic tests



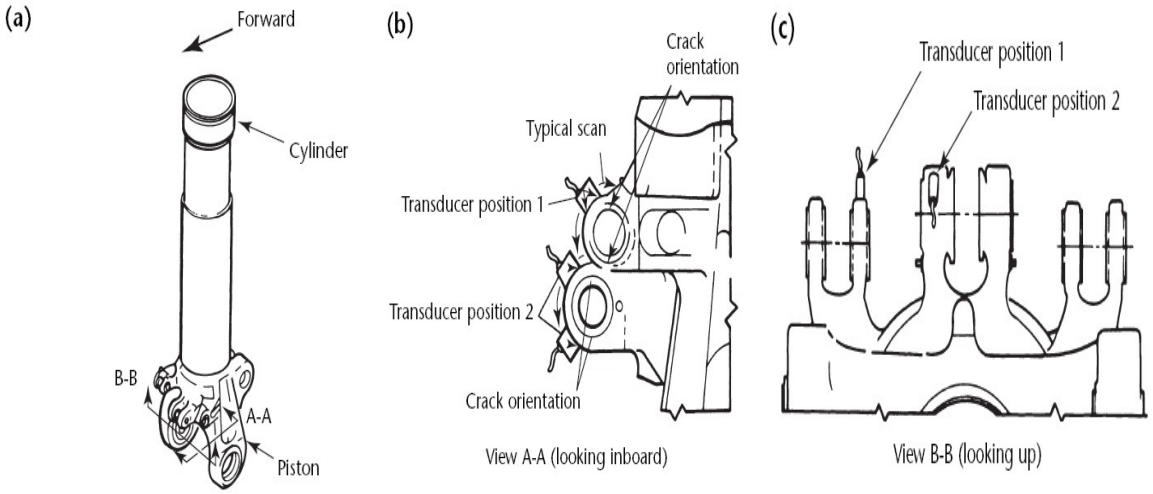
r_i = inner radius of tube or hinge (meter)
d = transducer offset from the centerline of tube or shoe (meter)
r_o = outer radius of tube or hinge (meter)
θ_1 = incident angle of beam in plastic (degree)
θ_r = desired refracted angle of the test beam (transverse θ_3 or longitudinal θ_2) for beam tangency at inside diameter surface (degree)
V_1 = velocity of sound beam in plastic offset shoe (meter per second)
V_m = velocity of sound beam in the tube or hinge (shear V_3 or longitudinal V_2) depending on critical angle (meter per second)

A clear plastic shoe must be fabricated to fit the outer radius of tire test object and to allow the transducer to move laterally in the shoe on a plane perpendicular to the center line of the shoe. The lateral motion of the transducer d within the plastic shoe effectively changes the angle of incidence and thus the angle of refraction at the curved interface.

The test object, unlike the reference standard, may have only a semicircular surface on which scanning can be accomplished. Therefore, to obtain maximum coverage around the hole, the transducer and shoe are moved around the entire curved surface in one direction and are then rotated 180 °, and the scan is completed in the opposite direction.

✓ A third example is a piston cylinder lug ultrasonic NDT inspection in which are used codes for modeling tests with a computer.

Fig.6 Ultrasonic testing of piston cylinder lugs:
(a) from side and above; (b) looking inboard; (c) from below



Such techniques use fundamental ultrasonic principles programmed into codes for modeling tests with a computer. Fig. 7 shows an example of using computer graphics to model the optimum angles. Once the geometry of the object is input into the program, the orientation of the transducer can be adjusted to peak the reflected signal.

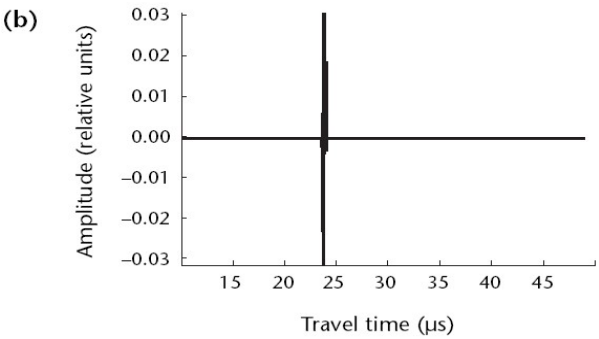
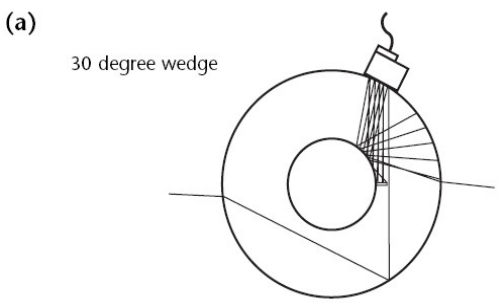
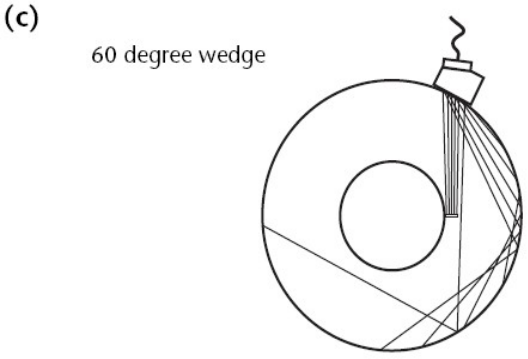
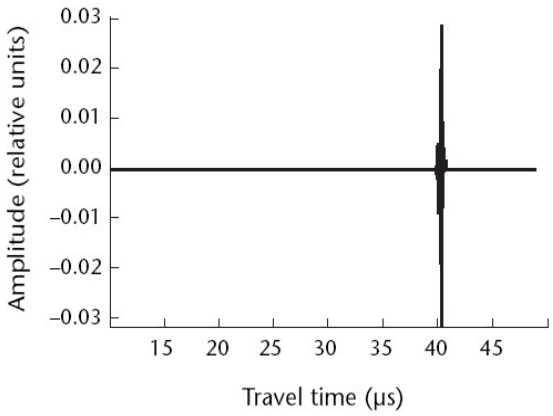


Fig.7 Computer model of ultrasonic testing: (a) 30º for longitudinal wave test; (b) longitudinal peak signal; (c) 60 º for transverse wave test; (d) transverse peak signal.





(d)



In Fig. 7, the signal is peaked for either a longitudinal wave or a transverse wave test of the object. The angles of refraction where the signals are peaked are found by changing the parameters in the model. The model also provides estimates of the timing of the reflection which are useful to aid in interpretation. In some cases, echoes may be obtained by both the longitudinal and transverse waves. The model will help determine the source and timing of these signals.

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AIMING PROCESS ALGORITHMS AND ALGORITHMS DETERMINING THE SECOND INITIAL MOMENT OF BOMB DROPPING ERROR

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Abstract: *Algorithms solving the aiming task and its precision for the already existing methods and the unified bomb dropping method are created*

Keywords: *unified method, algorithm, bomb dropping, precision*

1. INTRODUCTION

Aviation combat activity effectiveness depends on the precision of the aiming at ground and air targets task solution.

The advancement and modernization of the Aviation Aiming System (AAS) concerns the methods used to solve the aiming tasks, the algorithms and their precision, determined through the mathematical expectation and the average quadrantial aiming error.

The method of mathematical modeling used for the research and precision assessment consists of giving a math description of the aiming process, presentation of the process with algorithms and its computer modeling.

The model of the aiming process consists of the type of aircraft, the pilot, the AAS, the bomb and the atmosphere.

While choosing the quality criterion, the characteristics of the tasks to be solved and the combat use range conditions of the designed system are taken into consideration. Generally the system is optimized on the basis of the condition providing the extreme value of the average risk[2]. i.e.

$$R=M[L(У, У_{id})]=\text{extremum}. \quad (1)$$

As a quality determiner of the second initial moment of the system error is chosen:

$$\alpha_\varepsilon(t)=M[E^2(t)]=m_\varepsilon^2(t)+D_\varepsilon(t). \quad (2)$$

The necessary probability characteristics can be acquired through multiple repetition of the experiment, observation of the exit variables of the examined system and processing of the observation results. Statistical test method of dynamic models

allows nonlinear dynamic systems to be examined regardless of their complexity.

2. ALGORITHMS

In [3] a description of the existing methods used to solve the task of aiming in bomb dropping (Indication of the Fall Point – IFP and Indication of the Release Moment- IRM) is given. An algorithm of the aiming process of bomb dropping is developed on the basis of these methods.(Fig.1)

In [4] a unified method of bomb dropping aiming task has been created and is presented here.

An algorithm of the aiming process related to the unified method is developed. (Fig.3)

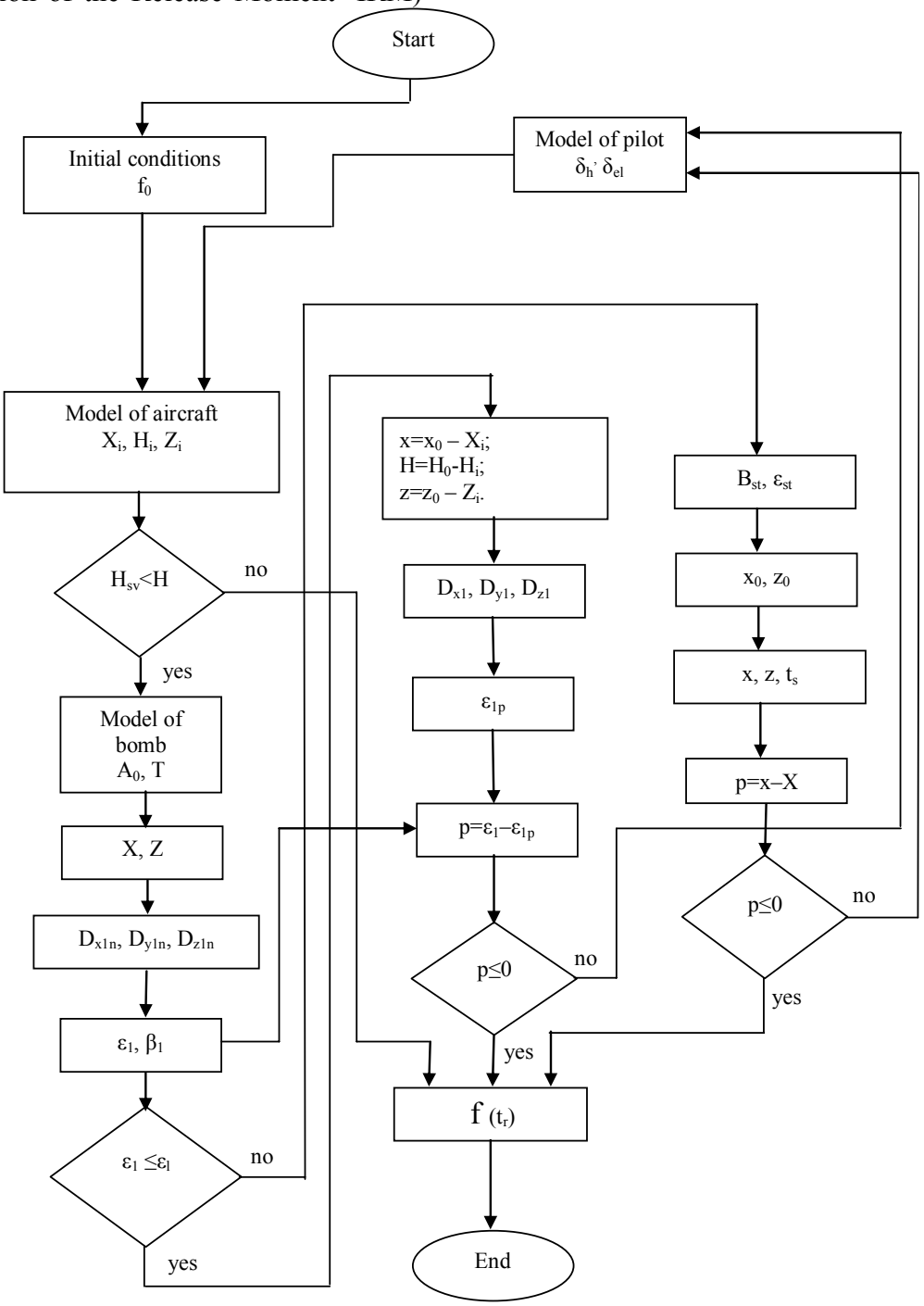

Fig.1. Algorithm of the aiming process in bomb dropping with the use of IFP and IRM

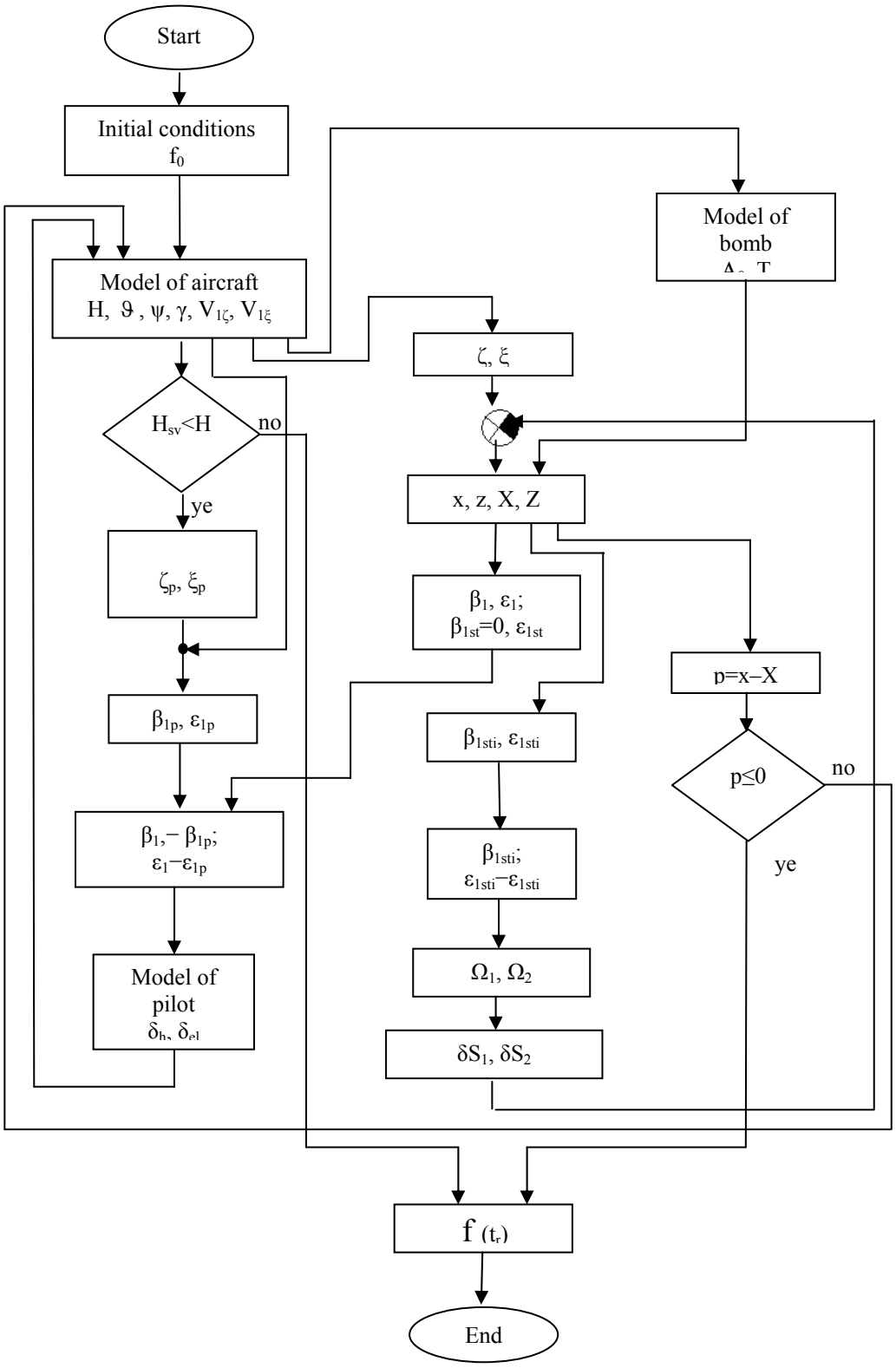

Fig.2. Algorithm of the aiming process in bomb dropping with the use of the unified method

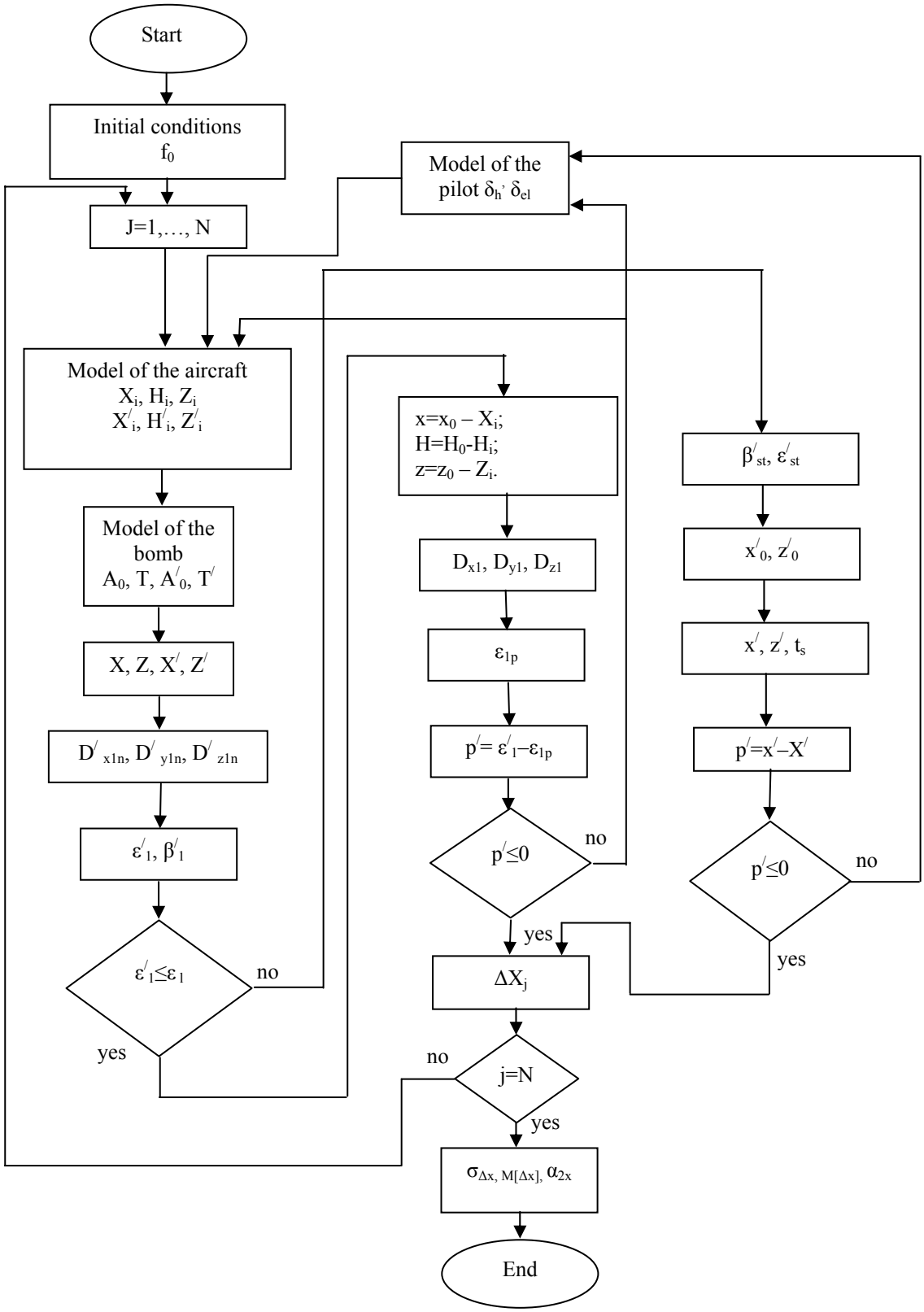

Fig.3 Algorithm for determination of the second initial moment α_{2x} of bomb dropping error with the use of IFP and IRM methods

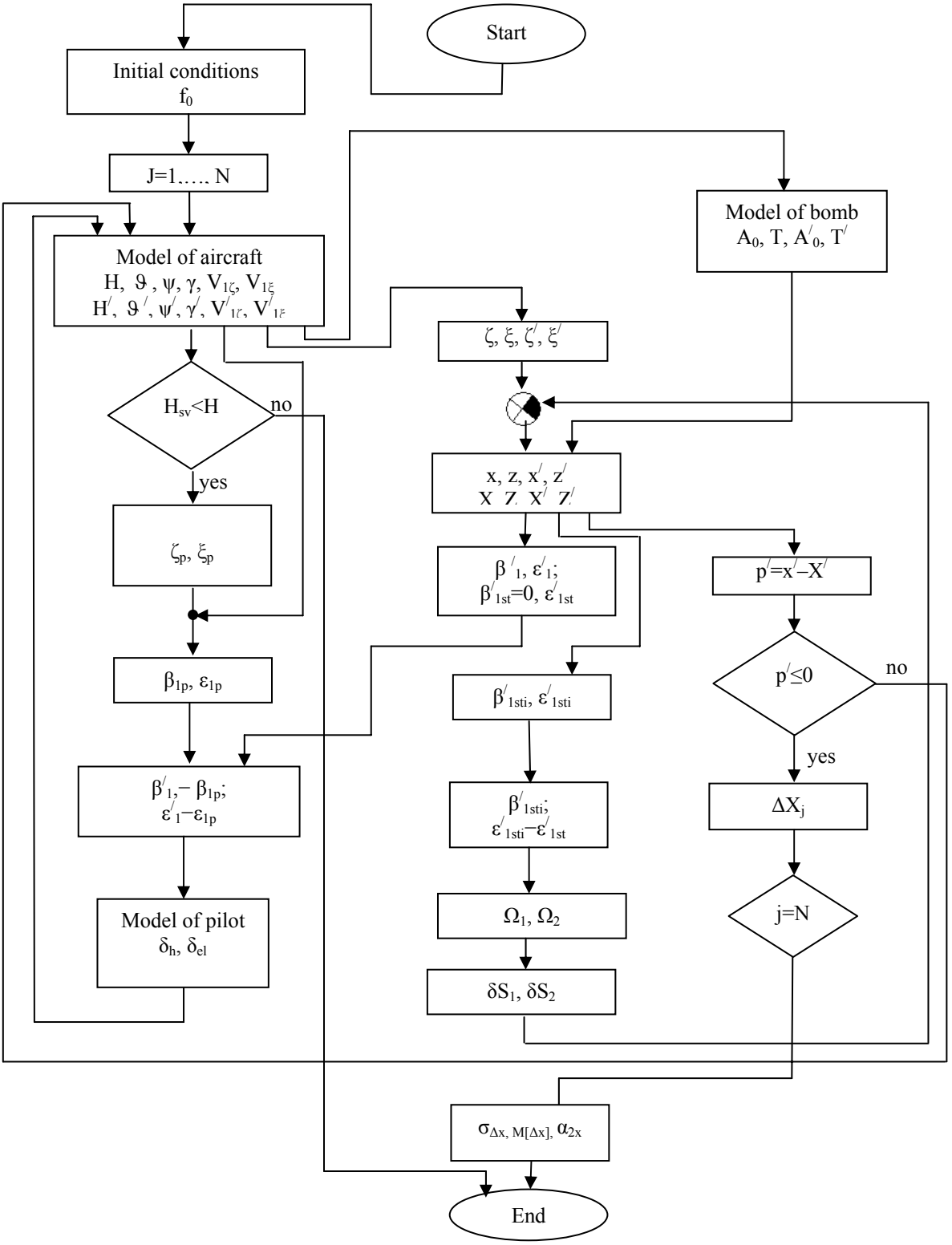

Fig 4.Algorithm for determination of the second initial moment α_{2x} of bomb dropping error with the use of the unified method

It is accepted that errors in the measurement values follow a normal law of distribution in order to determine the precision of bomb dropping. [1].

For the measured value $y_j(t)$, a random number ξ_{yj} is generated and it has a normal law of distribution with numerical characteristics $\sigma_{\xi yj}$ and $M[\xi_{yj}]$.

For time t the measured value $y'_j(t)$ is determined by the equation:

$$y'_j(t) = y_j(t) + \xi_{yj} \quad (3)$$

If IFP or IRM are used, the moment of bomb dropping is determined by the following equations:

$$p'(t) = p' = \varepsilon'_1 - \varepsilon_{1p}. \quad (4)$$

$$p'(t) = x'(t) - X'(t), \quad (5)$$

and for the unified method, the moment is expressed with the equation:

$$p'(t_п) = x'(t_p) - X'(t_p). \quad (6)$$

When $p'(t) \leq 0$ condition is fulfilled the error in bomb dropping ΔX can be determined:

$$\Delta X = x(t_p) - X(t_p); \quad (7)$$

The algorithms used to determine the second initial moment α_{2x} of the bomb dropping error for the IFP, IRM and the unified method in preset initial conditions f_0 are shown in Fig.3 and Fig.4 correspondingly.

3. CONCLUSIONS

A research on the aiming process for the different methods has been carried out; the second initial moment of bomb dropping error has been calculated (for different bomb dropping conditions) and a comparative analysis has been done on the basis of the developed algorithms.

The relative increase of bomb dropping precision (the second initial moment of error) of the unified method compared to the existing methods is between 16% and 70% in straight and level flight bomb dropping. In dive the relative increase of bomb dropping precision of the unified method compared to the precision of the existing methods is between 15% and 68%.

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THEORETICAL AND EXPERIMENTAL STUDY OF THE UNSTEADY HEAT TRANSFER IN THE BARREL WALL OF THE ARMAMENT SYSTEM

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Abstract: *In this paper it is presented a study of the unsteady heat transfer in the barrel wall of the armament system during the firing. The connection with the processes which take places inside the barrel is realized by using as input data the bore temperature and the convective heat transfer coefficient, obtained with the aid of the interior ballistics codes. The differential equation of heat conduction for a stationary, homogeneous and isotropic solid with no internal heat source was employed for the theoretical study of transient diffusion in the wall of barrel. The numerical solution of the differential equation was obtained by explicit finite difference method. The theoretical results and the experimental data are also compared.*

Keywords: *heat transfer in barrel wall of armament system, transient diffusion, mathematical model, numerical solution, explicit difference method, interior ballistic codes, specific simplifying assumptions*

1. INTRODUCTION

During the firing with armament system the temperature of barrel increases, producing several adverse effects on the overall system. The accuracy is diminished with repeated firings due to thermal distortion of the barrel. The barrel wears increases with temperature. Also, the heating of the barrel due to firing rate and the number of rounds fired can influence the thermal characteristics of the subsequent round. Knowing that the temperature is increasing during the firing with armament system, it is possible to establish a suitable firing rate, in the case of small caliber armament or the using of barrel cooling devices, in the case of large caliber armament.

Due to the complexity of heat transfer in the barrel of armament system the following assumptions are accepted:

- The armament system is supposed to have smooth barrel;
- The heat conduction in the axial direction may be neglected relative to that in the radial direction;
- The flow in direction of the inside barrel may be neglected;
- The thermal expansion of the metal barrel may be omitted;
- The metal of the barrel is stationary, homogeneous and isotropic medium;
- The density, specific heat at constant pressure and the thermal conductivity coefficient of metal are taken to be constant;
- The internal heat source does not exist.

The differential equation of heat conduction for a stationary, homogeneous and isotropic solid with no internal heat source was employed for the theoretical study of transient diffusion in the wall of the barrel. The

numerical solution of the differential equation with initial and boundary conditions was obtained by explicit finite difference method.

The connection with the processes which take places inside the barrel is realized by using as input data the bore temperature and the convective heat transfer coefficient, obtained with the aid of interior ballistics codes.

The theoretical results were compared with experimental data in the case of the 76, 2-mm caliber armament system.

2. THE MATHEMATICAL MODEL

The mathematical modeling of heat conduction is realized with the aid of fundamental equation of thermal conductivity

$$\rho c_p \frac{\partial T}{\partial t} = k\Delta T + f(x, y, z, t) \qquad (1)$$

where:

ρ - The density of metal [kg/m^3];

c_p - The specific heat at constant pressure of metal [J/(kgK)];

k - The thermal conductivity coefficient of metal [J/(msK)];

Δ - The Laplace operator;

$f(x, y, z, t)$ - The heat source density in every point of metal, at a certain moment;

T - The temperature of metal [K];

t - The time [s];

x, y, z - The Cartesian coordinates.

Taking into account the previous assumptions, the differential equation (1) becomes

$$\frac{\partial T}{\partial t} = a \frac{\partial^2 T}{\partial x^2} \qquad (2)$$

where $a = k/(\rho c_p)$ is the thermal diffusivity.

In cylindrical coordinates r, φ, z, the differential equation (2) is written

$$\frac{\partial T}{\partial t} = a\left(\frac{\partial^2 T}{\partial r^2} + \frac{1}{r}\frac{\partial T}{\partial r}\right), \qquad (3)$$

where r is radial coordinate.

For the numerical integration of equation (3) the following limit conditions (initial and boundary conditions) are used:

- The initial condition at a z given:

$$T(r,0) = T_a,\ t = 0,\ r_i \le r \le r_e; \qquad (4)$$

- The boundary conditions:

a. At the inner wall of the barrel:

$$-k\frac{\partial T}{\partial r} = h_g\left(T_g - T\right);\ t > 0;\ r = r_i; \qquad (5)$$

b. At the outer wall of the barrel:

$$k\frac{\partial T}{\partial r} = 0;\ t > 0;\ r = r_e, \qquad (6)$$

where:

T_a - The ambient temperature of the atmosphere;

r_i - The radial coordinate at inner wall of the barrel;

r_e - The radial coordinate at outer wall of the barrel;

T_g and h_g - The cross-sectional average temperature of the powder gases inside the barrel at time t and displacement z, irrespective, the coefficient of heat transfer.

The values of T_g and h_g are obtained with the aid of interior ballistics codes which are elaborated on the basis of mathematical models of the core flow and the flow in boundary layer inside the barrel during the ballistic cycle.

3. INTEGRATION OF THE MATHEMATICAL MODEL

Taking into account the differential equation (3), the initial condition (4) and the boundary conditions (5) and (6), the variation of temperature in the barrel wall during the ballistic cycle can be determined by solving the equations system:

$$\frac{\partial T}{\partial t} = a\left(\frac{\partial^2 T}{\partial r^2} + \frac{1}{r}\frac{\partial T}{\partial r}\right); \qquad (7a)$$

$$T(r,0) = T_a; \qquad (7b)$$

$$k\frac{\partial T}{\partial r} - h_g\left(T_g - T\right) = 0; \qquad (7c)$$

$$\frac{\partial T}{\partial r} = 0. \qquad (7d)$$

It is difficult to have the exact solving of this equations system because the coefficient of the heat transfer h_g and the cross-sectional average temperature of the powder gases inside barrel T_g are magnitudes which vary during the ballistic cycle.

The numerical solving of the system (7) can be realized by approximation of partial differential equations with finite difference formulas.

With the following notations:

δt - The time increment for calculation of temperature profile;

δr - The radial distance between two adjacent nodal points,

and $A = \dfrac{a\delta t}{(\delta r)^2}$,

the equation (7a) in finite difference is written

$$\frac{T_{m,n+1} - T_{m,n}}{\delta t} = a\left(\frac{T_{m+1,n} - 2T_{m,n} + T_{m-1,n}}{(\delta r)^2} + \frac{1}{r}\frac{T_{m+1,n} - T_{m-1,n}}{2\delta r}\right) \quad (8)$$

or

$$T_{m,n+1} = A\left(1 - \frac{\delta r}{2r}\right)T_{m-1,n} + (1-2A)T_{m,n} + A\left(1 + \frac{\delta r}{2r}\right)T_{m+1,n}, \quad (8')$$

It is observed that it is necessary to impose a positive condition for the second term from the right part of the equation (8'), so

$$1 - 2A = 1 - \frac{a\delta t}{(\delta r)^2} > 0. \quad (9)$$

From relation (9) it is obtained the condition for the time increment δt, namely

$$\delta t < \frac{(\delta r)^2}{a}. \quad (10)$$

The equations (7c) and (7d) in finite difference become:

$$k\frac{T_{m+1,n} - T_{m-1,n}}{2\delta r} - h_g\left(T_g - T\right) = 0; \quad (11)$$

$$\frac{T_{m+1,n} - T_{m-1,n}}{2\delta r} = 0. \quad (12)$$

At the inner wall the of barrel ($r = r_i$), the relation (8') becomes

$$T_{0,n+1} = A\left(1 - \frac{\delta r}{2r}\right)T_{-1,n} + (1-2A)T_{0,n} + A\left(1 + \frac{\delta r}{2r}\right)T_{1,n}. \quad (13)$$

From relation (11), written at the inner wall of the barrel, it is obtained

$$T_{-1,n} = \frac{2\delta r h_g}{k}\left(T_g - T_{0,n}\right) + T_{1,n}. \quad (14)$$

If it is taken into account the relation (14), then relation (13) becomes

$$T_{0,n+1} = A\left(1 - \frac{\delta r}{2r}\right)\left[T_{1,n} + \frac{2\delta r h_g}{k}\left(T_g - T_{0,n}\right)\right] + (1-2A)T_{0,n} + A\left(1 + \frac{\delta r}{2r}\right)T_{1,n} \quad (15)$$

or

$$T_{0,n+1} = \left[1 - 2A - \frac{2A\delta r h_g}{k}\left(1 - \frac{\delta r}{2r}\right)\right]T_{0,n} + 2AT_{1,n} + \frac{2A\delta r h_g}{k}\left(1 - \frac{\delta r}{2r}\right)T_g. \quad (15')$$

At the outer wall of the barrel ($r = r_e$), the relation (8') becomes

$$T_{NN,n+1} = A\left(1 - \frac{\delta r}{2r}\right)T_{NN-1,n} + (1-2A)T_{NN,n} + A\left(1 + \frac{\delta r}{2r}\right)T_{NN+1,n}. \quad (16)$$

From relation (12), written at the outer wall of barrel, it is obtained

$$T_{NN+1} = T_{NN-1}, \quad (17)$$

where NN is number of nodal points.

If it is taken into account the relation (17), than the relation (16) becomes

$$T_{NN,n+1} = 2AT_{NN-1,n} + (1-2A)T_{NN,n}. \quad (18)$$

With the aid of relations (8'), (15') and (18) it is possible to calculate the temperature in wall of the barrel for a time increment δt.

4. RESULTS

On the basis of relations (8'), (15') and (18) it was elaborated a computer code which provides the temperature profile in the wall of the barrel.

In Fig. 1 there are presented the curves of temperature variation for different moments of time (t_1=0.0024s; t_2=0.0048s; t_3=0.0072s; t_4=0.0096s; t_5=0.012s, t_6=0.0144s; t_7=0.1681s; t_8=0.0168; t_9=0.0192; t_{10}=0.0216s) in the wall of the barrel at the first firing.

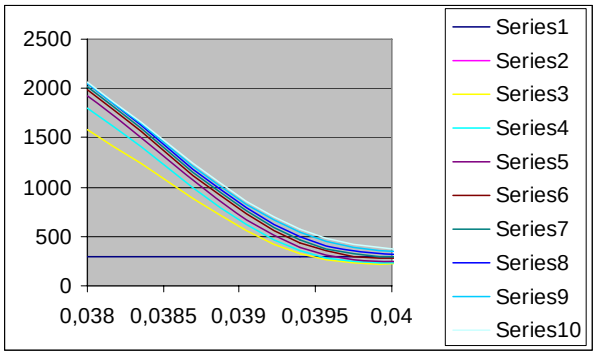

Figure 1 Repartition of temperature in wall of the barrel

In Fig. 2 there are shown the variation of temperature at inner and outer wall of barrel in function of time.

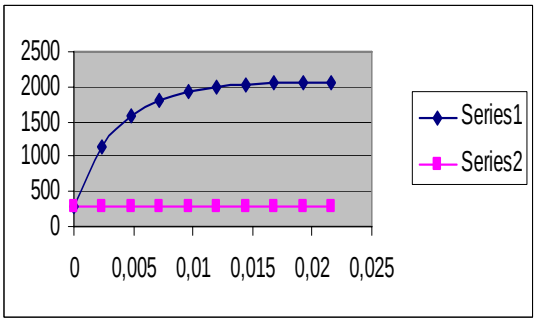

Figure 2 Variation of temperature at inner and outer wall of the barrel versus time

From Fig. 2 it is observed that the temperature at inner wall of the barrel increases rapidly at beginning of ballistic cycle, reaching approximately 90% from its maximum value. After this moment, the temperatures at inner wall of the barrel increase slowly although the temperature of the outer layers of barrel wall continues to increase. In the case of a single round, i. e. for very short time, the outer surface of the barrel wall does not succeed to increase too much the temperature.

If more rounds are fired, the temperature of inner surface of the barrel wall will increase. The history of temperature increasing in this case in the inner surface of the barrel wall, accepting the assumption that next round is fired immediately, is presented in Fig. 3.

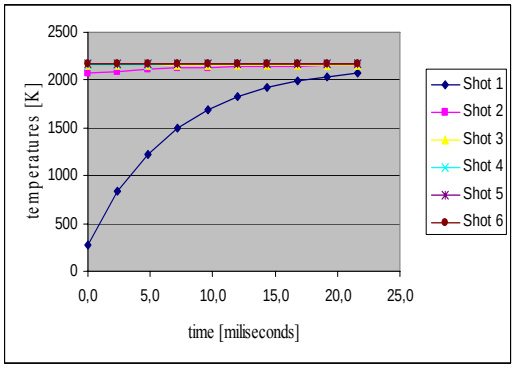

Figure3 The history of temperature increasing in the inner surface of the barrel wall

5. CONCLUSIONS & ACKNOLEWLEDGMENT

5.1 The theoretical results. The validation of the mathematical model of the unsteady heat transfer in the barrel wall of the armament system is made by the comparison of the theoretical results for the temperatures of the outer surfaces of the barrel of an existent gun with the experimental data measured in the case of the same gun.

The theoretical results are those provided by the computer code elaborated on the basis of the relations and equations included in this paper. The experimental data have been collected by measurements at the firing place.

5.2 The experimental data. The experimental data are the temperatures of the outer surfaces of the 76, 2 mm caliber barrel, information gathered during the firing of the 6 rounds in the firing place. The pyrometers Micronics OS 524 E type was used for

measuring the outer surface barrel gun (Fig. 4).

Figure 4 The pyrometers Micronics OS 524 E type

This no contact thermometer measures the surface temperature without touching it and it determines the value of temperature on the basis of the infrared radiation (IR) of an object. The captured radiation intensity depends on the temperatures of the surface and the emissivity of the material (barrel steel).

The basic procedure for temperature measuring consists of aiming the thermometer at the target and touching the trigger. On the basis of all carried out settings the display shows the current temperature value.

Due to the safety measures taken in the firing place, the temperatures of the outer surface barrel were measured before gun loading and after firing each shot.

Simultaneously, the main internal ballistic data such as firing such as: maximum pressure values and the projectile velocity values were measured for each round.

In Table 1, the experimental data are presented.

No. of round	Velo-city at the muzzle of barrel [m/s]	Maxi-mum pressure Kgf/cm^2]	Tempe-ratures [K] **before** firing / **after** firing	Time bet-ween firings [sec.]
1	662,8	2315	278 289	-
2	672,4	2344	288 298	140
3	671,7	2349	296 306	141
4	657,9	2307	305 314	125
5	667,5	2319	313 321	139
6	673,7	2297	320 328	123

Table 1. The experimental data

On the basis of the experimental data presented in Table 1, Figure 5 was drawn.

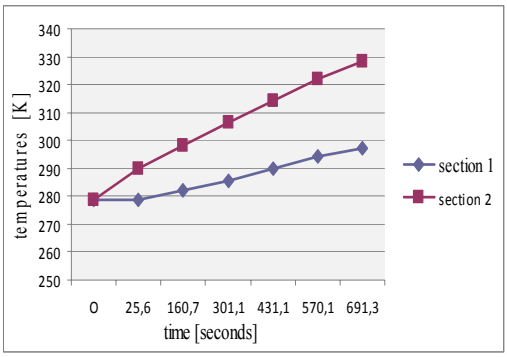

Figure 5 The history of temperatures on the outer surfaces barrel on the two sections

5.3 The comparison between the theoretical results and the experimental data. In order to validate the mathematical model for unsteady heat conduction in the barrel wall of the artillery system, the theoretical results and the experimental data are compared.

In Table 2 are presented the theoretical results and experimental data referring to the temperatures of the outer surface on the section 2 of the barrel, after firing.

No of round / details	Temperatures [K]					
	1	2	3	4	5	6
Section 2						
Experi-mental data	289	298	306	314	321	328
Theore-tical results	278	278	278	278	278	278,1
Diffe-rences [%]	3,9	7,1	9,1	11,4	13,6	15,2

Table 2. The experimental results and theoretical data

5.4 Conclusions. According to Table 2, the differences between the theoretical results and the experimental data and presented are small, this allowing the validation of the mathematical model of the unsteady heat conduction in the barrel wall of the armament system.

Those differences are generated both by the external conditions of the firing place and by the assumptions taken on the beginning of the mathematical modeling. Thereby:

- The procedure used for temperatures measurement is different from the calculation process of the barrel wall temperatures. In the calculation process, the input data for the current firing are the same with the exit data for the previous firing. That fact reduces very much the time for the heat transfer in the barrel;

- The simplifying assumptions at the beginning of the mathematical model contribute to removing from the real phenomenon of the heat transfer in the barrel wall of the armament system. According to one of these assumptions, there is not heat transfer from the outer surface of the barrel to the surrounding medium. Actually, at the level of the outer surface, the free convection and the external radiation of heat are the same order.

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4.3 MATERIALS AND TECHNOLOGY

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STUDY ON THE INFLUENCE OF MECHANICAL VIBRATIONS ALLOYS PROPERTIES

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***Abstract**: In this paper are presented the effects that occur during crystallization of alloys under the influence of mechanical vibrations.*
Because the decrease of viscosity and surface tension, if mechanical vibration is applied on cast alloy, it can be observed dynamic effects that cause a significant increase in the fluidity of alloys, although in terms of vibration intensifies heat transfer.
Advantages of mechanical vibration on the alloys can be: reduction of internal tensions, eliminate non-metallic inclusions, increase flow and reduce segregation alloys.

Keywords: *vibration, oscillation, mechanicals, alloy, effects.*

Introduction

Increased chemical purity, the phase composition and structural steel is one of the most important current problems of design and casting practice, knowing that the operational behavior of the steel depends on the shape, distribution and nature of inclusions segregation.

It is known that alloys containing significant amounts of non-metallic inclusions that lower than mechanical and operating properties of parts produced.

Inclusions present in the alloy solidified metal from forming impede flow, structural defects affect the distribution and movement of dislocations.

Multiple factors are affecting quality and manifested throughout the development process, casting, solidification and deformation in the hot and cold.

1.1 Physical processes occurring in vibrating mechanical alloys.

1.1.1 Action of impulse forces.

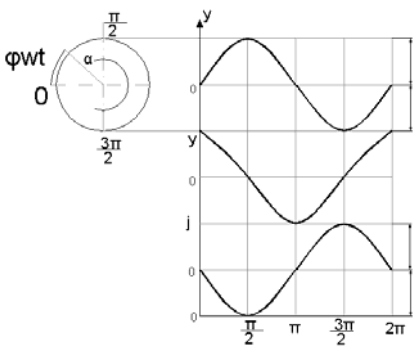

Fig.1 The correlation between trajectory, velocity and motion acceleration in the case of sinusoidal oscillations.

Applying forced harmonic oscillations (center of gravity moving an alloy after a sinusoidal law of mass m, acceleration j changes its meaning to each period of oscillation (fig.1) in the liquid alloy leading to the emergence of two alternative y1 and inertial forces y2 height equal but opposite sign:

$$y_1 = -m \cdot \left(-a \cdot w^2 \cdot \sin(\varphi)\right) = m \cdot j$$
$$y_2 = -m \cdot \left(a \cdot w^2 \cdot \sin(\varphi)\right) = -m \cdot j$$

Taking into account the force G = mg, G_{EF} actual weight will change over time, according to the relation:

$$G_{ef} = m \cdot (g \pm j) = m \cdot (g \pm a \cdot w^2 \cdot \sin(\varphi))$$

If $j = j_{max} = g$, the force acting in the liquid alloy is highest in the first half period, resulting in the following optimal correlation between the amplitude and frequency.f - frecvența de oscilație

1.2 Macroscopic mass transfer

If mounted at the bottom of the cavity shape of a vibrating rod whose front surface comes into direct contact with the liquid alloy, melt movement comes with $j > g_f$.

Macroscopic mass transfer depends on the correlation between parameters a and f taking place in areas II and III, not the field I (Fig. 2) when the alloy is independent of the vibrating rod. In zone III separation occurs equal to 0 while in the second separation is made for:

$$\varphi \in \left(0, \frac{\pi}{2}\right)$$

1.3. Phenomena of cavitation.

Under the action of mechanical oscillations of the alloy is moving the flow Reynolds criterion imposed by the expression of which involved the vibration amplitude and frequency.

Cavity occurs when the relative velocity between fluid and crystal is larger than a critical speed.

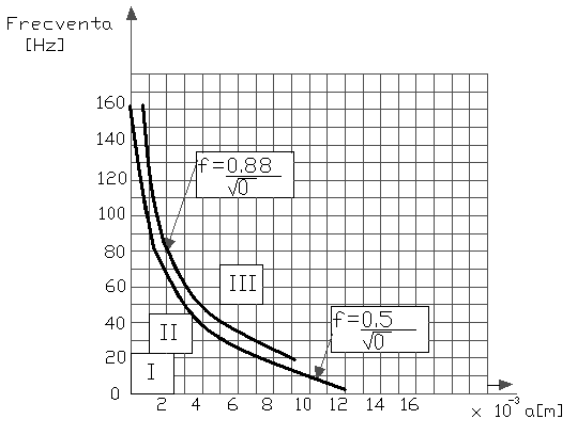

Fig.2 Vibration macroscopic effect on mass transfer

On the other hand, high speed travel of the liquid alloy cavitation process can occur outside the boundaries of the crystal. Following the destruction of cavitation bubbles, the gas within it is compressed nearly adiabatically. It produces an implosion that has the direct effect of a significant increase in local pressure, accompanied by crushing the crystal growth process.

1.4. Size of the degree of sub cooling

By vibrating the liquid alloy increases the coefficient of convective heat exchange, resulting in size criterion value and thus increase the heat transfer. Fragmentation of

crystals on the surface of the solidification front is an effect of vibration.

At the same time the transfer of heat from the crust solidified alloy intensifies.

Thermal analysis shows that under these conditions during the solidification conditions increase and improve the appearance and development of solid phase.

1.5. Changing conditions of equilibrium solid – liquid

Changing conditions of equilibrium solid - liquid crystal affect the appearance. So, for each pressure there is a temperature of solidification, the solidification started or well established. Variation of temperature with pressure is given by the Clausius - Clapeyron:

$$\frac{dT}{dp} = \frac{Ts(V_L - V_S)}{\Delta Hs}$$

where:

VL - VS - is the difference in volume contraction due to the passage of fluid in the solid alloy. If VL - VS> 0 (the case of steel and ferrous alloys) where dT / dp> 0, increasing pressure increases the temperature of solidification and conditions appear favorable for germination crystals.

Vibrations affect the surface tension Inter phase messengers - liquid downwards, leading to a decrease in minimum radius of the nuclei on which they remelt but is no longer a development process.

2.1 Technology Effects

2.1.1 Homogenization and finishing structure

Due to vibration, nascent dendrites break and fragments are made by natural convection currents or vibrations in the body of alloy. It creates favorable conditions for the emergence of many small crystals and preventing columnar macrostructure development of the area. Increasing the cooling rate as a result of vibration, leading to pronounced finishing solidification structures.

2.1.2 Size capacities cast materials

Get a compact cast material is provided if the rate of penetration of the alloy in the area of capillary channels is equal to the speed biphasic contraction. Following experimental research found that applying vibration during casting results in considerable increase capacities material to fill the cast and rigorous form.

2.1.3. Degassing alloys

In order to form an alloy in the form of distinct separation, gas pressure must be equal to or greater than the total pressure:

$P_t = P_{at} + pgH + 2\sigma/r$

where:

P_t – total pressure;

P_{at} – atmospheric pressure;

pgH – metal-static pressure;

$2\sigma/r$ – pressure caused by surface tension;

r – radius of gas bubble

After training, the rate of gas separation is given by Stokes law. Under the action of vibration has been a decrease in surface tension σ and viscosity along with an increase in the volume of bubbles, creating favorable conditions for their training and lifting gas separations.

2.1.4 The reduction of internal stress.

The most dangerous tensions that can arise from thermal cooling are tensions, both because of their higher values and difficulties of returning to their occurrence.

Mechanical vibrations reduce the temperature differences on sections of walls resulting in lower parts of the developing trend of internal stress.

2.1.5 Reducing segregation.

Macro segregation reduces vibration phenomena by increasing the solidification rate as a result of intensification of heat transfer to form capillary channels and through the two-phase segregation.

Layers are destroyed at the limit between the solid and the liquid which causes a reduction in intensities micro segregation processes.

2.1.6 Increased flow capacity of the alloy.

Due to the decrease of viscosity and surface tension, if applied mechanical vibration on cast alloy, one can observe dynamic effects that cause a significant increase in the fluidity of alloys, although in terms of vibration intensifies heat transfer.

Theoretical analysis of the influence of vibrations on the flow capacity of the alloy can be made taking into consideration of Fig. 3:

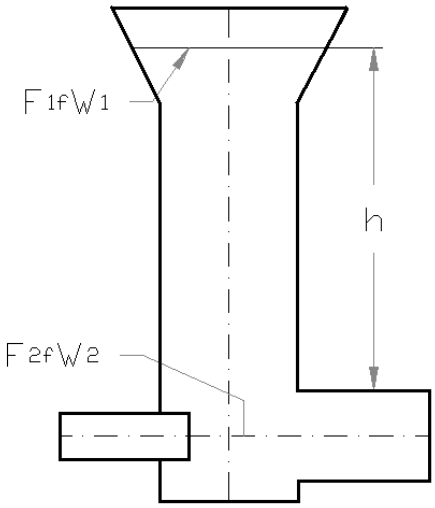

Fig. 3. Alloy flow under the influence of vibrations

From these equations it follows that the vibrations increase the flow velocity and flow of the alloy by decreasing the surface tension

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DEGRADATION OF MECHANICAL PROPERTIES OF ARMOURED STEELS AFTER ITS WELDING

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Abstract: *The paper deals with welding process of ARMOX armoured steels. The steels are sensitive on temperature above 200°C due to their thermo-mechanical processing. The paper describes the level of degradation of mechanical properties and also changes in microstructures that are the reason of degradation at welding of those steels.*

Keywords: *armour steels, ARMOX, welding, mechanical properties, tensile strength, termo – mechanical processing*

1. INTRODUCTION

The most known and most widely used steel armory plates are ARMOX steels by Swedish company SSAB Oxelosund. The steels have lean chemical composition which simplifies welding. Carbon equivalent (1) of these steel is relative low (0.6-0.7), therefore they have very good weldability.

$$CEV = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}[\%] \quad (1)$$

However, their welding is problematic due to heat influence during welding process. Armox steels have high strength, hardness and good toughness. The steels acquire these specific properties by application of thermo-mechanical treatment (TMT) and therefore the producer recommends do not exceed the temperature circa 200°C during their secondary processing as is welding. The high temperatures appeared during welding process leads to uncontrolled temperation and then to the degradation of mechanical properties level. Submitted paper study the level of the degradation of mechanical properties during welding process of selected ARMOX steels.

2. MATERIAL AND METHODS

Armoured steel ARMOX 500 is used for experiment. Its basic characteristics are shown in the table 1.

Tab. 1 Chemical composition and mechanical properties of ARMOX 500 [1]

Chemical composition [wt. %]	C	Si	Mn	P	S
	0.32	0.1-0.4	1.2	0.015	0.010
	Cr	Ni	Mo	B	
	1.0	1.8	0.7	0.005	
Mechanical properties	Tensile strengh R_m [MPa]	Yield strength $R_{p0.2}$ [MPa]	Impact energy KU[J]	Hardness HBW	Elongation A_5 [%]
	1450 - 1750	min. 1250	25	480 - 540	8

The shape of experimental samples with and without weld joint is designed according to STN EN ISO 6892 – 1 standard. Welded joint is situated in the middle of the weldment in compliance with STN EN 895 (fig. 1).

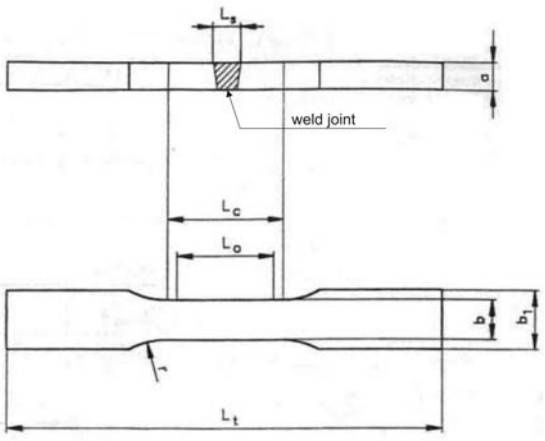

Fig. 1 Experimental specimen (a=4 mm, b=10 mm, L_0=40 mm)

Experimental specimens are cut by three various types of cutting technologies – plasma cutting, laser cutting and water jet cutting. One of experimental topics is the influence of used cutting technology on the final mechanical properties of the studied steels. The influence of cutting method choosing on the basic ARMOX material is described in [2].

Experimental specimens are welded using Metal active gas method (MAG). Thermanit X is used as a welding consumable (18 Cr/8 Ni). Protect atmosphere consist of 80 % Ar and 20 % CO2. Detailed information about welding parameters is shown in the table 2.

Tab. 2 Welding parameters

Weld method	Type of w. joint	W. position
MAG	BW (flat)	PA

Weld bead no.	Weld. consum.	Current [A]	Voltage [V]
1	Ø 1,0	145-155	27-29
2	Ø 1,0	145-155	27-29
3	Ø 1,2	160-260	18-26

3. EXPERIMENTAL RESULTS

All experimental samples were examined by tensile strength test (STN EN ISO 6892-1). Testing device Instron 5500R with automatic evaluation of mechanical characteristics (Tensile and Yield strength) is used. Results of tensile strength test are presented in table 3. The results from every presented alternative are average of ten measurements.

Tab. 3 Experimental results

Type of Armox steel	Cutting method	Yield strength $R_{p0,2}$ [MPa]	Tensile strength R_m [MPa]
500 T	Plazma	1359,60	1539,90
500 T	Laser	1392,68	1579,15
500 T	Water jet	1422,09	1614,32
500 T weldment	Plazma	593,82	614,65
500 T weldment	Laser	818	837,35
500 T weldment	Water jet	750,56	772,60

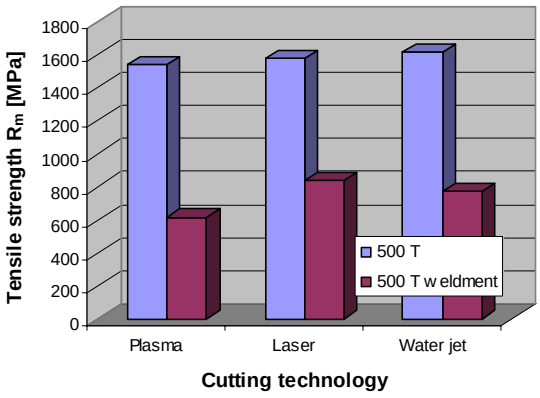

Fig. 2 ARMOX 500 - Yield strength of basic and welded material

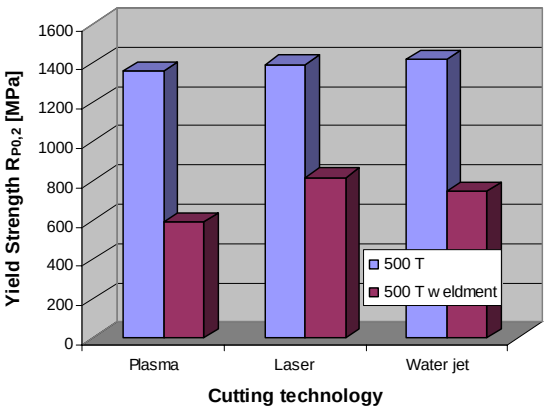

Fig. 3 ARMOX 500 - Yield strength of basic and welded material

Comparisons of all variants between weld and basic materials bring those results:
Yield strength ($R_{p0,2}$) decreases about 44% in the case of plasma cutting, about 42% in the case of laser cutting and about 45% in the case of water jet cutting. Decreases are almost equal; therefore cutting method has no influence on the yield strength level.

The highest decrease of tensile strength (R_m) indicates the alternative with plasma cutting, where the decrease is about 60%. The decrease is about 47% in the case of laser cutting and about 52% in the case of water jet cutting. Significant decrease of R_m at variant with plasma cutting means that affection by heat is so high to appear even after welding application (in contrast to other two cutting technologies).

3. INFLUENCE ON MICROSTURCTURE

The reason of degradation of mechanical properties during ARMOX 500 steel welding are changes in microstructure. The original (un-affected) microstructure is shown on fig. 4 and it consists of very fine-grained heterogeneous sorbitic structure obtained as a result of thermo – mechanical treatment.

This structure provides high strength, toughness and hardness required from this kind of steels.

Fig. 4 Mictrostructure of base material (ARMOX 500), 500x

Fig. 5 Microstructure of HAZ (area close to weld metal), 500x

Fig. 6 Microstructure of HAZ (area close to base material), 500x

The microstructure of heat-affected zone (HAZ) is absolutely different in comparison to microstructure of basic material. There is shown the microstructure of HAZ area close to welding metal. It consists of very coarse martensitic needles (fig. 5).

The needles became finest sequentially in areas farther from weld metal, but structure still remains martensitic (fig. 6).

Too much martensite and especially big coarse martensitic needle leaves HAZ area of steel brittle. In this case is the degradation effect bigger because of un-wanted change of microstructure deliberately obtained by thermo-mechanical processing.

3. CONCLUSIONS

Decrease of both mechanical properties (Rm and Rp0,2) is obvious at welding joints. The most weak place of welding joint is the weld metal where all of experimental specimens is broken. The level of decrease is in relation to the used welding consumable properties.

The study of microstructure of heat-affected zone brings detailed information about affection of ARMOX steels by welding process. Heat affection changes fine-grained sorbitic microstructure obtained by thermo-mechanical treatment to worse one, mostly consisted of coarse martensitic structure.

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METHODS OF INVESTIGATING AT A NANO-LEVEL THE SURFACES OF METALLIC MATERIALS IN LIQUID ENVIRONMENTS

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Abstract: *The final aim of the research presented in this article is to present some investigation methods of metallic surfaces in liquid environments. It has also taken into consideration preventing unwanted phenomena by first investigating surfaces at a nano – scale through technologies like Atomic Force Microscopy.*

Keywords: *investigating, metallic materials, Atomic force microscopy.*

1. INTRODUCTION

During the scanning process, the scanning area is initially set at step 1 by Xmin, Ymin, Xmax and Ymax values. The scanning is automatically performed by the program row by row. The scanning path is demonstrated in figure 1.

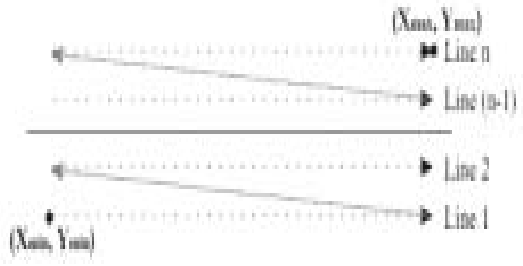


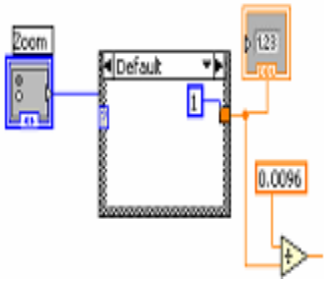
Fig. 1 Scanning Path

If the zooming function, is not chosen the default steps in x and y directions are incremented by 0.0096 V. The following zoom options that are available in the program can be seen in figure 2 (b). The user can select the value before running the program, but it cannot be changed while the program is running.

The front panel and the block diagram used to set zooming are shown in figure 2.

The maximum resolution (64x zoom) results in steps incremented by 0.0096 V/64 = 0.00015V.

(a)



(b)

Fig. 2 Zooming Options (a) Front Panel (b) Block Diagram in LabVIEW

The step increment in x and y directions exploits the highest possible resolution with the NI ELVIS system, and it is calculated according to the following formula:

$$\frac{\text{Maximum voltage}}{\text{Resolution} - 1} = \frac{10V}{2^{16} - 1} = 0.000153V \quad (1)$$

Ten volts is the maximum voltage output of the NI ELVIS system. This will be amplified 10 times to the maximum of 100 V by the Physik Instrumente piezo driver device before it is applied to x, y and z expansion of the piezo crystal of the Molecular Imaging scanner head. 0.000153V is the resolution resulting from the 16 bit output of the NI ELVIS system. The scanner head has 2 pairs of piezo actuators, for x and y directions (X+ (pin#8), X-(pin#9) and Y+(pin#4), Y-(pin#5)). However, the piezo amplifier device has only 3 channels. Therefore, two relays are implemented and controlled trough a digital output of the NI ELVIS board to share the channels between x- and x+ and also between y- and y+. The voltage function is shown in the following graph.

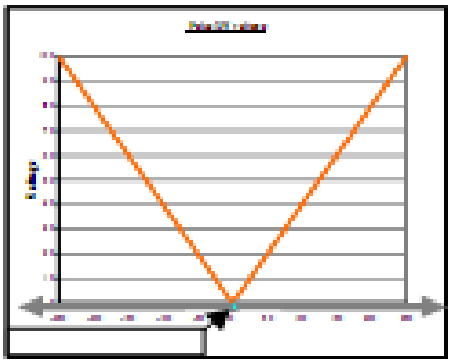


Fig. 3 The voltage function graph

In recent years, scanning probe microscopy (SPM) has become an important tool in materials science. It not only allows ultimate analyses of surface structures to be conducted, but also unique procedures to be performed, such as material deposition, initiation of chemical reactions (e.g. oxidation, lithographic reactions), mechanical structuring as well as manipulation of atoms, molecules, and clusters. Phenomena of practical importance, such as friction, adhesion, local magnetism, and surface diffusion can be studied on a microscopic scale. Several special types of instruments are now available for surface modification and for studying the surface properties of materials. Among other methods of interest in materials science are electrolytic SPM techniques and SPM techniques using magnetic and optical sensors. Descriptions of surface topography were the main objective of earlier studies of scanning probe microscopy. In the past few years, however, more and more quantitative analyses have been performed by means of scanning probe microscopes. In this overview, results will be discussed of nine cases of surface modification and quantitative analysis by scanning tunneling (STM) and scanning force microscopes (SFM, AFM). SPM has a considerable impact now on research and development in micro and nanotechnology. Scanning force microscopes have become important tools for controlling the topography of electronic chips in the production process, and for analysis of the topography of micromechanical components. One of the most promising applications of scanning probe microscopy is in the elucidation of the fundamentals of future nanotechnology. In technology, materials science and solid state physics on an atomic scale should meet. Also studies of chemical and biological nanosystems will contribute to the fundamentals of future nanotechnology. Two aspects are of special interest: Firstly, the self-organization processes occurring in nature and secondly, the creation of nanosystems by surface modification and by manipulation of atoms, molecules or clusters, and the characterization of such artificial systems. It is worthwhile studying biological molecular systems, such as motors, sieves, and electrical

conductors, to find ways of designing nanosystems for practical use.

A review is presented below the findings made in various subjects of potential interest in nanotechnology, which were studied at our laboratory over the past few years by scanning tunneling and scanning force microscopy.

2. EXAMPLES OF MODIFICATION AND STRUCTURING OF SURFACES

Local Material Deposition and Single Electron Tunneling. Deposition of materials from the tip of the STM was demonstrated nicely; for example, by for the case of Au cluster deposition on polycrystalline Au surfaces. The investigations described in this article are about the generation of small metal clusters on Si (111) surfaces, their thermal stability, and single electron tunneling through them. When the dimension of the metal clusters are on the order of 10 nm or smaller, single electron tunneling effects can be observed even at room temperature. Al-and Au-clusters with diameters between three and several hundred nanometers were generated on Si (111) surfaces by the application of voltage pulses between the tip and the sample. The clusters were stable for more than 24h at room temperature; for small clusters, Coulomb staircase effects were observed in the current versus voltage curves (I(V)). The A1 tips, for example, require a bias voltage below -6 V or above +6 V for the deposition process by field evaporation to take place. Figure 4 shows a typical Au cluster as deposited with the STM, and the I(V)-curve together with its derivative demonstrating staircase effects at room temperature.

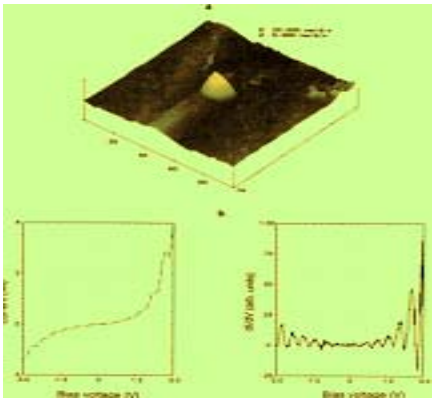


Fig. 4 (a) Au cluster deposited on Si (111) surface by application of a +10 V bias voltage pulse between the Au tip and the substrate (top). (b) I(V) curve measured at room temperature and its derivative showing Coulomb staircase with a step width of 450 mV caused by single-electron tunneling through the cluster

3. MECHANICAL STRUCTURING OF SURFACES

Nanostructures can be generated by ploughing furrows with SFM tips. Also thin Au films deposited on no conducting substrates were structured to demonstrate the possibility to create conducting nanostructures on an insulating substrate. Figure 5 shows a periodic grid generated on the surface of polycrystalline Au. The profile is quite homogeneous over the area of 2 µm x 2 µm. The cantilever tip (Si) shows no pronounced abrasion in the structuring process, as can be concluded from the homogeneity of the structure generated and from the analysis of the tips by scanning electron microscopy. Such periodic grids have been used for measuring the surface self-diffusion constant. Structures generated with the SFM could also be used as molds for making nanostructures out of molecules or clusters as building blocks. Corresponding grid profiles, derived from the images on top (bottom) temperature, however, these procedures are not as sensitive as the

periodic grid method. In these cases, the time dependence of the depth of the profiles, d(t), is given by:

$$d(t) \sim (c_4 t)^{1/4}, \text{ and } d(t) \sim (c_3 t)^{1/3}, \text{ respectively.} \quad (2)$$

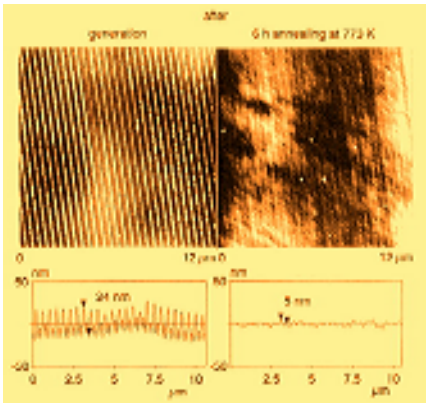


Fig. 5 Mechanical structuring of a polycrystalline Au surface with a stiff SFM cantilever (Si)

Images (top) taken with a soft cantilever (Si3N4) of a periodic grid as generated (left), and after annealing (right).

The latter methods are less sensitive because the time dependence is much weaker and no dependence on k exists. Another advantage of studying a periodic grid to determine the diffusion constant is the possibility to derive the grid parameters as a function of temperature by two dimensional Fourier transformations. The results of such analyses represent mean values averaged over the entire area analyzed.

The use of the SFM allows the surface self-diffusion constant to be measured for materials that are soft enough to allow grid generation with a hard cantilever tip, if the surface can be kept clean throughout the measurement so that the diffusion is not altered by contamination.

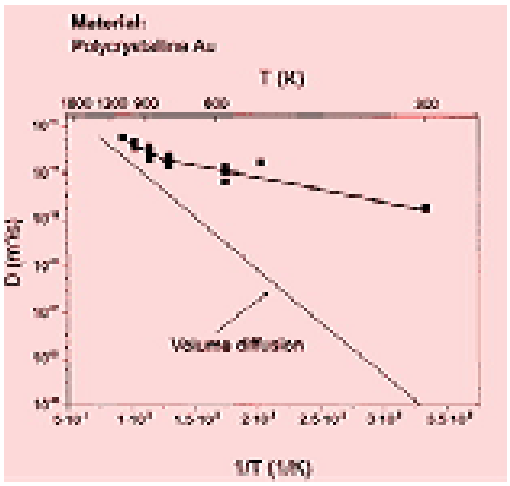


Fig. 6 Self-diffusion constant at the surface of polycrystalline Au as a function of temperature, derived from the decay of the amplitude of the periodic grid shown in figure 5, initiated by vapor deposition of material forming layers or islands

For general application, the measurements would have to be performed in UHV or, at least, in an inert atmosphere. Cluster Dynamics and Ostwald Ripening. Epitaxial growth of islands was studied in great detail on surfaces of single crystals by means of STM. Metal clusters and cluster systems were deposited also on different disordered substrate surfaces, and their structure was analyzed mostly by transmission electron microscopy (TEM). Here we are discussing the dynamics of clusters grown out of ultrathin (10nm thick) Au films deposited on native SiOx surfaces of Si wafers by annealing the films at relatively low temperatures (50-100° C). The dynamics of these Au cluster systems is determined by the Ostwald ripening process on the ubstrate surface, characterized, for example, by the rowth of the large clusters and the appearance of depletion zones around the growing clusters, as recently observed in SFM experiments. Ostwald ripening is regulated by the vapor pressure, P(r), on surfaces of clusters depending on the curvature of the surface. For spherical clusters with a radius of r, what is given, according to the Gibbs-Thomson equation, by the relation:

$$P(r) = P_\infty \exp(2\gamma\Omega / r k_B T) \approx P_\infty (1 + c/r). \quad (3)$$

A consequence of depending on the radius of the vapor pressure at the cluster surface is

16 that particles will be transferred from small to large clusters. The large clusters will grow at the expense of the smaller ones which, finally, will dissolve. The largest clusters produced in the generation process have the highest probability of survival during ripening. General theory yields the following time dependence for the growth of the cluster radius, r:

$$r(t) = r_0 t^x \quad (4)$$

The exponent, x, depends on detailed assumptions about the growth process as, for example, discussed in the framework of theories of the ripening process proceeding in two dimensions. In general, two characteristic zones around a growing cluster can be distinguished: a depletion zone defining the area in which material is removed by dissolution of small clusters and a nucleation zone around a growing gluster in what additional clusters may grow, whereas outside nucleation is excluded. If the interaction of the diffusing atoms with the substrate is isotropic, the borderlines between the different zones will be circles whose radii will depend on the diffusion length and the capture probability as a function of the radius of the clusters. Typical results of such ripening process are shown in Figure 7. The borderline around the largest cluster indicating the depletion zone is clearly visible (Figure 7a). Figure 7b shows that at other positions the cluster at the center is surrounded by a ring of clusters indicating the existence of a nucleation zone around the center, outside of which new clusters can not grow. Cluster size distribution, cluster density, cluster growth as a function of annealing time and temperature were studied by SFM analysis.

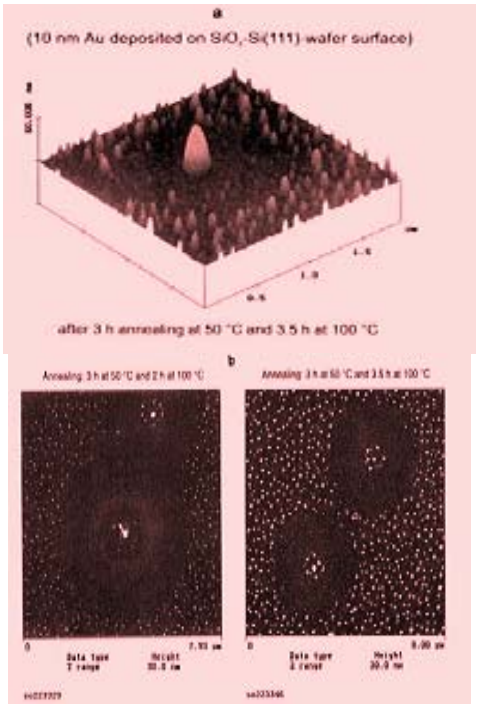
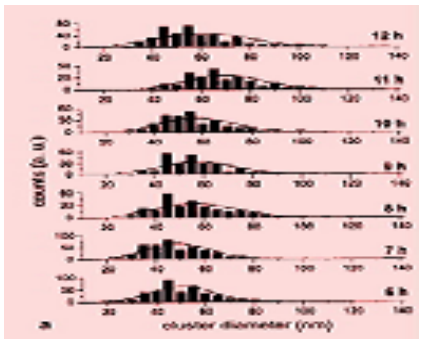
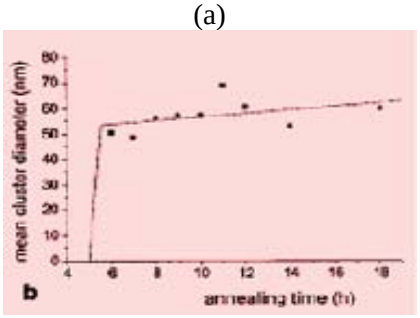


Fig. 7 Ostwald ripening at the surface of an ultrathin Au film from which clusters have been developed. Depletion zones appear around large clusters (a), and, at other positions, also rings of clusters around central clusters have appeared indicating the circular borderline of nucleation exclusion zones (b, left and right)

Cluster size and pair distributions as well as the mean cluster diameter as a function of annealing times are shown in Figure 8. The diameter distributions indicate an increase of the number large clusters with increasing annealing time. This change may be a precursor of Ostwald ripening processes. If the ripening processes occur, then the cluster diameter will rise much faster, as observed in another experiment. By characterizing cluster growth dynamics on the substrate surface, one could probably learn how the right kind of metal cluster systems for practical use in catalysis or in single electron tunneling systems could be generated.



(a)



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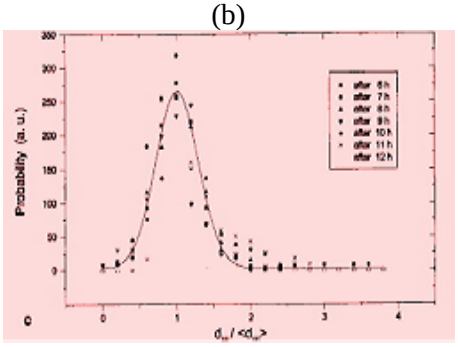

(c)

Fig. 8 (a) Au cluster diameter distributions for a system in states before the depletion zones appear and (b) mean cluster diameters (derived from a) as a function of the annealing time at an annealing temperature of 50°C. (c). The distribution of inter cluster distances (cluster pair distribution functions) as a function of annealing time indicates the self-similarity of the cluster system in the different states.

4. CONCLUSION

In recent years, scanning probe microscopy (SPM) has become an important tool in materials science. It not only allows ultimate analyses of surface structures to be conducted,

but also unique procedures to be performed, such as material deposition, initiation of chemical reactions (e.g. oxidation, lithographic reactions), mechanical structuring as well as manipulation of atoms, molecules, and clusters.

Phenomena of practical importance, such as friction, adhesion, local magnetism, and surface diffusion can be studied on a microscopic scale. Several special types of instruments are now available for surface modification and for studying the surface properties of materials.

Among other methods of interest in materials science are electrolytic SPM techniques and SPM techniques using magnetic and optical sensors.

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THE DESCRIPTION OF METALLIC LAYERS THROUGH SENSOR – SURFACE INTERACTION

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***Abstract**: The article presents the scanning technology based on scanning with the sensor-surface interaction. It shows the scanning possibilities given by applying such a method within technologies, allowing a measurement at a nano-level, as well as the advantages of implementing this type of investigation method.*

***Keywords**: sensor-surface, interaction, metallic layers.*

1. INTRODUCTION

Wire-bonding is a main interconnection process in the packaging industry. Wires are bonded to Al pads using combined thermal and ultrasonic activation. Gold wires are the widely used and well characterized media for this process [1]. Recently, the use of copper wires is of interest to the industry due to its electrical and mechanical properties. Since copper is relatively hard and readily oxidized, the use of copper wires in industrial interconnection processes requires special bonding procedures and equipment [2]. Moreover, due to the relatively slow formation of Al-Cu inter metallic, examination of the as bonded Al-Cu interface by conventional characterization such as optical microscopy (OM) and scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS), provide almost no information related to the deterioration of the wire-bonds as a function of the bond life. Until today, the Al-Cu wire bond interface was investigated by OM and SEM in samples which were mechanically polished, making it difficult to distinguish between the different Al-Cu inter metallic. Attempts were also made to resolve the inter-metallic composition of the bonds via EDS incorporated in SEM [2]. In the present study, transmission electron microscopy (TEM), scanning transmission electron microscopy (STEM) and TEM-EDS were used for quantitative analysis of the inter metallic composition of as-bonded and heat treated Al-Cu wire-bonds.

2. EXPERIMENTAL PROCEDURE

A dual beam focused ion beam (FIB) was used to prepare site-specific TEM samples. FIB was also used for preliminary analysis of cross-sections by ion-beam and high-resolution SEM. In order to understand the

processes that occur at the Al-Cu interface, as-bonded samples and samples annealed in air and argon were prepared [4].

The channeling effect may occur for incident ions if a crystal in the sample is oriented in a low index zone axis. In these conditions, the ion beam will penetrate deeper into the target before significant inelastic scattering occurs, resulting in a lower probability of secondary electrons escaping from the sample due to their limited mean-free-path. As a result, grains oriented in a low index zone-axis will have a darker contrast than randomly oriented grains (Fig. 1).

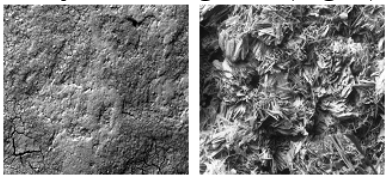

Fig. 1 (a) Secondary electron SEM micrograph of the as-bonded Al-Cu interface and (b) ion induced secondary electron micrograph of the same specimen, showing the Cu grain morphology

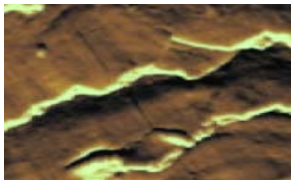

Fig. 2 HAADF-STEM micrograph of the as bonded Al-Cu wire-bond cross-section

Fig. 3 Bright field TEM micrograph of a central region of a Al-Cu wire-bond annealed for 24 hours in argon at 175°C. The inset diffraction pattern is of the dark inter metallic grain

Figure 2 presents high angle annular dark field (HAADF) STEM micrograph of an area of the as-bonded Al-Cu wire bond, indicating that inter metallic phases are formed in the as bonded samples [3]. EDS analysis confirmed the presence of Al-Cu inter metallic, and that changes in the Cu concentration in the large inter metallic region was not monotonic as a function of a distance from the copper layer. The composition of the inter-metallic regions in heat-treated samples was evaluated by TEM-EDS and, wherever possible, confirmed by selected area electron diffraction patterns (Fig. 3).

They will accommodate the flat TAB tape lead and provide the proper material for a reliable connection to the tape [4]. The bump fabrication process uses a metal deposition and plating process. First a series of barrier and seed layers of metal are deposited over the surface of the wafer. A layer of photo resist is deposited over these barrier and seed. A photo mask is used to pattern the locations over each of the pads that will be bumped. An etching process exposes the pads, and the open resist hole defines the shape and height of the bump. The bump, which is typically gold, is then electroplated over the pad and the deposited barrier metals. Once the plating s complete, a series of etching steps are used to protects the underlying materials from being etched. While gold bumping is the most common, copper, tin-lead, as well as layered combinations of these materials is used for bumping. An alternative to die bumping is to create bumps on the tape. For high lead, wafer bumping is more common. Figure 4 illustrates a completed bump and a TAB tape lead.

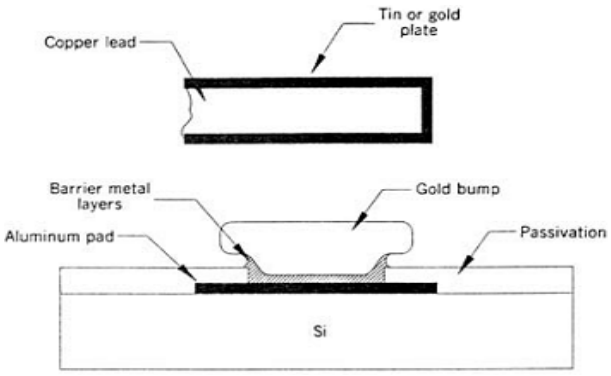

Fig. 4 Tab with wafer bumping

Gold top wafer metallurgy had been practiced in the past. With exception of GaAs and TAB, gold had been replaced by aluminum interconnects and then by advanced copper interconnects. Lower material cost plus ultra-fine line capabilities of both aluminum and copper were reasons for the displacement of gold as interconnect. However, to enter high

temperature IC applications, to achieve superior reliability or to dissipate greater power, the resurrection of gold as the top metal is both practical and effective. This protective gold top is coined Power Au for the ability of gold to increase power capabilities of ICs, packages and systems. Au wires bonded to aluminum forms many Au-Al inter metallic. This inter diffusion of Au atoms into Al bond pads is well studied. At higher temperature, diffusion and growth rate of inter metallic also accelerate. If the entire thickness of aluminum bond pad were converted into Au4 Al inter metallic, then the poor adhesion of Au4 Al to barrier metal between aluminum layers can result in wire bond separation and electrically open failure. Even as Au4 Al inter metallic is growing, voids coalesce into hairline crack at inter-metallic interface. These weakened interfaces are susceptible to stress failure and again result in electrically open failure. The metal between Power Au and Al is not a perfect barrier however. Under higher temperature testing, barrier metal does eventually break down. Above 250°C plus self heating from 860mA current, gold atoms punch through the barrier metal and then gold diffuse into aluminum.

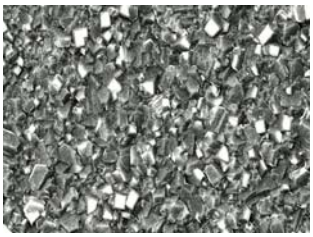

Fig. 5 Power Au line with void above contact to aluminum after extremely high temperature testing and 860mA current. Gold diffused into aluminum and left a void

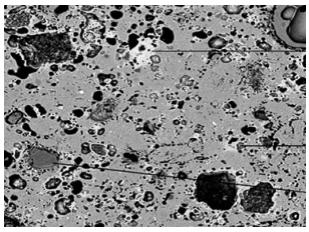

Fig. 6 Cross section of a Au-Al bond

The wire pull test is used to measure the strength and failure mode of the wire bond. A small hook is bond to gauge the strength of the 1st bond or next to the wedge at the 2nd bond to ensure a reliable weld. Generally, if the hook is placed at the mid span of the wire, then the test will show the weakest link of the bond. This is typically either the neck of the ball bond (right above the ball) or at the heel of the wedge bond. The Pull test is basically a function of the wire diameter. Loop height & wire span are the most significant factors that determines the strength of a wire for a given wire diameter. Shorter span & a lower loop will result in lower pull strength. As opposed to a longer span & a higher loop height which will result in higher pull strength. Copper wire bonding is normally formed by a copper ball onto an aluminum based bond pad in microelectronic package. However, copper oxidation at the interface of Cu- Al bonding area causes the cracks, decreases the interfacial shear strength, and weakens the Cu-Al bonding. Surface analysis of ball-peeled pad of Cu-Al bonding using XPS demonstrates the copper oxidation in the Cu-Al interface after autoclave test (at 121oC and 100% relative humidity). The binding energy scans for Cu 2p on the specimen after 0, 192, 384, and 576 hours in autoclave test chamber is carried out. After 576 hours corrosion, the chemical change of copper in a few atomic layers of surface from Cu to Cu O. Furthermore, there are two major copper oxides peaks observed in the study, Cu O and

Cu(OH)2. Cu2O is not table in air and change to Cu O immediately. Therefore, CuO2 is not expected to be detected at the specimen [6].

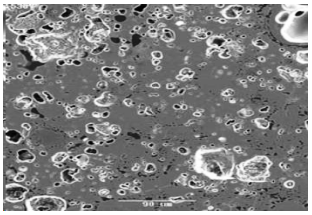

Fig. 7 SEM pictures show corrosion and a crack after test hour increase (X1000)

Low cost, high thermal and electric conductivity, easy fabricating and joining, and wind rang of attainable mechanical properties have made copper widely used in electronic packaging, such as lead frames, interconnection wires, foils for flexible circuits, heat sinks, and WPB traces. However, unlike the aluminum oxide, the copper oxide layer is not self-protect. Therefore, copper is readily oxidized, especially at elevated temperature. Copper oxidation interface of Cu-Al bonding area causes the cracks, decreases the interfacial shear strength, and weakens the Cu-Al bonding. Also, Copper oxidation in the area of the lead frames die pad and mold compound causes the laminated of packages. Furthermore, the moisture penetrates through the crevices because copper oxidation induces poor adhesion in the area of the copper lead frames and molding compound, creating corrosion problem in the packages [6].

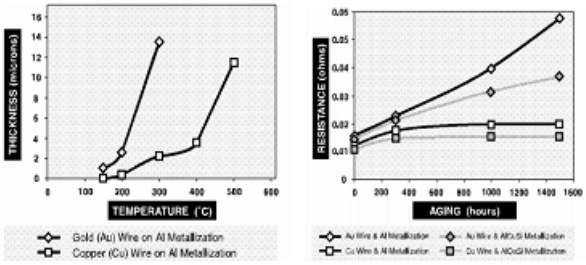

Fig. 8 Inter metallic thickness vs. exposure for 6 hrs at respective temperature b) effect of wire material & substrate metallization on electrical resistance after aging

Tests show that, after exposure at various temperatures, inter-metallic growth is significantly slower in copper wire bonds than in gold wire bonds and device performance. Tests also show that despite a lower amount of inter metallic penetration, pull force and shear testing show values that are equivalent to, or greater than, those obtained with gold wire. Potential for maximum conductivity, device performance (tact frequencies of < 500 MHz) and resistance to degradation in a mono-metallic system are the driving forces for the use of Cu wire in packages with Cu pads. DHF and Cu wire have been successfully ball-bonded to bare Cu lead frames and also AlSi Cu metal pads.

3. CONCLUSIONS

Recent studies have shown that, in many applications, copper wire bonding can provide better performance and reliability than gold wire bonding. While copper wire and ribbon have been used in discrete and power devices for many years, these latest studies also show that successes in ball bonding thin copper wire to aluminum, silver-nickel plating and even bare copper, provide the potential for its use in high-end, fine-pitch packages with higher lead counts and smaller pad sizes. For these reasons, along with the lower inherent cost of copper material, Kulicke & Soffa Bonding Wire has developed and optimized two copper wire products: DHF copper wire for ball and wedge bonds in power devices and discrete packages; and Cu for fine-pitch or high-end IC applications.

ACKNOWLEDGEMENTS

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SOME ASPECTS REGARDING IMPACT ABSORBERS APPLIED ON AIRCRAFT LANDING GEARS

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Abstract: *This paper is devoted to presentation of impact absorbers equations applied on aircraft landing gears.The landing gear shock absorber is an integral component of an aircraft's landing gear.*
The role of the shock absorber is to absorb and dissipate energy upon impact, such that the forces imposed on the aircraft's frame are tolerable. These accelerations must be acceptable not only to structural components, but also to everything contained within the aircraft (passengers, cargo, weapons, avionics etc).Designing a shock absorber is an iterative process, as each aircraft is individual and the shock absorber must be optimized to reduce size and weight, whilst maintaining the desired performance. The following set of equations offer a general starting point for this design process. Often the design must be altered from the initial conception to find an optimum balance between performance, weight and size.

Keywords: *impact absorption, damper equations, landing gear*

1. INTRODUCTION

Designing a shock absorber is an iterative process, as each aircraft is individual and the shock absorber must be optimized to reduce size and weight, whilst maintaining the desired performance. The following set of equations offer a general starting point for this design process. Often the design must be altered from the initial conception to find an optimum balance between performance, weight and size. These equations have been derived from a basic energy analysis of an aircraft during landing.The touchdown kinetic energy or the kinetic energy in the vertical direction at touchdown can be approximated from:

$$E_t = 0.5 \cdot (W_L) \cdot (\frac{v_Z^2}{g}) \qquad (1.1)$$

Where:

E_t – touchdown kinetic energy of the aircraft
W_L – weight of the aircraft at landing
V_Z – design vertical touch rate

This equation may be further extended to include potential energy term for completeness:

$$E_t = 0.5 \cdot (W_L) \cdot (\frac{v_Z^2}{g}) + (W_L - L)(S_S + S_t) \qquad (1.2)$$

Where:
L - the lift at landing
Ss - the shock absorber stroke
St - the tyre deflection

For conservative design it is assumed that all of the energy at touchdown is absorbed by the main landing gear. The energy that can be absorbed by the shock absorber and the tyres is as follows:

$$E_{absorbed} = W_L N_g (\eta_t S_t + \eta_S S_S) \qquad (1.3)$$

Where:

Ng - The landing gear load factor (the ratio of maximum load per leg to the maximum static load)

- η_t - tyre efficiency
- η_S - shock absorber efficiency

It is assumed that by definition: $W_L = n_S P_m$

As: n_S - number of main gear struts

P_m - the maximum static load per main gear

$$E_{absorbed} = n_S P_m N_g (\eta_t S_t + \eta_S S_S) \qquad (1.4)$$

Thus shock absorber energy can be equated to the touch down energy, Et:

$$n_S P_m N_g (\eta_t S_t + \eta_S S_S) = 0.5 \cdot (W_L) \cdot (\frac{v_Z^2}{g}) + (W_L - L)(S + S_t) \qquad (1.5)$$

Design touchdown rates can be found in Section 1.2.1. Some rough values of efficiencies and landing gear load factors can be approximated from Sections 1.2.2 and 1.2.3. By using these values the required stroke length of the shock absorber can be determined. If we assume that the potential energy term is negligible, if the lift generated is approximately equal to the weight of the aircraft during landing, then the stroke length is determined by:

$$S_S = \left[\left\{ \frac{0.5 \cdot (W_L) \cdot (\frac{v_Z^2}{g})}{n_s P_m N_g} \right\} - \eta_t S_t \right] \Big/ \eta_S \qquad (1.6)$$

This above equation can further be simplified as $W_L = n_S P_m$ by definition:

$$S_S = \left[\left\{ \frac{v_Z^2}{2 g N_g} \right\} - \eta_t S_t \right] \Big/ \eta_S \qquad (1.7)$$

Note that the shock absorber stroke length does not depend on the aircraft's weight, but only on its vertical sink speed, load gear factor, the tyre parameters, and overall shock absorber efficiency [2]. For design length an inch is added to this length as an additional safety margin.

$$S_{S\_design} = S_S + 1/12\, ft \qquad (1.8)$$

The diameter of the shock absorber strut can be estimated from:

$$d_s = 0.041 + 0.0025\, P_m^{0.5} \qquad (1.9)$$

(in feet, where P_m is in pounds)

This analysis is only valid for telescopic strut or similar shock absorbers where the shock absorber stroke is equal to that of the wheel stroke.

For articulating and semi articulating configurations an independent analysis must be under taken to incorporate the relationship between stroke length and wheel travel [5].

1.2.1 Design touchdown rates

Table 1

	Design touchdown rates
FAR 23*	$4.4(W/S)_L^{0.25}$ fps
FAR 25	12 fps
USAF	10 fps
USN	10 fps for transports
	17 fps for other non-carrier based airplanes
	22 fps for carrier based airplanes

*no less than 7 fps and more than 10 fps

1.2.2 Gear load factors

Table 2

Aircraft type	N_{gear}
Large bomber	2.0-3.0
Commercial	2.7-3.0
General aviation	3.0
Air Force fighter	3.0-4.0
Navy fighter	5.0-6.0

1.2.3 Shock Absorber Efficiency

Table 3

Type	Efficiency, •
Steel leaf spring	0.50
Steel coil spring	0.62
Air spring	0.45
Rubber block	0.60
Rubber bungee	0.58
Oleo-pneumatic:	
-Fixed orifice	0.65-0.80
-Metered orifice	0.75-0.90
Tyre	0.47

.

1.2.4 Drop test Equations

To test a given landing gear a drop test is conducted. Each landing gear must pass this test in order to meet safety regulations, and demonstrate its reserve energy absorption capacity. The vertical kinetic energy can be calculated from the aircrafts sink speed and its weight and is given by equation 1.1.

The drop test on the landing gear is conducted with the same mass. At a given height the potential energy is given by:

$$E = W_L H \qquad (1.10)$$

If we equate the potential energy of the drop test (Eq. 1.10) to the vertical kinetic energy of the aircraft (Eq. 1.1) then we get:

$$0.5 \cdot (W_L) \cdot (\frac{v_Z^2}{g}) = W_L H \qquad (1.11)$$

$$\therefore H = \frac{v_Z^2}{2g} \qquad (1.12)$$

For a given sink speed the drop test height can be calculated accordingly.For a sink speed: V_Z = 12 fps = 3.6m/s.Equivalent drop test height:

$$H = \frac{3.6^2}{2 \times 9.81} = 0.66m$$

2 CASE STUDIES

We made some case studies with an estimation of the stroke length for Cessna 177RG , Airbus A310 and MiG29 Fulcrum.

The calculus for each model was made using Eq. 1.7, shock absorber stroke:

$$S_S = \left[\left\{ 0.5 \left(\frac{v_Z^2}{g} \right) \Big/ N_g \right\} - \eta_t S_t \right] \Big/ \eta_S$$

The assumptions for each case are:

- All energy at landing is absorbed by shock absorber
- Lift at landing is equal to weight of aircraft
- Acceleration due to gravity, g = 9.81 m/s2
- Tyre deflection is negligible (data is unavailable)

2.1 Cessna 177RG

The Cessna 177RG is a general aviation aircraft that is primarily operated by private individuals and organizations.

The aircraft may carry 4 persons (including 1 crew), utilizes a high wing configuration, and is powered by a single engine. The maximum takeoff weight of the Cessna 177RG is 1100 kg.

Figure 1: *Cessna 177RG*

The main landing gear of the Cessna 177RG consists of a simple, solid spring landing gear (refer Fig. 1), in addition to a single wheel. Although such a system is cost effective and therefore appropriate for general aviation aircraft, it offers relatively poor shock performance. Apart from tyre scrubbing that results from lateral motion of the landing gear, the solid spring landing gear offers no shock absorption. The result is an aircraft that tends to bounce, similar to a car with poor shock absorbers.

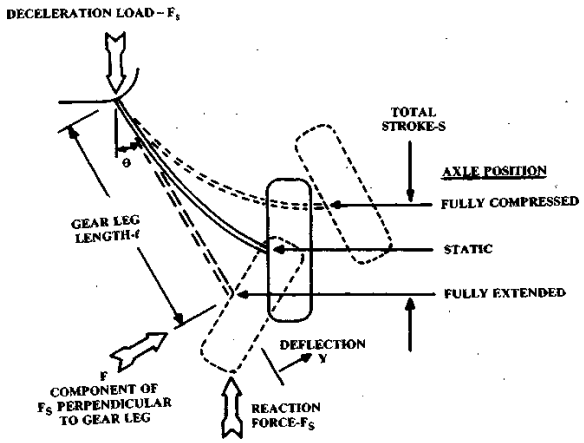

Figure 2: *Solid spring shock absorber with deflection*

Unlike the main landing gear system, the nose landing gear implements a telescopic, oleo-pneumatic shock absorber.

A more effective shock absorber is implemented, as it must support the Cessna 177RG engine.

In contrast to the main landing gear, this landing gear offers superior shock absorption. Note that in comparison to the oleo-pneumatic struts used on the Airbus A310, the nose landing gear shock absorber of the Cessna 177RG is much smaller. This is due to the relatively low mass and design touchdown rate of the aircraft.

2.1.1 Stroke Calculation

An estimation of the Cessna 177RG stroke length may be provided using Equation 1.7 and the assumptions mentioned:

Data

Design touchdown rate, V_Z = 10fps = 3.6576 m/s (FAR 23) (Section 1.2.1)
Gear load factor, Ng = 3.0 (Section 1.2.2)
Shock absorber efficiency, η_s = 0.50 (Section 1.2.3)

Results $S_S = 0.22021\text{m} = 8.669\,68 + 1\text{in} \approx 9.7\,\text{in}$

2.2 Airbus A310

Figure 3: *Airbus 310*

The Airbus A310 is a medium range, transcontinental airliner. The maximum takeoff weight of a Airbus A310 is as much as 141,974 kg

The landing gear of the Airbus A310 is comprised of a retractable tricycle configuration.

The main landing gears (refer Figure 4), located underneath each wing, consist of dual tandem wheel layouts.

Multiple tyres not only disperse the load and therefore pressure within each tyre, but also increase shock absorption and protect the surface of the runway.

Each of the main landing gears consist of a side brace and drag brace for lateral and longitudinal loads (respectively), and a telescopic, oleo-pneumatic shock absorber for vertical loads.

This shock absorber has a relatively high stroke distance, due to the high aircraft weight, and the importance of energy dissipation for commercial aircraft.

The nose landing gear of the Airbus A310 consists of a twin wheel layout, at the end of a telescopic landing gear.

In comparison to the main landing gear, the nose landing gear contains fewer wheels and a smaller oleo-pneumatic shock absorber, due to the relatively small loads induced to the forward landing gear.

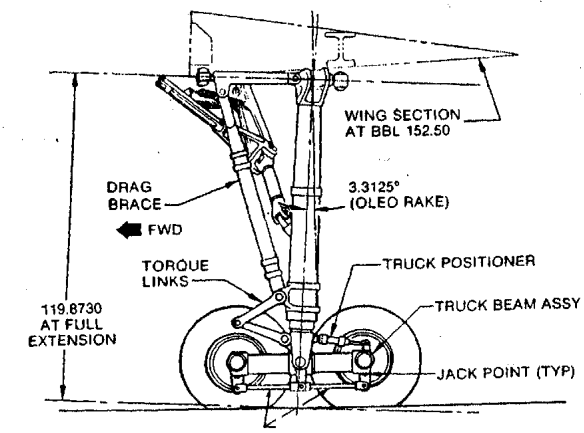

Figure 4: A310 main landing gear

2.2.1 Stroke Calculation

An estimation of the A 310 stroke length may be provided using Equation 1.7 and the assumptions mentioned:

Data

Design touchdown rate, V_Z = 12 fps = 3.6576 m/s (FAR 25) (Section 1.2.1)
Gear load factor, Ng = 2.85 (Section 1.2.2)
Shock absorber efficiency, η_s = 0.75 (Section 1.2.3)

Results $S_S = 10.189\,960\,63\,\text{in} + 1\text{in} \approx 11.2\,\text{in}$

2.3 MIG-29 Fulcrum

Figure 5: *MiG 29 Fulcrum*

The MIG-29 FULCRUM is a supersonic, twin-engine, bomber and tactical reconnaissance aircraft. Its maximum takeoff weight is 16,750kg.

The MIG-29 Fulcrum landing gear is composed of a retractable tricycle configuration.

As illustrated in Figure 5 above, the relative size of the landing gear system is considerably larger in comparison with the Cessna 177RG.

This is a result of the large design vertical velocities of carrier based aircraft (refer Section 1.2.1).

Each main landing gear of the MIG-29 FULCRUM consists of a retractable, OLEO pneumatic shock absorber attached to a single wheel.

This system is implemented for its high efficiency, which is required for high vertical velocity landings.

Similarly to the main landing gear, the MIG-29 FULCRUM nose landing gear consists of a telescopic OLEO pneumatic shock absorber, however in a twin wheel arrangement.

Figure 4: *MiG29 main landing gear*

2.3.1 Stroke Calculation

An estimation of the MiG 29 Fulcrum stroke length may be provided using Equation 1.7 and the assumptions mentioned:

Data

Design touchdown rate, V_Z = 22 fps = 6.7056 m/s (Section 1.2.1)

Gear load factor, Ng = 5.5 (Section 1.2.2)

Shock absorber efficiency, η_s = 0.75 (oleo pneumatic) (Section 1.2.3)

Results $S_S = 12.586141\text{in} + 1\text{in} \approx 13.6\,\text{in}$

3. DISCUTION

The outcome of the stroke length calculations for the Cessna 177RG, A 310, and MiG 29 Fulcrum are summarised in Table 4 below:

Table 4

Aircraft	Shock Absorber Stroke, S_S (inches)
Cessna 177RG	9.7
A 310	11.2
MiG 29	13.6

As expected, the shock absorber stroke length of the Cessna 177RG is the smallest stroke estimation of the three aircraft.

Although the main landing gear is relatively inefficient, the effect that the lower design speed has on decreasing the stroke length is of greater significance.

The stroke length of the Airbus 310 is in-between that of the Cessna 177RG and Mig 29 Fulcrum.

This result is due to the low design vertical speed in comparison to the Mig 29 Fulcrum, and the high speed relative to the Cessna.

The stroke length of the Mig 29 Fulcrum exceeds that of the Cessna 177RG and Airbus 310 by a significant margin.

This can be explained by the large design vertical velocity that such aircraft landing gears must tolerate upon landing.

Note that the above discussion does not indicate any relationship between the shock absorber stroke length and the weight of the aircraft.

Although this variable is critical in landing gear design, it simply 'cancels' in the energy analysis of aircraft at landing (refer Section 1.2).

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ELASTIC FOUNDATION MODEL OF ROLLING CONTACT WITH FRICTION BY FINITE ELEMENT

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Abstract: *The difficulties of elastic contact stress theory arise because the displacement at any point in the contact surface depends upon the distribution of pressure throughout the whole contact. To find the pressure at any point in the contact of solids of given profile therefore, requires the solution of an integral pressure. The difficulty is avoided in the solids, can be modeled by simple Winkler elastic foundations or "mattress" rather than an elastic half-space, and the modulations by finite elements.*

Keywords: *elastic, mattress, finite element, rolling contact.*

1. FOUNDATION MODEL

The profile, therefore, requires the solution of an integral equation for the pressure.The difficulty is avoided if the solids can be modeled by a simple Winkler elastic foundation or 'mattress" tether than an elastic half-space .The model is illustrated in fig.1. The elastic foundation, of depth h, rests on a rigid base and is compressed by a rigid indenter. The profile of the indenter, z(x, y), is taken as the sum of the profiles of the two bodies being modeled:

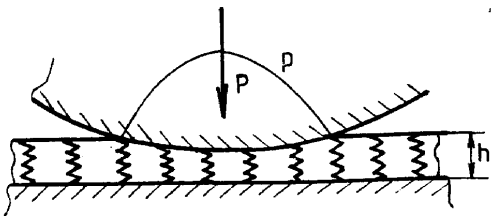

Fig.1.The elastic foundation model

$$z(x,y) = z_1(x,y) + z_2(x,y) \qquad (1)$$

There the difficulty of elastic contact stress theory arise because the displacement at any point in the contact surface depends upon the distribution of pressure throughout the whole contact. To find the pressure at any point in the contact of solids of given is no interaction between the stings of the model, shear between adjacent elements of the foundation is ignored. If the penetration at the origin is denoted by δ , then the normal elastic displacements of the foundation are given by:

$$\bar{u}_z(x,y) = \delta - z(x,y), \quad \delta > z$$

$$\bar{u}_z(x,y) = 0 \qquad \delta \le z \qquad (2)$$

The contact pressure at any point depends only on the displacement at that point, thus

$$p(x,y) = (K/h)\,\bar{u}_z(x,y) \qquad (3)$$

where K is the elastic modulus of the foundation.

For two bodies of curved profile having relative radii of curvature R' and R'', z(x ,y) we can write

$$\bar{u}_z = \delta - (x^2/2R') - (y^2/2R'') \qquad (4)$$

Inside the contact area. Since $\bar{u}_z = 0$ outside the contact, the boundary is an ellipse of semi-axes $a=(2\delta R')^{1/2}$ and $b=(2\delta R'')^{1/2}$.

The contact pressure by (3), is:

$$P(x,y)= (K\delta/h)\{1-(x^2/a^2)-(y^2/b^2)\} \quad (5)$$

Which is paraboloidal rather ellipsoidal as given by Hertz theory. By integration the total load is:

$$P=K\pi a\, b\, \delta/2h \quad .. \quad (6)$$

In the axi-symetic case $a=b=(2\delta R)^{1/2}$ and

$$P = \frac{\pi}{4}(\frac{Ka}{h})\frac{a^3}{R} \quad (7)$$

For the two-dimensional contact of long cylinders:

$$\bar{u}_z = \delta - x^2/2R = (a^2 - x^2)/2R \quad (8)$$

so that

$$p(x)=(K/2Rh)(a^2-x^2) \quad (9)$$

and the load

$$P = \frac{2}{3}(\frac{Ka}{h})\frac{a^2}{R} \quad (10)$$

In the bidimensional case (cylinder), $K/h=1.8E^*/a$, and in the axes-symmetric case $K/h=1.7E^*/a$ where E^* is:

$$\frac{1}{E^*} = \frac{1-\nu_1^2}{E_1} + \frac{1-\nu^2}{E_2} \quad (11)$$

Equations (7) and (10) express the relationship between the load and the contact width. Comparing them with the corresponding Hertz equations, agreement can be obtained, if in the axi-symmetric case we chose $K/h=1.70E^*/a$ and in the two-dimensional case we choose $K/h=1.18E^*/a$.

For K to be material constant it is necessary to maintain geometrical similarity by increasing the depth of foundation h in proportion to the contact width a. Alternatively, thinking of h as fixed requires K to be reduced in inverse proportion to a. It is consequence of the approximate nature of the model that the value of K, required to match the Hertz equation are different for the two configurations. However, if we take $K/h=1.35E^*/a$, the value of a under a given load will nod be in error by more than 7% for either line or point contact.

The compliance of a point contact is not so well modeled. Due to the neglect of surface displacements outside the contact, the foundation model gives $\delta = a^2/2R$ which is half of that given by Hertz. If it were more important in a particular application to model the compliance accurately we should take $K/h=0.60E^*/a$; the contact size *a* would then be too large by a factor of $\sqrt{2}$.

2. PNEUMATIC TYRES. TRANSVERSE TANGENTIAL FORCES FROM SIDESLIP AND SPIN

The lateral deformation of the tyre is characterized by the lateral displacement *u* of its equatorial line, which is divided into the displacement of the carcass us and that of the tread a_t. Q wing to the internal pressure the carcass is assumed to carry a uniform tension T. This tension resists lateral deflexion in the manner of a stretched string. Lateral deflexion is also restrained by the walls, which act as a spring foundation of stiffness K per unit length. The tyre is deflected by a transverse surface traction q(x) exerted in contact region $a\le x\le a$ .The equilibrium equation is

$$K_c u_c - T\partial^2/\partial x^2 = q(x) - K_t u_t \quad 12)$$

where K_t is the tread stiffness. The ground is considered rigid ($u_2=0$) and the motion one dimensional, so that we can drop the suffixes. Equation (12) can then be solved directly throughout in contact region for any assumed pressure distribution. The carcass deflexion are clearly not negligible however and it is more realistic to follow von Schilippe (1941) and Temple (1952) who neglected the tread deflexion compared with the carcass deflexion ($u_t=0$, $u=u_c$) as show in fig. 3. Equation (12) then becomes

$$u - \lambda^2 d^2/dx^2 = q(x)/K_c \quad (13)$$

where the relaxation length $\lambda=(T/K_c)^{1/2}$.Tafing the case of side slip first, the displacement within the contact region is given by

$$u=u_t-\xi x \quad (14)$$

where u_t is the displacement at the leading edge (x=-a) . Outside the contact region q(x)=0 so that the complementary solution to (13) gives

$$u=u1\exp(a+x)/\lambda \quad (15)$$

a head of the contact and

$$u=u_2 \exp\{(a-x)/\lambda\} \quad (16)$$

at the back of the contact.
The foundation model is easily adapted for tangential loading also to viscoelastic solids.
A one-dimensional model of the resistance of a tyre to lateral displacement is shown in fig.2.

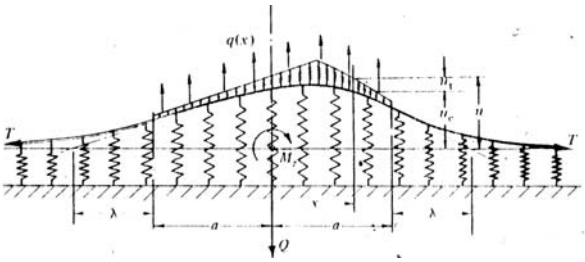

Fig.2. The stretched sting' model of the lateral defluxion of a type.

The deflected shape of the equatorial line is shown in fig.3 together with the traction distribution.

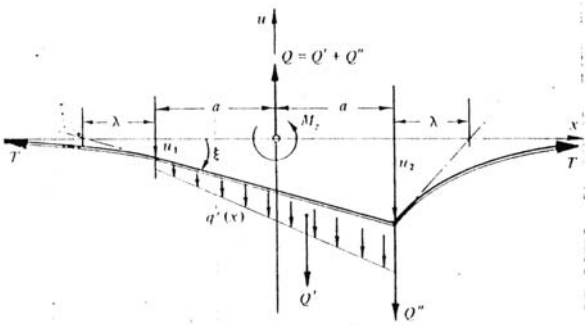

Fig.3. Traction distribution for a tyre with yaw angle ξ and no slip in patch: von Schlippe's theory.

It is with solid bodies, the infinite traction at the trailing edge necessitates slip such that deflected shape u(x) has no discontinuity in gradient and satisfies the conditions $q(x)=\mu\, p(x)$ within the slip region. Calculations of the cornering force Q and self-aligning torque M_x by Pacejka assiming a parabolic presure distribution and taking λ =3a are show in fig. 4.

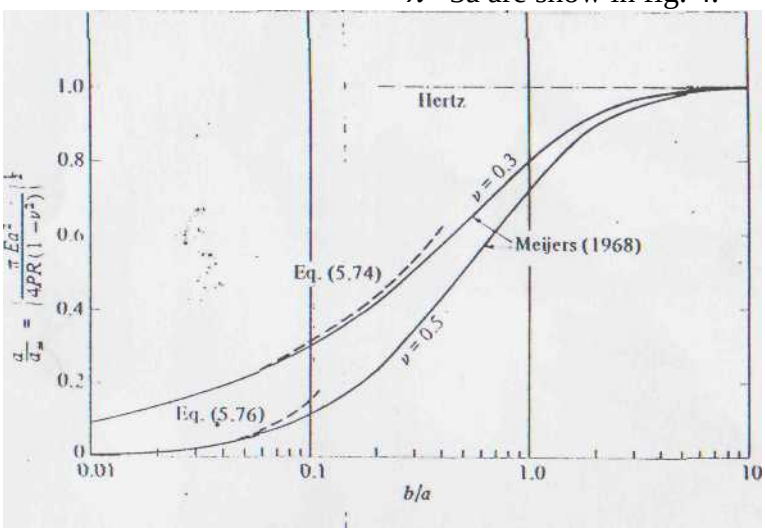

Fig.4. Parabolic presure distribution

3. ELASTIC FOUNDATION MODEL BY FINITE ELEMENT

The model is presented in fig.4, the finite plane rectangular elements. In fig.4 is presented the variation of contact pressure between the role and the rule .The process is

iterative and every date when a node by the possible zone of contact is make in contact, the matrix of stiffness it is modified corresponding.

For the 19-27 nodes it was introduced the stiffness (springs) of one constant size for beginning about of Ox, Oy, directions,determinated by the measure of pressure of the 19-27 nodes.

. If the pressure is changed the direction and it is negative and in the anterior node, it is positive, than the limited of the contact zone it's in those case two nodes which interacted.

If the process is repeated from the intermediate nodes, we find the place where the pressure is changing the sign P>0.

In this way the x coordinate of the respective node represent the semi-breth of contact zone. If every nodes where is in contact, the stiffness matrix is differenced and the maximum stiffness of the elements by who we works carrying o

The dates are: R=150 mm, D=300 mm, b=40 mm, ν=0.3, $E=2.12*10^5$ Mpa, $K=3*10^8$ Mpa – the maxim stiffness in this node If the pressure is changed the direction and it is negative and in the anterior node, it is positive, than the limited of the contact zone it's in those case two nodes witch interacted.

If the process is repeated from the intermediate nodes, we find the place where the pressure is changing the sign P>0.

In this way the x coordinate of the respective node represent the semi-breath of contact zone. If every nodes where is in contact, the stiffness matrix is difference and the maximum stiffness of the elements by who we works carrying oel case and from this case of loads the semi-breath is a=63 mm.

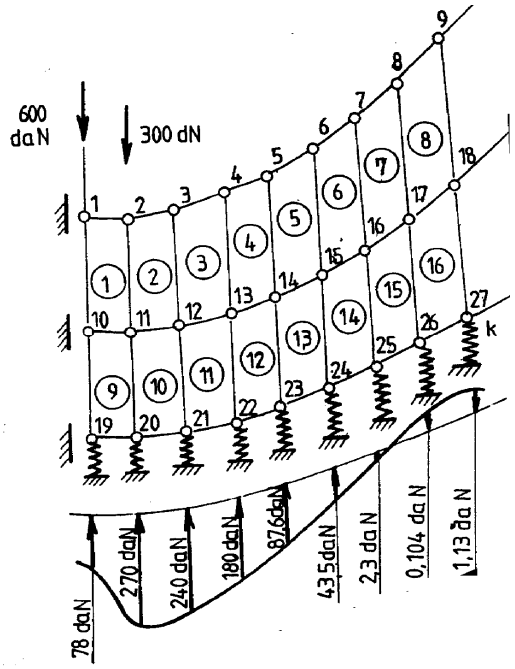

Fig.5. The elastic foundation model by finite elements

4. CONCLUSIONS

The normal elastic contact could be greatly simplified by modeling the elastic bodies by a simple Winkler elastic foundation rather than by elastic half space. The finite element method are one of the best methods to determinations the pressure of contact

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RESEARCH ON RECONDITIONING WELDING ROTOR COAL PULVERIZING MV

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Abstract: *50 MV mill fan pallets reconditioning by welding machine, which provides power boiler with solid fuel (coal), used to produce steam that makes electricity and heat. During operation, the grinding of coal produces large breaks, parts of the whole plant in a central component of thermo-electric technology was used MIG-MAG welding that leads to sustainability of the equipment as long as possible.*

Keywords: *pallets, reconditioning, welding, mill, electrodes.*

1. INTRODUCTION

Within energy facility of thermal researches on improving their technical performance are done. A special aspect of the operational behavior of coal mills is the life of grinding elements, especially high intake of metals. Due to the aging phenomenon that occurs in the grinding process, but also due to an operating deficit, expenditure on repairs may have a higher percentage of the cost of energy produced. Wear by abrasion is characterized by the appearance of microplastic deformities and separation of thin metal, hard abrasive particles, which are located between the friction surfaces. Wear by abrasion depends on the physicochemical properties of the materials of construction parts, sliding speed and pressure during friction. Pallets are the building blocks of the mill fan and are designed to grind to a fine-grained coal and also a time of injection in the boiler through burners, the coal dust to achieve combustion with a constant heating temperature [2] .

2. PALLET RECONDITIONING

The paper presents attempts that were made by soldering pallet reconditioning mill MV fan 50, the component of power plants based on coal. Showing excessive wear and uneven pallets require reconditioning training before using the technologies: grinding and smoothing. Reconditioning procedures by welding are: [1]

- High alloy welding electrodes coated;
- Submerged arc welding wire and flux alloy electrodes;
- Welding flux cored wire;
- Submerged arc welding electrodes with or without additional heating multiples of some electrodes;

- Submerged arc welding electrodes or metallic tape laminated core band or tape sintered powder;
- Shielding gas welding electrode fuse (wire or core dust, MIG / MAG);

Values of base material participation MB for loading different welding processes is presented in Figure 1.

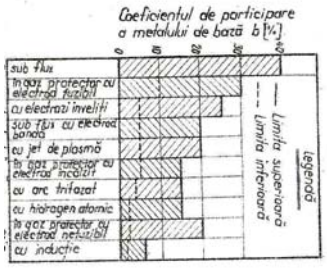

Fig. 1 Participation coefficient values for different methods of the base metal weld load.

Note that for welding submerged arc welding in shielding gas and electrode fuse large coefficient values are obtained for the participation of the welding base material so that greater dilution of base material alloy layers.

The most important advantage is the low participation shows the processes of base material that reduces the increase HAZ (heat influenced area) and its overheating. Also, here are obtained by dilution with the bath reduced the base material, weld metal properties can therefore be transferred loaded structures by welding a single or a small number of layers.

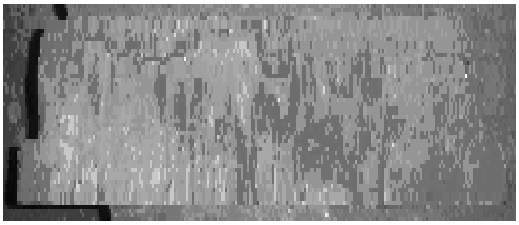

Figure 2 Pallets before reconditioning.

The following figures present reconditioning pallets before and after with coated electrodes, figure 2 and figure 3.

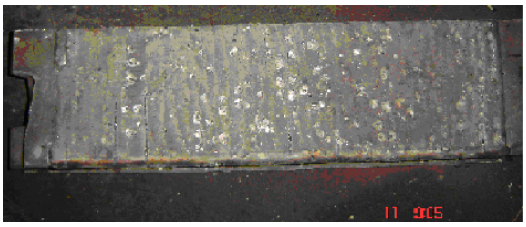

Figure 3 After reconditioning pallets with coated electrodes.

3. LOADING SAMPLES AND WELDELD EXPERIMENTS.

Currently, coal mills pallets are made by casting steel T 135 135 Mn in paper proposes the execution of S 235 mark material, STAS EN 10025-2:2004, S 355, EN 10025-4:2004.

Attempts have been made by the welding process with coated electrodes using five different types with the following brands: EI 350 H, 450 H EI, EI 58 H INOX 307, [4] LEDs 65. [5]

Samples were performed on materials derived from S 235, STAS EN 10025-2:2004, S 355, EN 10025-4:2004 thick welding and cooling 12 mm. After the welds were sectioned and polished samples for determinations.

Corresponding recommendations were given by using the next producer of welding parameters:

Table 1 Basic Material S 235:

Electro-de type	Is (A)	Ua (V)	Vs (cm/s)	Electro-de polarity	Elec-trod	Prehea-ting tempera-ture
EI 350 H	93 - 100	20-24	0,21	DC +	3,25	20°C
EI 450 H	98 - 111	24-30	0,12	DC +	3,25	20°C
EI 58 H	101 - 116	24-27	0,13	DC -	3,25	20°C
INOX 307	87 - 95	24-27	0,14	DC +	2,5	20°C
LEDURIT65	214 -	24-26,8	0,176	DC +	4	20°C

	223					

Table 2 Basic Material S 355:

Electro-de type	Is (A)	Ua (V)	Vs (cm/s)	Electro-de polarity	Elec-trod	Prehea-ting tempera-ture
EI 350 H	96 - 109	21,3-22,2	0,109	DC +	3,25	20°C
EI 450 H	98 - 109	22-24,7	0,15	DC +	3,25	20°C
EI 58 H	103 - 111	23,1-25,6	0,147	DC -	3,25	20°C
INOX 307	87 - 94	24-26,1	0.171	DC +	2,5	20°C
LEDURIT65	235 - 244	25-27,2	0,204	DC +	4	20°C

Based on metallurgical characteristics obtained for the steels investigated and given the qualities chosen for electrode reconditioning works envisaged for assessment technology that were taken into account these two types of loading by welding with coated electrodes.

Notations for values in the table 3 and 4 determinations are shown in figure 4.

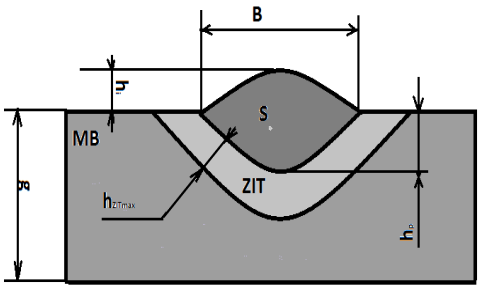

Figure 4. Representation of the notations in the tables, where:

hp - penetration on welding;
B - bead width;
hi - height increasing bead;
h_{ZITmax} - maximum height of ZIT;
g – thickness 12 mm;
ZIT - thermally influenced area;
s – welding;
HV_{03} - average hardness Vickers HV_{ZIT}; HV_{MB}; HV_s;

Table 3 Average hardness

Electro-de type	h_p	h_i	B	h_{ZIT}	HV_{ZIT}	HV_s	HV_{MB}
EI 350 H	0,7	3,3	10,5	3,8	458	764	233
EI 450 H	1,1	1,4	12,8	3,4	382	527	234
EI 58 H	2,3	2,3	14,1	3,8	450	776	317
INOX 307	1,9	1,6	11,3	2,4	279	395	237
LEDU-RIT65	1,8	3,4	18	6,3	625	764	217

Geometrical parameters obtained from the ribbons made by the representation in Figure 2 are presented in Table 3 for the base material S 235 and Table 4 for the base material S 355.

Table 4 Average hardness

Tip electrod	h_p	h_i	B	h_{ZIT}	HV_{ZIT}	HV_s	HV_{MB}
EI 350 H	0,9	2,2	8,9	1,2	632	758	223
EI 450 H	0,8	3,5	,12,5	2,8	437	549	244
EI 58 H	0,8	3,3	13,9	2,9	453	539	229
INOX 307	1	2,8	9,2	2,4	270	308	220
LEDURIT65	1,3	4,5	17	3,2	699	717	226

Evaluation of experimental results obtained leads to the following conclusions: Alternative loading technological LEDURIT65 filler materials based on S 235 and S355 provide an acceptable compromise between the hardness

characteristics of the seams is recommended for reconditioning of the blade works.

4. CONCLUSIONS.

Hard facing welding shown is the best chosen method for the mill pallet reconditioning.

From the technological point of view chosen materials have demonstrated good resistance to corrosion and anti-friction wear.

Hard facing welding technology proposed has a good productivity and optimal material consumption.

The cost of the proposed welding recondition pallets is lower than obtained by casting the pallets.

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EXPLOSIVE WELDING OF COPPER TO STEEL

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ABSTRACT: *Explosive welding has mainly found commercial application in large plate cladding of one metal on another, tube to tubeplate welding, cladding one tube on another, plugging of heat exchangers, various electrical connectors, especially those between cooper and aluminium, transition pieces, especially for pipe working cryogenic systems, pipe to pipe welding etc. We used explosive cladding to produce a bimetal Cu+steel for plane bearings required in big electro- hydro- generator construction. The experiments were made with the aim to find out welding parameters which provide minimal reject in production.*

The aim of the paper is to present some results obtained from experimental research in the explosive welding of copper to steel.

Key words: *Explosive welding, plate cladding copper to steel*

1. INTRODUCTION

Explosive welding is a process which for many applications cannot be performed by conventional methods. It is possible to weld metals with very different melting points such as Al and Ta, widely different thermal expansion, such as titanium and stainless steel, and large variations in hardness, such as lead and steel.

Explosive welding has mainly found commercial application in large plate cladding of one metal on another, tube to tubeplate welding, cladding one tube on another, plugging of heat exchangers, various electrical connectors, especially those between cooper and aluminium, transition pieces, especially for pipe working cryogenic systems, pipe to pipe welding etc. To date, the explosion welding process has been employed to bond more than 260 combinations of similar and dissimilar metals.

In explosive welding, for the bonding to take place, the metal surfaces must come together at a characteristic velocity and angle, which must be controlled within certain limits. A very high pressure is developed near the collision point, and the metal surfaces can flow as a spray of metal from the apex of the angled collision. The surfaces are stripped off in the collision and discharged in the resulting jet, thus removing the bond inhibiting surface films. The resulting film free surfaces are pressed in to atomic contact by the very high collision pressure, and a metallurgical bond is formed.

Explosive welding criteria may be expressed in three categories: weld geometry, explosive parameters and material properties.

With regard to weld geometry it has been shown that the plates must come together at an angle to permit formation of the jet.

The most important explosive parameter is the detonation velocity, which determines the collision point velocity. The collision point velocity must be less than the sonic velocity of either the flyer or the base plate.

The most important material properties governing successful explosive welding are ductility and solid solubility.

With regard to the future, explosive welding techniques will be applied in areas where it is difficult to use conventional welding, due to weight of conventional welding equipment, remoteness of operation, problems of logistics, and incompatibility of

material properties with conventional welding processes. Fabrication of structures in space, underwater explosive welding for salvage or repair, shipbuilding, building construction, large plate cladding of one metal on another, tube to tubeplate welding, cladding one tube on another, plugging of heat exchangers, chemical and petroleum work and most of the major areas of industry have hundreds of potential explosive welding applications. Currently the largest plates which have been cladded have areas of 30…40 m^2 and explosive charges of up to 1500 kg or more have been used [1].

2. FUNDAMENTAL PROBLEMS

Initial positions of the elements involved in the welding process can be different. In a general form, this scheme includes (fig. 1a): a base plate (parent plate) 1 and a flyer plate 2, inclined to the first at an angle $\alpha \geq 0$. Over the flyer plate is placed directly or through a protective layer (or buffer) 3, the high explosive layer 4, with the detonator 5, necessary to initiate the explosion. The buffer may be: rubber, polythene, cardboard, or even a thick coat of plastic paint, depending on the explosive used. The high explosive, either in the form of a sheet explosive, granular explosive or powder is detoned from the lower edge. [6]

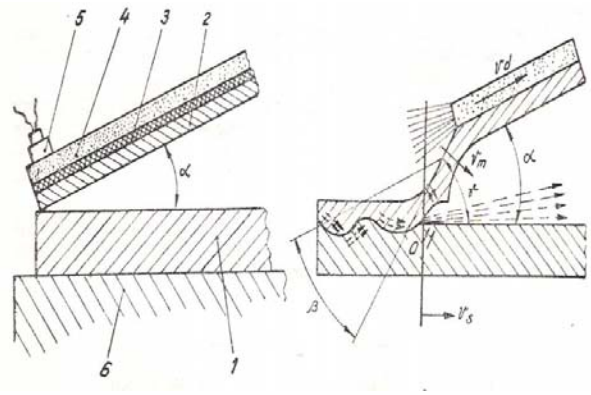


Fig.1. Basic setup for explosive welding: a- prior the detonation; b- an instant after detonation.

The shock wave produced by explosion accelerates the flyer plate at a speed v_m and at an angle (dynamic plating angle) γ, which is kept constant if $\alpha=0$, or increases during the movement of the detonation front if $\alpha>0$ (fig.1b). The high-velocity oblique impact between the two components being welded cause the metals to behave like fluids. As a result a high-velocity jet is formed from the two surfaces of both components, which leaves two virgin clean surfaces which are pressed together to form a weld. The weld interface shows well-formed regular waves. Fig. 1 b shows the geometry, short time after the detonation has been initiated, and before the detonation wave has reached the extremity of the charge. Waves between materials of equal density appear to by nearly completely symmetrical, while with materials of different density, such as copper to steel, the waves are asymmetrical.

In the Crosland emitted theory - that appeals jets theory, obtaining a good joint is related to jet formation, which may not take place if the velocity of point O (welding velocity v_s) is not lower than the sound velocity in the two metals. [1] On the other hand, between the welding velocity v_s and the explosive detonation velocity v_d the relationship exists:

$$v_s = v_m / \sin\gamma = v_d \sin(\gamma-\alpha)/\sin\gamma$$

where the impact velocity

$$v_m = v_d \sin(\gamma-\alpha)$$

Note that, $\sin(\gamma-\alpha)/\sin\gamma < 1$ for $\alpha > 0$, so starting from an initial position of plates in dihedral , can be obtained for v_s a lower velocity comparatively of sound metal velocity, even for high explosive with detonation velocity higher at its, on we meet accessible usually.

Explosives with detonation velocity higher than sound velocity in the two metals, even with $\alpha > 0$, can not be used when large surfaces planting is required, such as in the studied case, because with the displacement of the detonation wave, the real impact angle γ increases to the outside of a small interval of values, interval in which the jet forming and proper joints are insured. In such situations it is necessary to work with an initial angle $\alpha = 0$, corresponding at $v_s = v_d$ in which case, requires the use of explosives with a

detonation velocity lower than sound velocity in the same two metals. For this situation corresponds better the use of explosive mixtures which in certain proportions, provides a subsonic detonation velocity and a stable detonation transformation.

Plastic explosives are preferred in sheets, with features that meet user needs, easier to handle. In our case, for easier utilization is adequate to use an explosive mixture of granular ammonium-nitrate - ammonit.

3. EXPERIMENTAL RESEARCH

For making the plated product we have used: base plate- mild steel carbon OL37; flyer plate- industrial copper-Cu 9. Base plate (parent plate) material had dimensions as in figure 2, being processed on the surface to be plated at Rz50. Before cladding has been cleaned of impurities with gasoline, acetone and alcohol

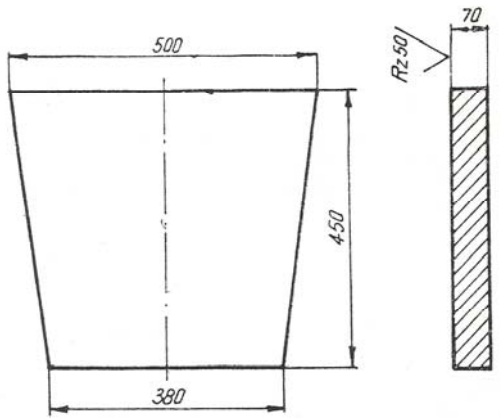


Fig. 2. Shape and dimension of parent plate

Flyer plate material (coated material) with thickness s = 5 ... 6 mm, was cut with added material to contour, compared to the base plate at 20 mm. After an annealing heat treatment, it was chemically etched.

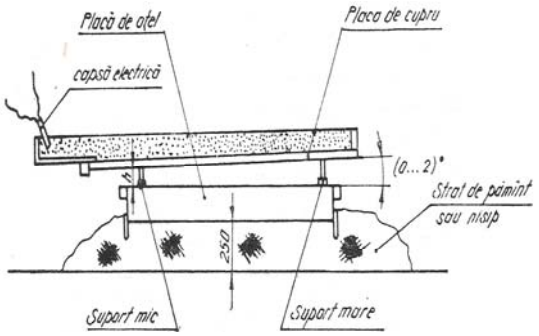


Fig. 3. Explosive device for cladding Cu to steel

Explosive device was placed on the sand (fig. 3), in a mining area, respecting technical rules for safety explosive material working. Explosive layer composed of ammonium nitrate sensitized with an addition of ammonite, have ensured the stable detonation velocity of 2500 ... 3500 m / s.

Flyer plate was placed on the parent plate, using copper rivets, being achieved between two plates a distance of about 7-8 mm and an angle of 2^0 (fig.3). Explosive charge was detonated with an electric cap placed like in the figure. After the explosion welding, the cladded parts were subjected to an annealing treatment at 450 ^{0}C, for 4 hours and slow cooling.

The mechanical testing of copper and copper alloy/steel composites is covered by American National Standards. The essential problem in the testing of explosive welds is that the cladding is mostly thin, and consequently it is difficult to devise a test to measure the strength on the bond at the weld interface.

In our case, according to the product norm, the weld testing consisted in:

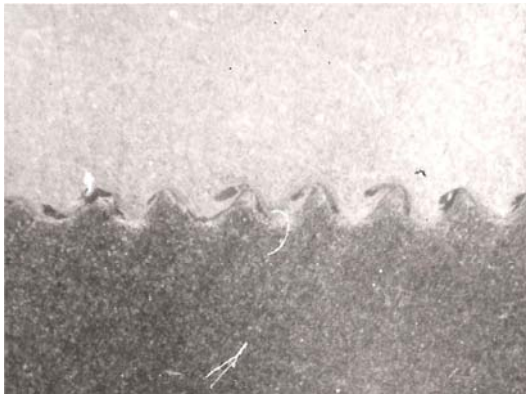
-ultrasonic test after cladding;
-metallographic examination at interface;
-hardness testing in piece section.

Ultrasonic test is capable of establishing areas of no bond. It is not able to detect the presence of a poor metallurgical structure at the weld interface. However, when the weld is defective, the reflection from the weld interface will be larger and the one for the back surface smaller, so the ratio of amplitudes will increase, and this growth will be a measure of the imperfection.

Ultrasonic control data showed small bondless surfaces (less than 2%), in piece corners, caused by interference phenomena and located in the added metal for dimensional working.

The progressive development of interfacial waves after welding process for copper to steel is shown in fig.4.

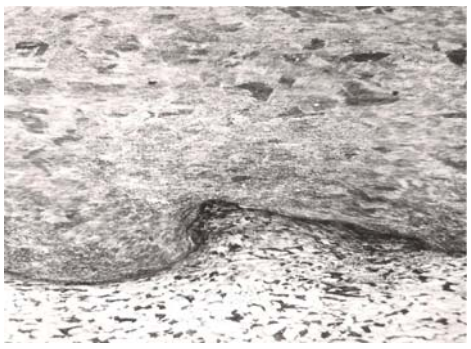
a



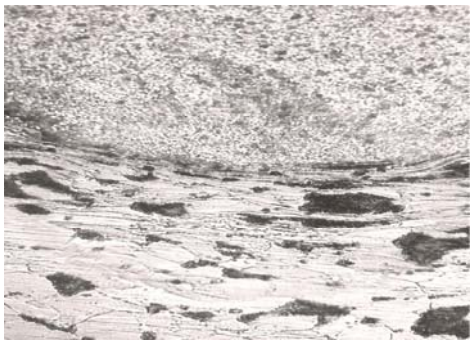
b

Fig. 4. Interface zone (x5) in explosive weld of Cu to mild steel: a) transverse section , b) longitudinal section.

Fig. 5 and 6 shows microstructures of bimetal Cu to mild steel after explosive welding. At fig. 4b and 5a is a typical example of waves formation by explosive welding of metal with dissimilar density.



a



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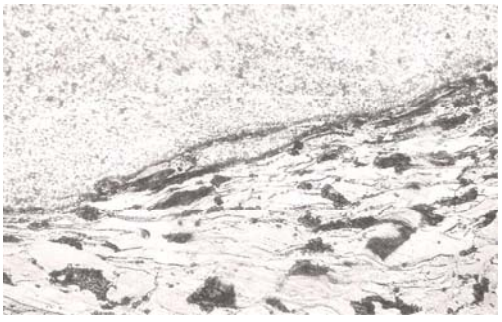

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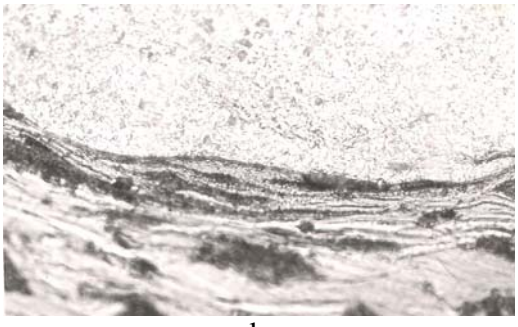

d

Fig. 5. Microstructures of joint zone after explosive welding for bimetal Cu+mild steel: a) steel apex of vortex (x100); b) copper entering in the steel plate (x500); c) perlitic structure and deformation bands in steel

(x500); d) mixture Cu+steel and deformation bands (x1000).

Fig. 6. Fused and solidified metal in Cu flyer plate near interface

The flyer plate is subjected to an intense stress wave from the detonation of the explosive layer in contact with it, and subsequently both the flyer plate and the parent plate experience an intense stress wave resulting from the high velocity impact. These intense stress waves give rise to metallurgical changes which results in an increase in hardness, illustrated in fig. 7. The general level of hardness in both plates is increased to interface (fig. 7 *a* and *c*). After annealing at 450^0C overall level of hardness is decreasing (fig. 7 *b* and *d*).

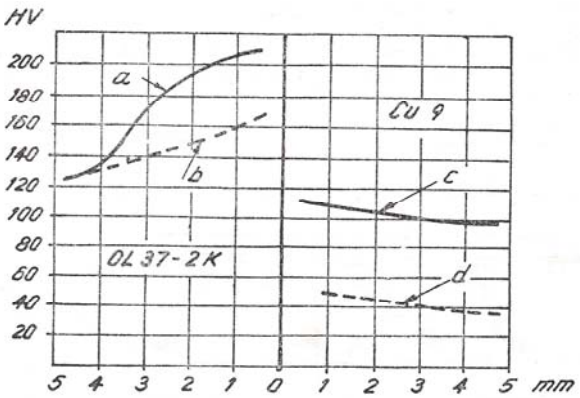

Fig. 7. Hardness profiles in weld by copper to steel:
a and *c* – after explosive welding; *b* and *d* – after annealing

Lastly, the theory explains that, the presence of a high residual concentration of point defects contribute to increase in hardness.

The developed technology was used for the manufacturing of a large number of pieces for Uzinele Resita.

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WEAR FACTORS ACTING ON AVIATION TURBO ENGINES

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Abstract: *"Hot parts" of turbo engines, co generative systems, etc. during operation are driven by factors wear complex, tough acting simultaneously at high values.*
From the types of wear identified - corrosive, erosive, adhesive, by thermal fatigue - industrial applications targeted group the thermal fatigue wear heat shock assign most disruptive acts on multilayer structures such as TBC- thermal barrier coating. TBC is widely accepted as technological solution for protection of turbo engines.
In this paper we chose to specifically analyze the relationship between the parameters that define the thermal shock and structural changes induced in the TBC type layers of protection.
To conduct the testing phase coatings, the authors have designed and developed a quick thermal test shock installation to evaluate the materials under extreme conditions of the basic parameters of the process.
This paper aims to contribute at expanding the information structural changes, of the delaminating mechanism and finally on the damages of coatings induced by extreme heat factor.

Key words: *turbo engines, wear factors, quick thermal shock, thermal fatigue, TBC*

1. Introduction

Gas turbine generators are characterized by operational conditions far worse than those usually encountered in engineering. Thus, the turbo engines work at mechanical and thermal superior limits, plus the corrosive effects of chemical fuels. The temperature in commercial aircraft turbines can reach 1500°C [1].

For extreme operational conditions occurring in aircraft flight, engine stop in flight, missing landing, etc., for other equipment, machine power and metallurgical industry is very important to know the behavior of materials at high speed heating and cooling.

"Hot parts" of turbo- engine fire walls, blades, adjustable nozzles, tube, etc. - during operation are subject to wear complexity factors that can act simultaneously.

From all wear the factors that work simultaneously on the "hot parts" of the turbo engines – temperatures above 1500ºC,quick thermal shock, pyrolyzed particle erosion to speeds above Mach 3, corrosion, adhesion, etc.-the thermal factor acts most disturbing.[2]

Thermal fatigue is defined as a phenomenon of gradual destruction of the material due to repeated heating and cooling which induces thermal cycle's efforts. Each cycle is a complex combination of effort to change with the temperature and material properties vary.

In the case of "hot parts" of turbo engines, temperatures vary depending on flight operation rules on taking off, landing, intermediate cruising, engine stop in flight, missing landing, etc.

Temperature distribution produces stretching and contracting thermal efforts and implicitly thermal stresses inside.

These increases in thermal efforts though short duration, especially at start up and shut down, can have considerable value and lead to plastic deformation of the material.

Repeating these cycles can lead either to damage or decrease the resistance to oxidation and corrosion of components.

Transitional arrangements worst in terms of thermal shock applications are starting and stopping the engine and the post-combustion functioning.

Successive passages through other operating modes (maximum take-off, intermediate cruising, landing and idling), lead to changes in thermal parameters with values between 5-20%.

In the case of combustion chamber and turbine jet engines, the use of protective systems is absolutely necessary in view of the operating system very hard.

Compressors and valves for storage, which directs the hot gas to the turbine wall, are usually cooled with air at temperatures below 1100°C.

Those components are clearly degraded by oxidation, hot corrosion and thermal fatigue.

Mechanical stresses when the combustion chambers are generally minor.

To the wear by thermal fatigue, we associate thermal shock stresses which act the most disturbing on the turbo engines TBC coatings.

We present some situations that thermal shock still operates predominantly in the functioning of turbo engines:

- Start engine leads to a thermal shock from ambient temperature of engine to operating temperature within tens of seconds. Conditions imposed restrict military aircraft under one minute interval for interceptor aircraft engines in conditions of emergency take off.
- Another example of thermal shock is the stop of the turbo engine at cruising altitude around 11.000m, where the cold air temperature is about -50°C
- Failure landing requiring maximum engine operation in intervals of tens of seconds to restore the aircraft in flight cruising speed

2. Experiments

In the conditions mentioned above, which associate turbo engine extreme operational conditions with values very much on short-term for thermal shock appeared to be necessary to study material behavior at high speeds of heating-cooling, at quick thermal shock test.

2.1. Materials

For experiments were used multilayer samples:

1. Refractory super alloy Nimonic 90 support
2. Bonding layer MeCrAlY layer (AMDRY 997) having as composition Ni, Co, Cr, Al, Ta, Y chemical elements -shaped spherical particles with sizes 37 μm
3. Outer layer of 0.1; 0.2 and 0.3 mm thickness of AZY25 nanometric powder achieved by INCDMNR - Institutul National de Cercetare Dezvoltare pentru Metale Neferoase si Rare.

The specimens have rectangular shape with dimensions 2.6 x 30 x 50 mm.

2.2. Methods and instrumentation

To assess structural changes due to thermal fatigue, thermal barrier coatings were tested at thermal shock and then were investigated by electron microscopy.

Layers of protection were obtained by depositing successive the bonding layer and ceramic layer with air plasma jet method on a type METCO installation.

The thermal shock is the heating of samples from tens of degrees temperatures at hundreds of degrees temperatures i

n a short time (approx. 1 min) and vice versa the cooling of the samples from high temperatures (hundreds of degrees) at low temperatures (tens of degrees).

It should be noted that there is no standardized method and an installation for thermal shock tests for materials covered with layers of protection.

Generally the manufacturers as well as the materials users have both created their own equipment.

It is also important to note that the known installations have generally lower heating and cooling rates of the order of several tens of ºC / min, for both heating and cooling.

These installations are useful for parts that are subjected to mild thermal shock, installations which may not give results in the case of parts from the aerospace industry, space shuttles, hot parts of the turbo engines, parts of metallurgical industry, turbine blades from power industry, etc..

These parts are subjected to heating-cooling cycles hard within a few tens of seconds, the temperature at which they undergo can increase from the ambient temperature above 1000ºC and in as many seconds to reach from 1000ºC to ambient temperature.

Below is presented QTS2 installation, designed and built by the authors for testing materials under conditions of mild heat shock but also for extreme conditions of heating-cooling rates. (Fig.1)

Fig.1. QTS2-Installation for material testing in extreme thermal conditions

Functional parameters of QTS2 installation are: testing materials up to 1500°C, variable heating speed and quick cooling speed of the specimen up to 70°C/s, operating in automatic cycle, monitoring functional parameters, continuous measurement of temperature specimen at heating and cooling, Lab View data acquisition system, view oven heating curve, heating curve cooling curve of specimen.[7]

2.3 Thermal shock resistance test

Thermal shock resistance test aims to reveal micro structural changes of samples tested. Thermal shock test is completed when the macroscopic appear-exfoliation damage, cracks, porosity, more than 25% of the TBC surface tested.

The thermal cycling has been performed at 900ºC, 1000ºC and 1100ºC temperatures.

There were 25 tests for each temperature cycling. There were tested 6 specimens, numbered N94, N96, N97, N98, N99 and N100

The oven is heated at the test cycling temperature. The sample is moved from the environment temperature into the oven. The heating speed of the specimen is variable depending on the specimen size, type of material, single layer or multilayered.

The specimen is moved from inside the oven to the cooling area where is cooled till about 40°C.

The quick thermal test shock were carried out with the following parameters: speciemn heating speed 12.98°C/s;specimen cooling speed 12°C/s; cooling time – 60 s; maintaing time in oven-5 min;test duration- 6 min; cooling air maximum pressure- 8,7 bar; cooling air minimum pressure- 7.13 bar.

In Fig. 2 are presented images of the specimen N98, before and after thermal shock.

2.a 2.b. 2.c.

Fig.2 Specimen N98 before thermal shock test and after test shock at 900ºC and 1000°C.
2a- before starting the test
2b- after test at 900°C
2c- after test at 1000°C

In Fig.3 and 4 are graphs of thermal shock test at temperatures of 900ºC and 1100°C.
The data were obtained with Lab View software and processed with the Origin 6 program.

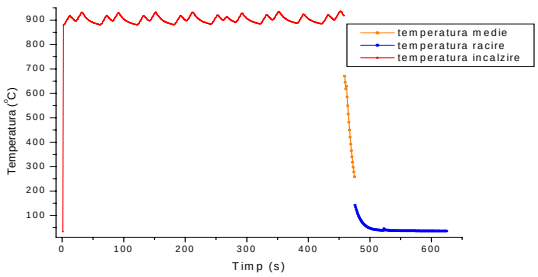

Fig.3 Graphic thermal shock test N98 specimen at 900ºC

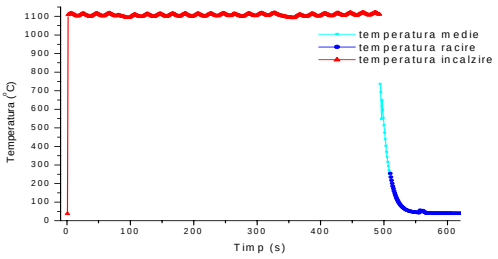

Fig.4. Graphic thermal shock test N98 specimen at 1100ºC

3. Microscopic investigations

Micro structural investigations were made by scanning electronic microscope SEM. It was made a comparative study of the layers deposited both before and after successive testing of specimens at thermal shock.

Fig. 5 and 6 show the composition image of protection coating layer NiCrAlY/ $ZrO_2Y_2O_3$ Al_2O_3 (ASZ25) nano before thermal shock testing. It shows a uniform thickness. It also noted a relatively low porosity. The ceramic layer thickness is between 46.5 -55 µm. The thickness of the bonding layer is 17 - 21.6 µm. At the interface bonding layer / metal support but also the bonding layer / ceramic layer can notice the existence of horizontal cracks.

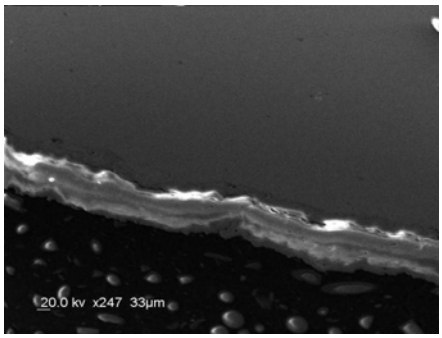

Fig. 5 Image composition NiCrAlY/$ZrO_2Y_2O_3$ Al_2O_3 (ASZ25) protection coating layers before thermal shock test (x247)

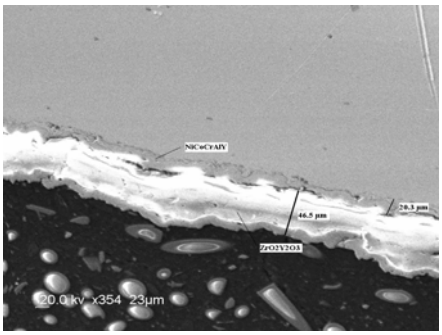

Fig.6. Image composition NiCrAlY/$ZrO_2Y_2O_3$ Al_2O_3 (ASZ25) protection coating layer before thermal shock test (x354)

Fig. 7 and 8 show the composition image of protection coating layer NiCrAlY/$ZrO_2Y_2O_3$ Al_2O_3 (ASZ25) protection coating layers after thermal shock test at 900°C. Note maintaining thickness uniformity. It also noted a relatively low porosity. The ceramic layer thickness is between 47 -64 µm. The thickness of the bonding layer is 17.65 - 24.58 µm. At the interface bonding layer / base metal is observed the existence of horizontal cracks. At the interface bonding layer / ceramic layer is formed a transitional oxide layer, TGO - thermal oxide grown with a variable thickness ranging between 15.69 - 16.35 µm. This oxide layer was formed due to oxidation of bonding layer after migration from coating of the reactive elements (eg Al).

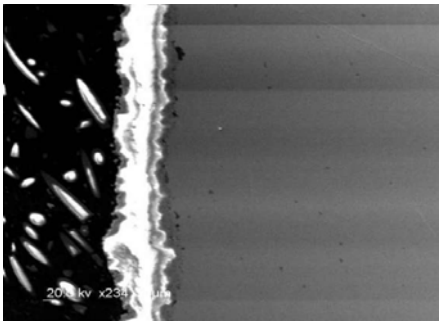

Fig. 7 Image composition NiCrAlY/ $ZrO_2Y_2O_3$ Al_2O_3 (ASZ25) protection coating layers after thermal shock at 900 ° C (x234)

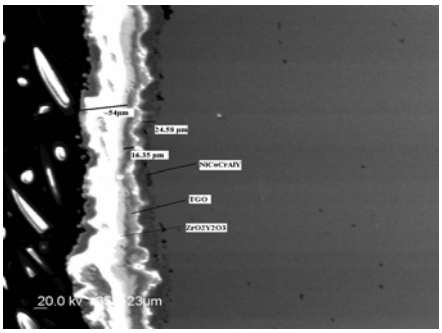

Fig. 8 Image composition NiCrAlY/ $ZrO_2Y_2O_3$ Al_2O_3 (ASZ25) protection coating layers after thermal shock at 900 ° C (x354)

Fig. 9 and 10 shows the composition image NiCrAlY/$ZrO_2Y_2O_3Al_2O_3$ protection system, after thermal shock test at 1000ºC. Note maintaining thickness uniformity. Porosity is low. The ceramic layer medium thickness is 68.28 µm. The thickness of the bonding layer is about 23 µm. At the interface bonding layer / base metal is observed the existence of horizontal cracks. It reveals the existence of chaotic oriented cracks on a small area in the bonding layer.

At the interface bonding layer / ceramic layer are witnessing TGO layer - thermal oxide grown with a variable thickness between 5.69 - 16.40 µm.

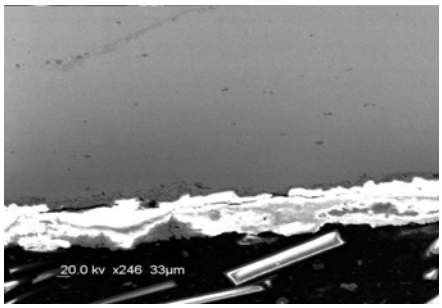

Fig.9 Image composition NiCrAlY/ $ZrO_2Y_2O_3$ Al_2O_3 (ASZ25) protection coating layers after thermal shock at 1000 ° C (x246)

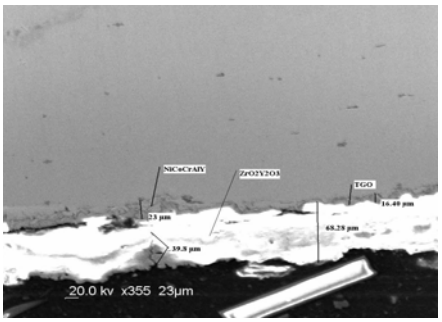

Fig.10 Image composition NiCrAlY/ $ZrO_2Y_2O_3$ Al_2O_3 (ASZ25) protection coating layers after thermal shock at 1000 ° C (x355)

4. Conclusions

1. The "hot parts" of the turbo engines but also those of the co generative systems from power industry are subject to factors of wear-corrosive, erosive, adhesive, by thermal fatigue, which act simultaneously at high values
2. Wear by thermal fatigue which we associate the thermal shock act most disturbing on the endurance of TBC-Thermal Barrier Coating- type protecting coatings of turbo engines
3. Thermal shock tests of the elaborated materials, in order to evaluate the behavior of materials under extreme conditions of the turbo engines were made with an original installation conceived and achieved by the authors of this paper. The QTS 2, quick test installation is a necessary tool, versatile, for evaluating the behavior of materials under high thermal regimes, operating in automatic cycle, monitoring functional parameters, continuous measurements of temperatures between 20 ÷ 1500° C, heating rate specimen up to 100°C / s and cooling rate specimen up to 70°C / s.
4. Quick thermal shock testing on QTS2 installation, allowed the hierarchy of the elaborated materials in relation with a fundamental functional parameter of turbo engine
5. Quick thermal test shock parameters increase, induces macro and micro structural modification of the TBC layers-porosity, developing networks of reticular cracks, oriented mainly horizontally
6. Electron microscopy study reveals the formation of an oxide layer, complex, nano or micron thick at the interface bonding layer/ceramic layer, TGO-Thermal Oxide Growth - due to migration of reactive elements from the bonding layer and their subsequent oxidation
7. TGO layer grows, due to increasing thermal shock parameters amounts, (temperature, and heating-cooling velocity) and may represent fundamental cause which initiates the delaminating of the ceramic coating of the turbo engine and finally its deterioration.

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ANTIFRICTION MATERIALS TECHNOLOGIES TO ACHIEVE BY ELECTROMAGNETIC SUBMITTING

Elena Irimie (*)

THE MILITARY TECHNICAL ACADEMY

Abstract: *Sliding bearings are important machinery elements which sustained other members (spindles or cranked shafts) to send motions. By sliding surfaces, the bearings are taking over radial, axial and combined forces and in the same time, they allow the spindle to have rotary motions or oscillations. The relative motion between bearing and spindle is faced with a resistance due to friction, which the overcome necessitate energy input. Accordingly sliding bearings frictions, thermal effects is very important for practical applications. The paper presents a simulation procedure by finite elements for hydrodynamic lubrication of sliding bearings. We are also studied, using numerical analysis the influences of geometric discrepancy and pin-bearing misalignment. This research was realizing bases on the contract no. 2/2005, in CEEX Program.*

Keywords: *hydrodynamic lubrication, sliding bearings, MEF, geometric discrepancy, misalignment*

1. INTRODUCTION

Sliding bearings are machinery elements which sustained other members, like spindles or cranked shafts, to send motions. By sliding surfaces, the bearings are taking over radial, axial and combined forces and in the same time, they allow the spindle to have rotary motions or oscillations. The relative motion between bearing and spindle is faced with a resistance due to friction, which the overcome necessitate energy input. Accordingly sliding bearings frictions, thermal effects is very important for practical applications.

We have distinguished two kinds of friction: sliding friction, when the surfaces glide one over the other, and rolling friction, when the surfaces effectuate a rolling around an axis, contained by the contact instantaneous plane. Due to these friction, in the couple bearing - spindle develop heat and wear, dignified by substance loss. When the thermal effect and the wear, exceed the calculate values, the sliding bearing is take out of service. The knowledge of friction processes, the couple materials selection, the contact surfaces qualities and form design, correct lubrication with appropriate lubricant, are the main and efficient solutions to disprove and diminish the friction and his destroyer results.

The elaboration of a new realization technology for sliding bearings, with superior performances, suppose to know theirs roles, materials, types of existing sliding bearings and working conditions. In the paper, we are studied, using numerical analysis the influences of geometric discrepancy and pin-bearing misalignment.

We present a simulation procedure by finite elements for hydrodynamic lubrication of sliding bearings. This procedure are based on an finite elements analysis module of thermal distribution assimilated by a pressure distribution in sliding bearing lubricant film and include calculus subroutines for conversion, preparing input data and automatic analysis of output data. These procedures are iterative applied for high precision.

The lubricant film particularities permitted to reduce the specific mathematical model for Newtonian fluids flow in solid space. Reynolds's equation represent the reduced of automaton for lubricant flow in sliding bearing and contains a few specifics simplifying hypothesis [1,2]:

-the lubricant films are very slim comparing the global dimensions of sliding bearing;

-the fluid inertia is negligible;

-the rounding of sliding bearing elements introduces negligible second order mechanical effects.

For stationary work conditions and incompressible lubricant, the Reynolds's equation is [1,2]:

$$\frac{\partial}{R\partial\theta}\left(\frac{h^3}{\eta}\frac{\partial p}{R\partial\theta}\right)+\frac{\partial}{\partial z}\left(\frac{h^3}{\eta}\frac{\partial p}{\partial z}\right)=6R\omega\frac{\partial h}{R\partial\theta} \quad (1)$$

where:

p = lubricant film pressure;

R = average lubricant film radius;

η = lubricant viscosity;

ω = relative angular speed pin-bearing;

h = lubricant film thickness.

The boundaries limits conditions associated to equation (1) are expressed as pressures on feed whole supply and the bearing ends, generally.

Under isothermal conditions, viscosity is constant throughout the lubricant film. This condition presupposes a balance between the quantity of heat generated throughout the lubricant film and the heat absorbed and dissipated by the bearing elements.

2. NUMERICAL SIMULATION WITH FINITE ELEMENTS FOR HYDRODYNAMIC LUBRICATION OF SLIDING BEARINGS

The Reynolds's equation can be seeing like a thermal distribution in 2D space. The similarity of equation (1), including the boundary condition with thermal distribution permitted the numerical simulation with finite elements. We are considered the pressure distribution *p(θ,z)* like temperature. Similar, the thermal conductivity coefficients depend on lubricant film thickness and viscosity:

$$k_\theta=\frac{h^3}{\eta} \quad \text{and} \quad k_z=\frac{h^3}{\eta} \quad (2)$$

The right member of equation (1) is a heat source equivalent. The simulation with 2D finite elements was realized on lubricant film median surface using deltoid element (SHELL) with 6 nodes (suitable for curved surfaces). We are obtained 3245 elements and 6652 nodes that constitute the lubricant film finite elements model.

The finite element model considered only one supply nozzle through which the lubricant is introduced into the bearing at absolute pressure.

For exemplification, we present the solution of hydrodynamic lubrication of a sliding bearing with follow dimensions:

-bearing sizes: diameter, D = 100 mm; length, L = 80 mm; radial play, J0 = 0,2 mm.

-working conditions: stationary, isothermal, steady load space fixed, F = 25 kN,

- lubricant viscosity: η = 0.1 Ns/m2.

The analysis of slide bearings has been carried out for a series of angular velocity steps of the shaft, ranging between 10 s-1 and 500 s-1 (Fig. 1), with developments for the rating with angular velocity of 200 s-1. This was considered proper operation.

Under stationary and isothermal operation, under the prescribed load, the pin occupies within the bearing position determined by eccentricity ε and the positioning angle α.

For each operation mode the solution is obtained iteratively, controlling the two

parameters ε and α to reach the foisting bearing capacity with a tolerance f±0,5%.

The solved procedure is incorporated in an iteration loop, including 3 steps:

- INPUT DATA preparing;
- Running thermal analysis module;
- OUTPUT DATA interpretation.

The input data preparations was done using a calculus subroutine, which starting from the values reached by the parameters ε and α determine the average thickness of the lubricant film on the finite elements and than the material coefficients (2).

After the modification of the material properties the standard thermal analyses program is run, then the out put data are interpreted also using a calculus subroutine.

A part of the results using MEF in lubrication of sliding bearings are presented in Figure 2 and Figure 3. For numerical simulation we used COSMOS/M .

3. NUMERICAL ANALYSIS OF GEOMETRIC DISCREPANCY AND MISALIGNMENT OF SLIDING BEARINGS

From OUTPUT DATA we are extracted the fictitious nodal temperatures and we have determined the sliding bearing elements real pressures. Then, by numerical integrating, we are determined the bearing capacity components and the deviation angle to vertical axis (Fig.4).

4. CONCLUSIONS & ACKNOWLEDGMENT

The numerical simulation of slide bearings with hydrodynamic lubrication allows obtaining useful solutions in the research and design of mechanical systems. In the complete analysis of the insertion process is required where the real heat field developed in the bearing depends on time we have a complicated problem to solve which is associated with an effective thermal analysis problem. The proposed procedure is able of approaching the more general problem of hydrodynamic slide bearings irrespective of their shape, their operation on the lubricants properties.

The position, form and dimensional discrepancy influences on hydrodynamics sliding bearings work can be easy dignified by described numerical simulation procedure. In the paper we are considered three cases of discrepancy – parallel misalignment axis of pin and bearing, "oval" form of bearing and rippled form of bearing interior surface. The sources of these discrepancies are the technological processing, assemblage inaccuracy, working load deformation and wearing out.

Misalignment axis of pin and bearing produced a non-uniform wearing out at the ends of these elements. The "oval" bearing modified the pin hydrodynamic pressure distribution without consequences on sliding bearing work. The rippled form of sliding bearing interior surface produced some distortions of hydrodynamic pressure distribution with consequence of vibrations apparition.

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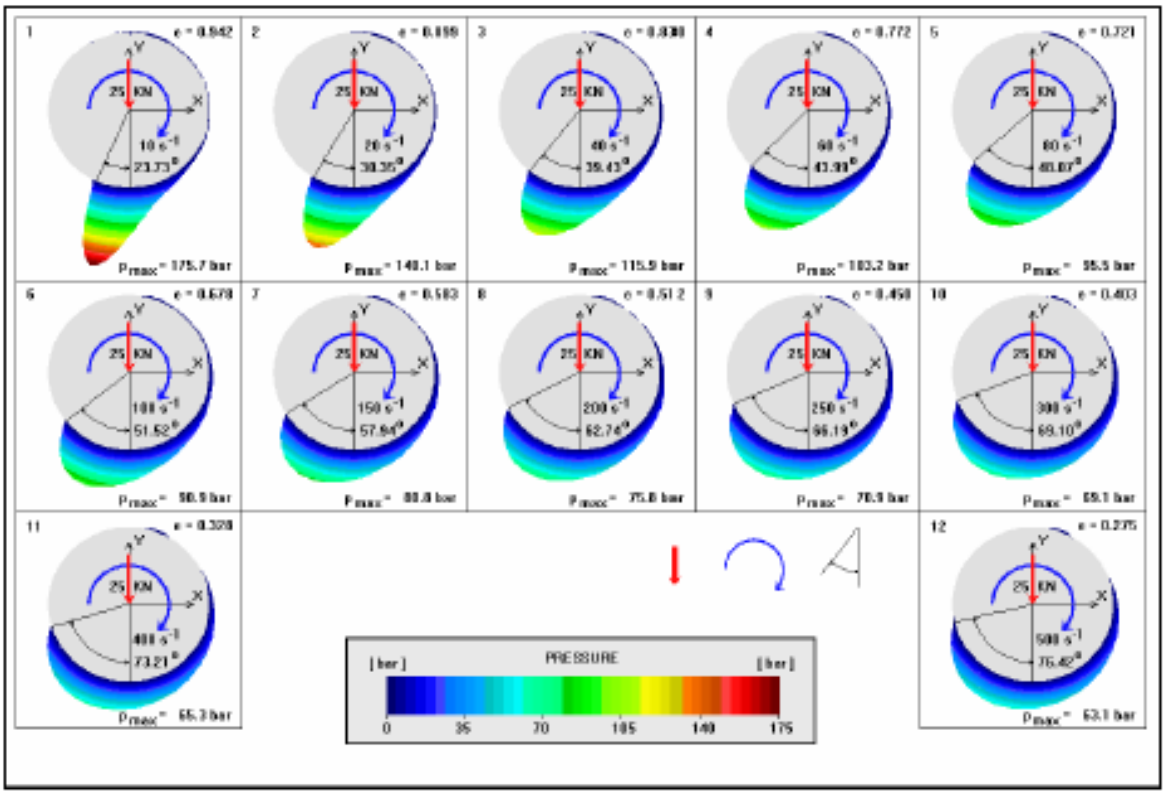

Fig. 1 Pin hydrodynamics pressure distribution function of angular velocity of the shaft

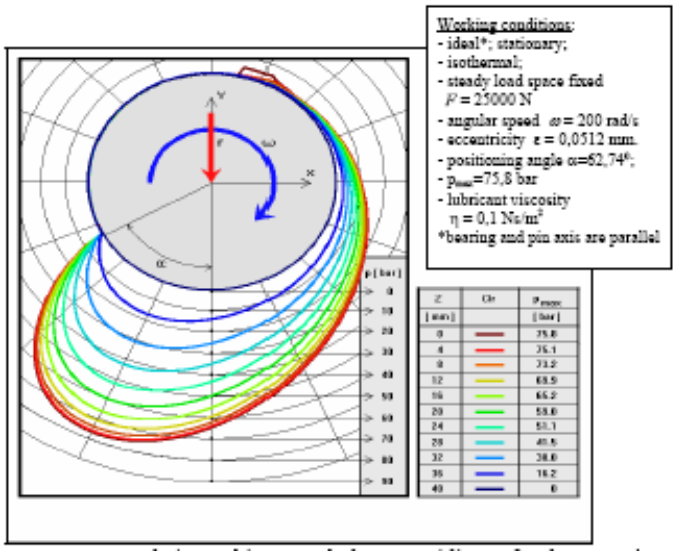

Fig. 2 The pressure curves on axle journal in normal planes equidistant for the operation with the eccentricity ε =0,0512 mm. and the angular speed ω = 200 s-1.

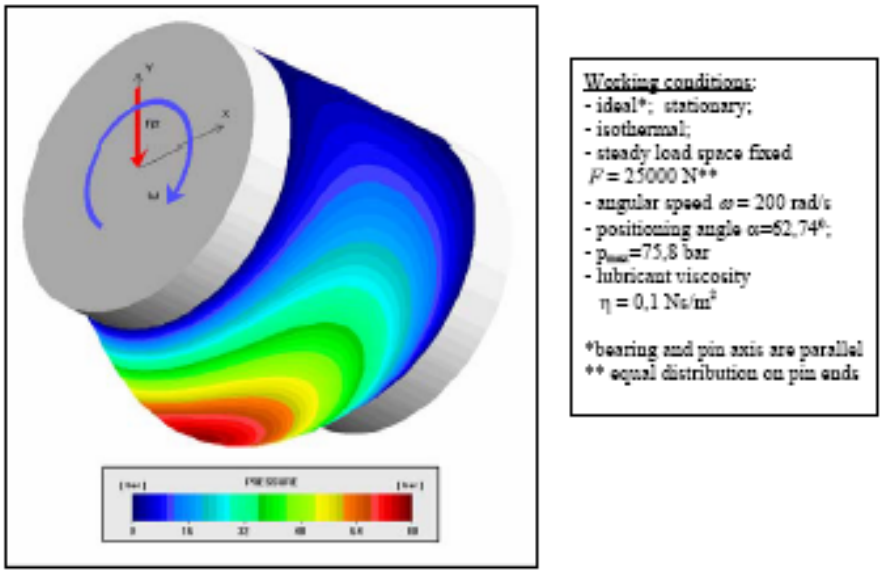

Fig. 3 Pin hydrodynamics pressure distribution.

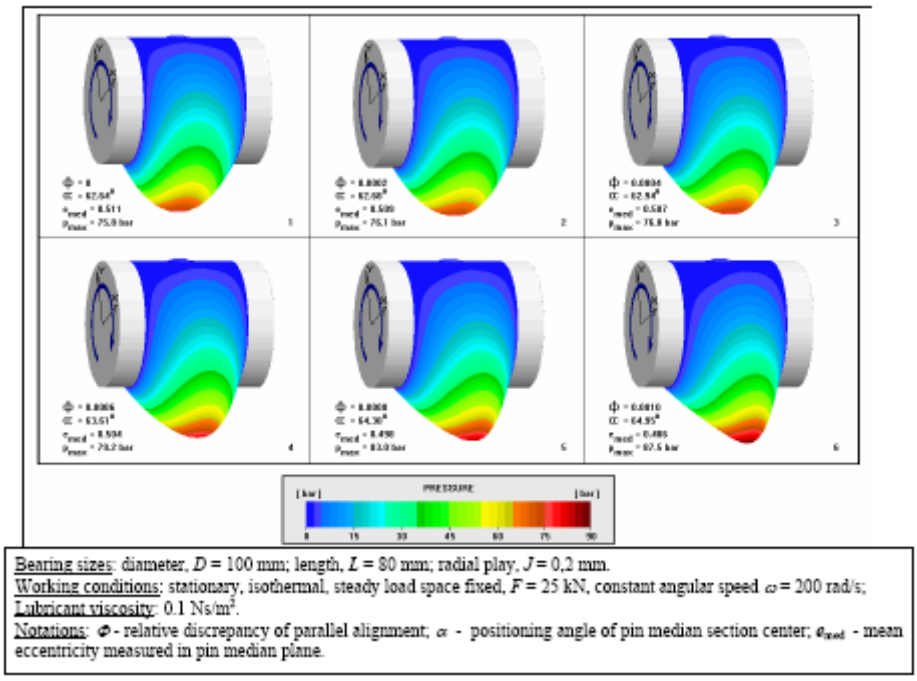

Fig. 4 Pin hydrodynamics pressure distribution in parallel misalignment conditions

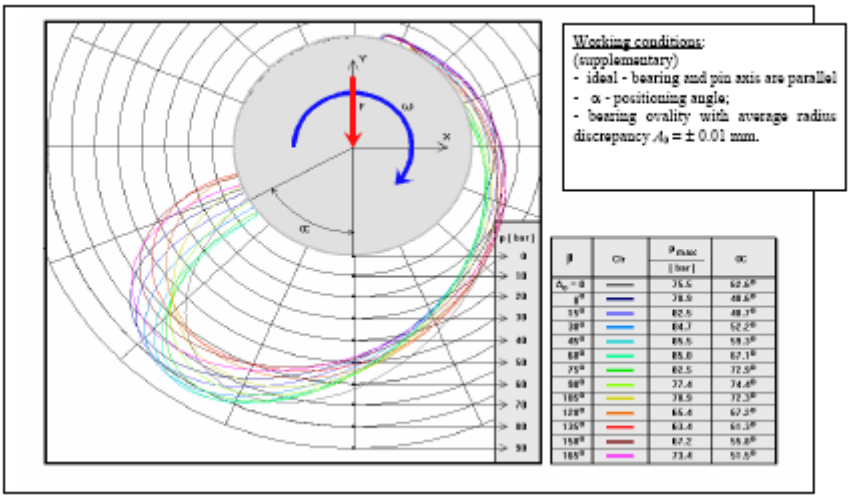

Fig. 5 Hydrodynamics pressure distribution in bearing median plane ("oval" form of interior surface)

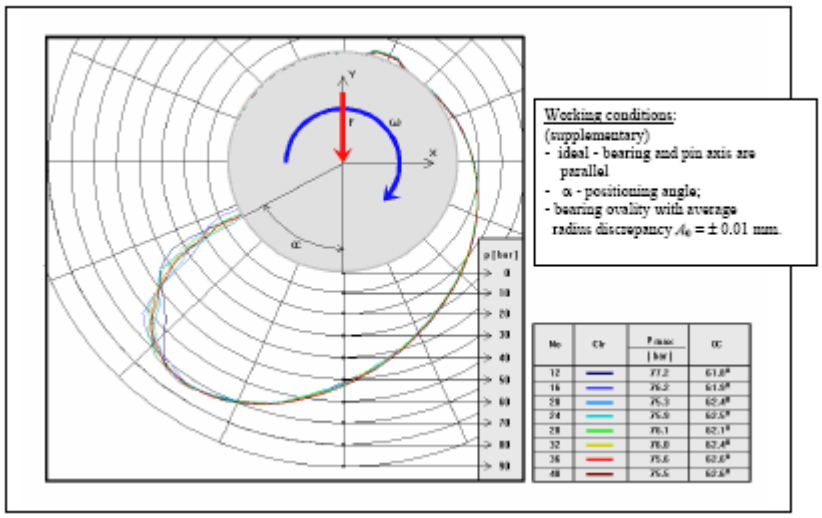

Fig. 6 Hydrodynamics pressure distribution in bearing median plane (rippled form of interior surface)

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ANALYSIS OF SPECIFIC AREAS ON LASER WELDS CROSS-SECTION

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Abstract: *There have been made welds on carbon steel plates. Laser welding process is characterized by obtaining the melting of material. There is an analysis of welds cross section made by laser Nd:YAG laser operated continuously. Were varied the laser power, welding speed and defocusing. Weld cross section was characterized by three sizes related with fused zone. These are measured or calculated surfaces values. Their variation by laser power, welding speed and their ratio linear energy was examined. Three particular values were considered for defocusing. We analyzed the effect of defocus on the molten zone.*

Keywords: *laser welding, steel, weld cross section, melted material*

1. INTRODUCTION

Experimental research in laser welding is an open field. Research on laser welding of steels have been presented in the works [1,2]. Laser irradiation produces metal melting for laser beam intensities of range 10^4-10^7 W/cm^2 and time of interaction between laser beam and material 10^{-3}-10^{-2} s [3]. In these conditions it is possible to achieve laser welding. The conditions of irradiation of the piece in the welding process is performed by varying the laser power, welding speed and defocus (or defocusing depth) [4].

Defocusing is the distance between focal plane and the workpiece surface, figure1. Negative values of defocus show the location of the focal plane below the surface of the workpiece. In such case, get a convergent radiation propagation in the interaction zone with the material. Focus within the piece has been applied in the experiments presented in the works [5,6]. The main part of the analysis refers to the study of welds cross sections [7].

Purpose of the paper is to conduct a comparative analysis of alternative ways to measure the weld area on the weld cross section. Evaluation of the laser beam parametres to obtain the necessary characteristics of melting material and weld quality is emphasized best by weld cross section area. Detailed study of it can be different. In this work it considers different ways of assessing it. Direct measurement of molten area MA is strictly linked by obtains melt. The area of this zone can be measured.

There are issues of demarcation between the melted and heat affected material and not melted. The interface between these areas is not smooth. Heat affected zone and melted zone after weld is visible on the photograph of weld cross section. This area A will be called heat affected zone area. Evaluation of the two areas together is a combination of the effect of thermal heating and melting of the material. This area can be assessed much better because it is larger than melted area and the interface between it and the material is smooth and

unaffected by heat. In other situations it is necessary only a rough assessment of the penetration of the weld in material. This is done on only by measured melted zone width at the piece surface and depth of the weld. It is considered a form triangle form of weld cross section.It is associated with the melting.

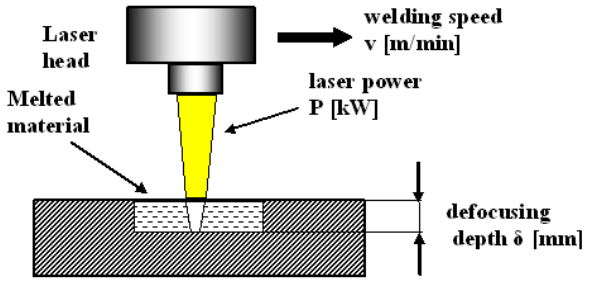

Fig. 1. Varied parameters in experiments

Triungiulare zone area is calculated and named as S. Sizes above can be used to evaluate weld in accordance with a specific purpose. On the other hand they show the particular effect of thermal phenomena. The area MA shows the effect of laser melting material. A area shows the cumulative effect of melting and heating the material and thus indicates the energy transmitted by laser to the material. S calculated area is a quick way to assess the weld cross section area. Areas A, S and MA on the weld cross section are presented in Figure 3.

For high penetration welds under keyhole welding regime the S area contains mostly melted zone area. All three areas analyzed are related to the molten weld zone. Part of the energy transmitted by the laser is used for maintenance of thermal phenomena that are unfavorable to achieve the weld. These are vaporization and melt movement.

2. EXPERIMENTAL PROCEDURE

The material used was steel Dillimax500 EN 10137. This is a fine grain steel with high elasticity limit elasticity $C \leq 0.16$.

The experiment consisted of fusion lines (welds) with the line length of 110mm on steel Dillimax500 plates with thickness 10mm. An industrial laser machine Nd: YAG Trumph Haas 3006D was used. It emits radiation with wavelength $\lambda = 1.06$ μm and have a maximum power of 3kW. Irradiation was performed in continuous regime. The radiation was controlled by variation of three parameters: laser power, welding speed and defocusing distance (position between the focal point and the piece surface), figure 1. Welds are presented in figure 2

Fig. 2. Welds on steel plate a) Plate surface b) Cross-section for welds

Defocus change by lowering the focal plane inside the piece increases the laser spot on the piece surface. This decreases the laser beam intensity at the piece surface, but provides convergent laser radiation propagation in the interaction area. Values produced by the laser beam spot size on the workpiece surface are presented in the following table 1.

Table 1 The relationship between spot diameter and defocusing

Defocusing δ [mm]	0	-2	-4
Spot diameter D[mm]	0,6	0,84	1,08

Linear energy is a quantity that characterizes the material irradiation in terms of the relative motion between the material and laser head, and in terms of ability of laser beam to radiate the material.

In welding it is a standard size that characterizes the heat source. It shows the energy that is sent to the material per unit length traveled. It is calculated by the ratio between power and speed.

$$E_l = \frac{P}{v} \quad [\text{J/cm}] \qquad (1)$$

For welds made were analyzed following the welds. Have been measured weld width

near the piece surface and the weld depth at weld center. These were used to calculate the area of a triangular area S. On the weld footprint were measured directly using graph paper area MA of molten zone and area A of heat affected zone that including melted zone MA.

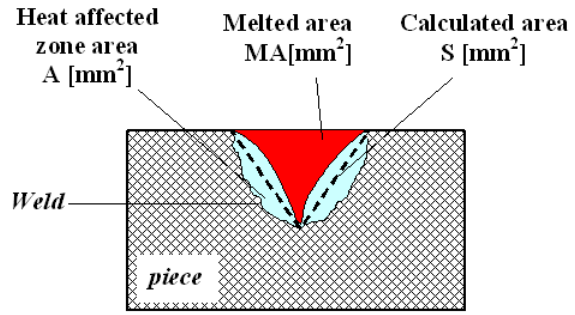

Fig. 3: Scheme variables measured on the weld cross-section

Production of melt the in material is given by the laser beam intensity at piece surface and interaction time between laser radiation and material. Values for these physical quantities are given, as general field, by the following: laser beam intensity 0.54×10^5 -10.61×10^5 [W/cm^2] and interaction time 24-480 ms.

The varied parameters laser power, welding speeds and defocusing have the following effects on molten zone dimensions:

- Laser power. Increasing the laser power produce increase the intensity on piece surface therefore melted material amount increases. From a certain value, intensity not too high melting material amount, favours material vaporization.

- Welding speed. Increases the welding speed decreases the interaction time between laser radiation and material. If the interaction time is less then the molten zone dimensions are smaller.

- Defocusing. Defocusing by lowering the focal plane within piece produce lower intensity at piece surface by increasing laser spot area at piece surface and from same issue will increase interaction time between laser and material. Table 1 shows the relationship between the values of spot diameter on the piece surface and defocusing.

Focus within piece associated with the presence of keyhole welding bath will increase the spread of radiation in keyhole and coupling of laser radiation and material. Defocusing may thus have different effects on melting material. You can not predetermine a clear trend of increasing or decreasing the molten zone. Defocusing effects will be analyzed based on experimental results.

3. VARIATIONS WITH LASER POWER

Figure 4 shows a linear increase of the melted area with the laser power. This trend is valid for all three values of defocusing. At low power defocusing $\delta = 0$ produce the largest weld melted area. At high power focus inside piece $\delta = -2\,mm$ produce higher values of weld melted area. It leads to a strong dependence on the laser beam intensity on the piece surface for melted area both by varying laser power and spot diameter on the workpiece surface.

Figure 5 shows a increase of heat affected zone area with the power for all three values of defocusing. The highest values for this area are obtained to focus at surface $\delta = 0$.It shows the increase of spaces between the regression straight lines with the increase of laser power.Increased laser power produce variations of laser beam intensity on the workpiece surface. These are highlighted for the isothermal curve vursection that separates the material unaffected by heat affected zone of weld.

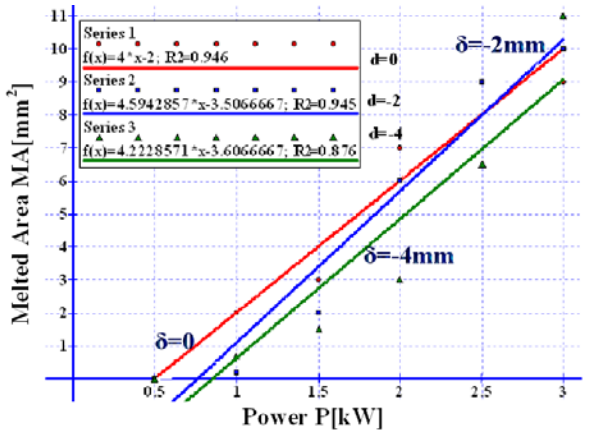

Fig.4 Weld melted area depending on the laser power at welding speed v=0,6 m/min

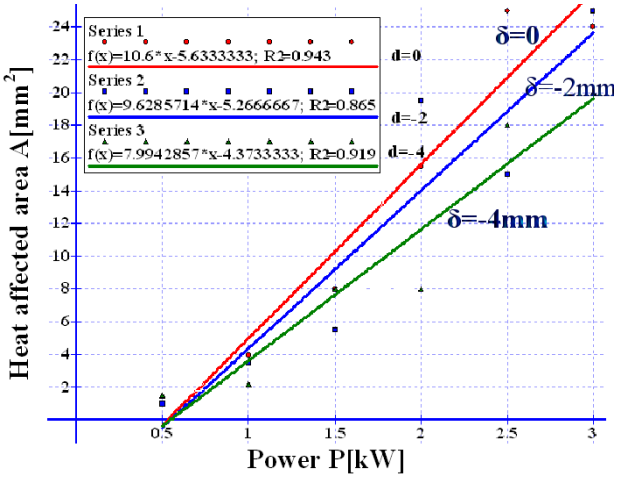

Fig.5 Weld heat affected zone area depending on the laser power at welding speed v=0,6 m/min

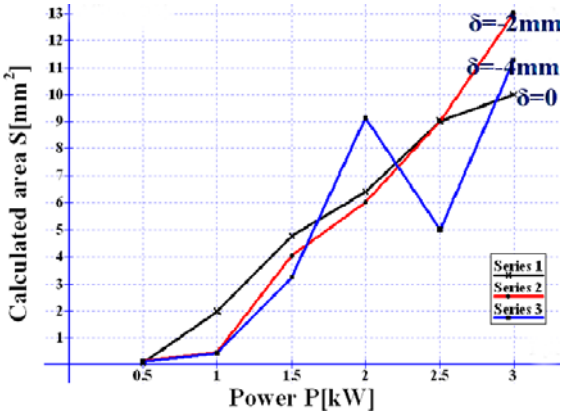

Fig. 6 Weld calculated area depending on the laser power at welding speed v=0,6 m/min

Figure 6 shows the variation with laser power for the calculated area S. There is an increase in S area with power for three values of defocusing. Higher values are for S are obtaned for focus to the surface $\delta = 0$ and for focusing in deep $\delta = -2\,mm$ variation are in a similar manner to the MA. Focusing inside piece $\delta = -4\,mm$ to produce instability in the melt zone area. These put out statements such as increased focus within the piece weld calculated area.

It is noted that experimental series where power was varied shows the same variation type for analyzed sizes MA, A and S and the three defocusing values.This increase is linear, the regression lines slopes close for the three values of areas analyzed.

4. VARIATIONS WITH WELDING SPEED

Figure 7 shows the variation for melt area MA with welding speed.

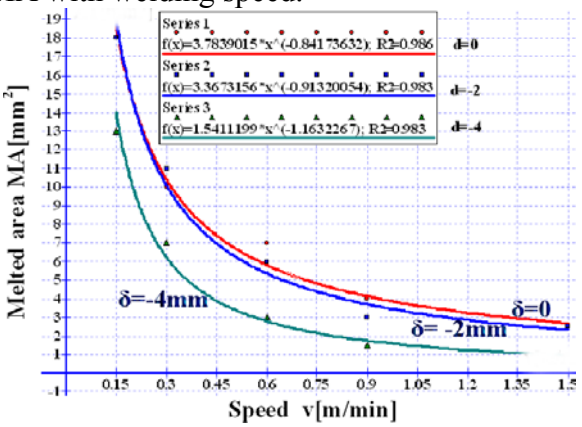

Fig. 7 Weld melted area depending on the welding speed at laser power P=2kW

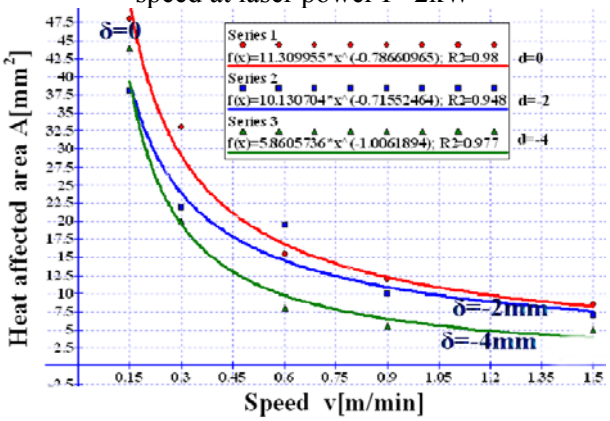

Fig. 8 Weld heat affected zone area depending on the welding speed at laser power P=2kW

There is a logarithmic decrease in the melted area with the welding speed for three values of defocusing. Higher values for melted area MA were obtained for the focus to the

surface $\delta = 0$ and inside piece $\delta = -2\,mm$. For experimental series with speed variation does not varied the laser beam intensity on the piece surface. Effect of focus within the piece area is rendered more powerful at lower welding speed.

Figure 8 shows the variation of heat affected zone area A with welding speed. There is a logarithmic decrease of A area with welding speed. It is noted that the focus within the piece at $\delta = -2\,mm$ has an effect close to the focus $\delta = -4\,mm$ at the beginning of the experimental field and close to the $\delta = 0$ at the end of experimental field .This indicates an efficient transfer of heat in the material provided by the focus is inside the piece and welding speed is high. This trend is more being evidenced by a isothermal at temperature lower than melting temperature.

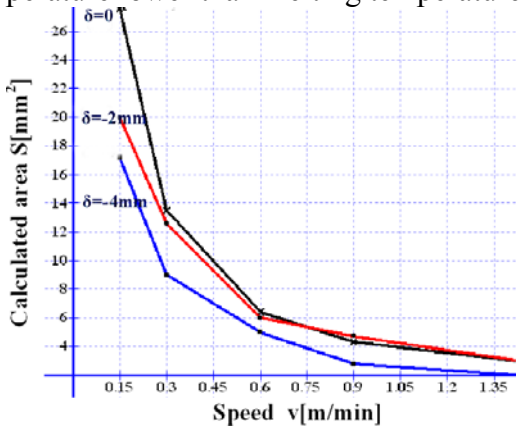

Fig 9 Weld calculeted area depending on the welding speed at laser power P=2kW

Figure 9 shows the variation of calculated area S with the welding speed. There is a tendency to decrease the sectional weld calculated area with welding speed. The highest values are obtained for the focus to the surface $\delta = 0$ and inside the piece.

The variations are similar to those produced for the size MA. For the three values analyzed MA, A and S there is a similar behavior in terms of variation of welding speed. This is the type of logarithmic decrease.

5. VARIATIONS WITH LINEAR ENERGY

Figure 10 shows a linear increase in the area of the weld molten zone with linear energy. Aria MA is higher to focus on the surface $\delta = 0$ and in piece deep $\delta = -2\,mm$. For these cases the laser beam intensity was higher compared to that of $\delta = -4\,mm$

Figure 11 shows a linear increase for area A with the linear energy. In this case the effect of high intensity at the surface is much stronger. It looks like that with decreasing temperature obtained isotherm of material structure change given the effect of main heat source represented by the laser beam becomes more pronounced.

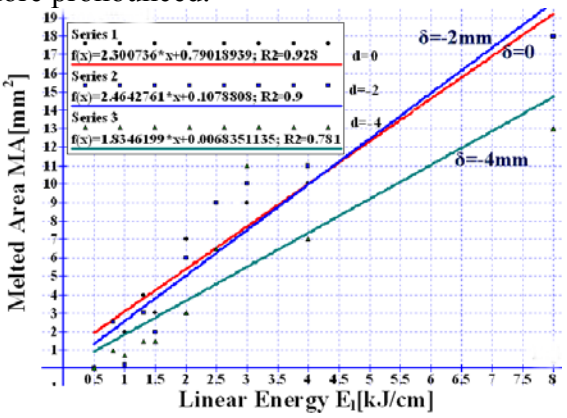

Fig. 10 Weld melted area depending on linear energy

Figure 12 shows a linear increase of the calculated S area with linear energy. It is noted that the increase complies with most of part the experimental field order intensities at piece surface. Higher values are obtained for the laser focus at the workpiece surface $\delta = 0$.

All three types of areas considered to show the same type of linear increase. The slopes of

regression straight lines are close. Thus all three sizes can be used to characterize the weld cross section MA is less sensitive to the value of laser intensity on the surface while maintaining the high values.

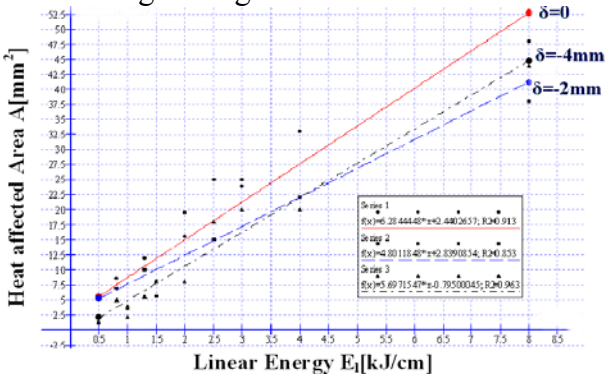

Fig.11 Weld heat affected zone area depending on linear energy

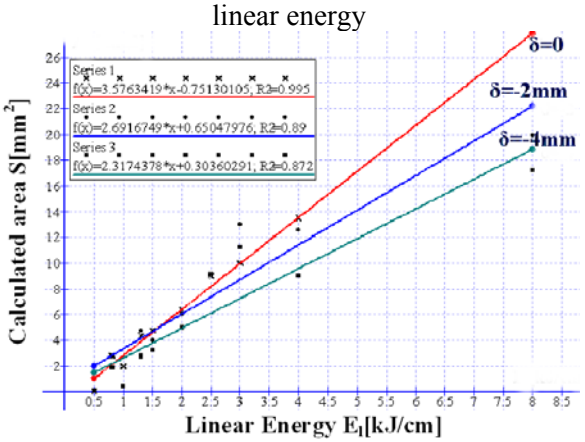

Fig. 12 Weld calculated area depending on linear energy

Contrary A is less sensitive to low values of laser intensity on the piece surface. S area has a average size effect compared with the two sizes discussed above. This has a balancing effect for the three defocus values, respecting the laser intensity decreases

3. CONCLUSIONS

The paper addressed three different ways to treat the cross-section area for welds. It was shown that the variation of the three areas expressed in way similar parameters effects. Selection between these sizes to characterize the weld cross section will be according to a particular purpose. Highest thermal effects are obtained for the laser beam focus on the workpiece surface $\delta = 0$. In this case the laser beam intensity at the workpiece surface was maximum. Generally considered the areas decrease with the focus within the piece and from that with the laser beam intensity to the workpiece surface.Defocusing at present has a closer effect to the $\delta = 0$ when the size is associated with production of the melt. It shows that for $\delta = -2\,mm$ the increasing amount of melt is produced. It is recommended to use defocus for making welded joints

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LASER BEAM DEFOCUSING EFFECTS ON LASER WELDS SURFACES

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Abstract: *It presents experimental results for laser welding of carbon steel. Weld surface shows issues of the welding process dynamics. It analyzes several dimensions that characterize the weld surface. Changes in their aspects shows melt movement and vaporization of material which appear under keyhole welding regime. It examines the effect of defocus on particular areas of welds. It examines the crater obtained at the end of the welding process after stopping irradiation.*

Keywords: *laser welding, steel, weld surface, weld crater*

1. INTRODUCTION

Laser systems are used in welding technology. The laser beam is used as a heat source to achieve melting of the material. For laser welding are two welding regimes conduction regime and the keyhole regime. For keyhole welding regime take place for the material vaporization and a strong movement of the melt. These produce changes in surface characteristics of welds.

Laser welding of steels has been presented in the works [1,2]. Study of characteristics of welding work was presented in works [3,4]. In laser welding usually are varying the average laser power and welding speed. A better characterization of the condition in which laser welding has been achieved has been presented in works [5,6]. Defocusing or depth of focus is the distance between the focal plane (minimum diameter of the laser beam is the focal plane) and the workpiece surface. Negative values for defocusing means positioning of laser beam focal plane below the workpiece surface.

This method provides convergent laser beam propagation in the interaction zone. Focus within the song was used in the work [7,8].

The study of laser welds surfaces provides information about the dynamics of the welding process. Welding starts with an elevation zone of the weld. This is due by melt movement to back of the welding bath.

At the beginning of the welding process welding bath is unstable. At the end of the welding process is a crater. It is associated with a stable region of the weld. The crater has the shape of the welding bath. Weld width, waves appear on the piece surface and crater at the end of the weld provides information about the movement of melt in the welding bath. Welds were made in keyhole regime. It shows that for this welding regime to obtain interesting effects sizes that characterize the welds surfaces.

The aim of this work is to study the effect of defocus on some quantities that characterize the welds surfaces for laser welding. Experiments consisted of classic experimental series that were varied laser power and welding speed.

For this was achieved variation of linear energy which is given by the ratio between laser power and welding speed. Most welds were showed keyhole welding regime. Analyzed sizes were characteristics of the weld surface that can be linked to vaporize and melt movement.

2. EXPERIMENTAL PROCEDURE

The experiment consisted of fusion lines (welds) with the line length of 110mm on steel Dillimax500 plates with thickness 10 mm.An industrial laser machine Nd: YAG Trumph Haas 3006D was used. It emits radiation with wavelength $\lambda = 1.06$ μm and have a maximum power of 3kW. Irradiation was performed in continuous regime. Laser beam was transmitted through a fiber with 0.6 mm diameter. The focusing system assures the spot in focal point with 0.6 mm diameter.

The focal distance of lens was 200 mm. As protective gas was argon with a flow rate of 20 l/min. On the 6 sheets of material with $100\times130\times10$ mm dimensions was made between 5 and 8 welds on each plate, total 37 welds.

The material used was steel Dillimax500 EN 10137. This is a fine grain steel with high elasticity limit elasticity. Chemical composition, the upper limit expressed as a percentage is given as follows $C\leq0.16$, $Si\leq0.5$, $Mn\leq0.1.6$, $P\leq0.02$, $S\leq0.01$, $Cr\leq0.7$, $Ni\leq1$, $Mo\leq0.6$, $V+Nb\leq0.08$

The radiation was controlled by variation of three parameters: laser power, welding speed and defocusing distance (position between the focal point and the piece surface).

Analyzed sizes in the paper were weld width L [mm], the area of crater which was obtained at the end of the welding process acr[mm^2], crater shape as expressed by the deviation from circularity abc[%], and the crater depth i[mm] and the crater volume V[mm^3]. Weld width L [mm] was measured at the surface of the weld. It was considered an average value based on three values measured at the beginning of the weld in the middle and end of weld. Crater dimensions (X axis in the direction of welding, and the Y transversal axis elongation b) and its area were measured indirectly using its image, figure1,2 .

Crater depth was measured using a comparator device. Weld width, crater dimensions X, Y, b, crater depth and crater area are directly measured quantities.Deviation from circularity and crater volume are calculated sizes. They are given by the following relations:

- for the deviation of circularity:

$$abc = \frac{b - r_{med}}{r_{med}}\,[\%] \tag{1}$$

with:

$$r_{med} = \frac{1}{2}\left(\frac{Y}{2} + X - b\right)\,[\text{mm}] \tag{2}$$

- for the volume of the crater (it was considered a conical shape of the crater)

$$V = \frac{i}{3} \times acr \tag{3}$$

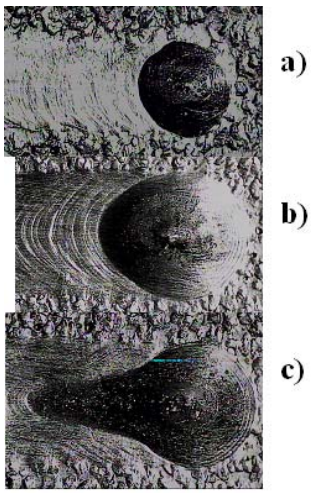


Fig.1 Crater obtained at the end of the welding process with the following forms: a) circular b) oval c) oblong

To assess the effects of melt movement and vaporization compared with that of the material melting is compared the weld depth with the crater depth. This comparison is done by the ratio between crater depth and weld

depth named G ratio. It will discuss the variation of ratio G with energy linear.

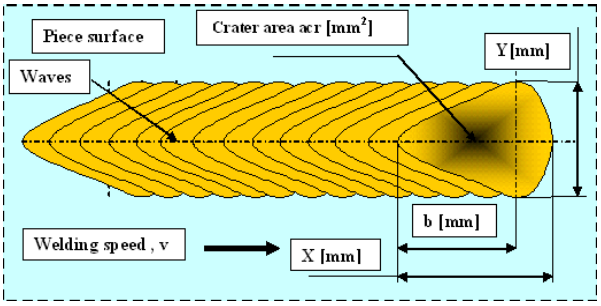


Fig. 2 Weld surface with analyzed sizes

By variation of these parameters was made the control of two parameters: the laser beam intensity and time interaction time. Both parameters were calculated in relation to the size of 0.6 mm focal spots. To achieve a complete characterization of experimental conditions were presented in term of calculated parameters interaction relative to the size of focal spots and the laser beam intensity.

Laser spot on the workpiece surface is circular. It is characterized by its diameter. The relationship between defocusing and spot diameter on the workpiece surface D was determined by measuring the focal spot. These are presented in Table 1. On the basis of their relationship was made the following correlation between defocusing and focal spot diameter D. It took into account the range of variation of experimental values for defocusing.

$$D = 0{,}12|\delta| + 0{,}6 \quad [\text{mm}] \qquad (4)$$

Applying this relationship (4) to defocus values used in the experiments are presented in Table 2.

Linear energy E_l is a quantity that characterizes the material irradiation in terms of the relative motion between the piece and laser head, and in terms of ability to radiate the laser material with laser beam.

Table1 Experimental variation of laser beam spot diameter with defocusing

Defocusing δ [mm]	0	± 5	± 30
Spot diameter D[mm]	0,6	1.2	5

Table2 Calculate variation of laser beam spot diameter with defocusing

Defocusing δ [mm]	0	-2	-4
Spot diameter D[mm]	0,6	0,84	1,08

For welding the linear energy is a standard size that characterize heat source. Linear energy show energy that is sent to the material per unit length traveled. Energia liniară se calculează prin raportul dintre putere şi viteză. Linear energy is calculated by ratio between laser power and welding speed.

$$E_l = \frac{P}{v} \quad [\text{J/cm}] \qquad (5)$$

3. WELD WIDTH AND WELD HEIGHT ABOVE THE SURFACE

Figure 3 shows variation of the weld width with the energy linear. There is a tendency to increase weld width is with linear energy for all three values of defocus. The highest weld widths are obtained for laser beam focusing surface.There is a minimum around 3 kJ / cm for all three values of defocus. The type of variation presented shows that the weld width increase with increasing linear energy are limited.

Figure 4 shows the variation of weld height with linear energy. Welds made had generally a low height over the piece surface. At high values of welding speed welds were lowered below the surface of the workpiece. Higher values for weld height were obtained for the laser beam focusing to the workpiece

surface $\delta = 0$. It is noted that for all three values of defocus to obtain a maximum value close to 3 kJ /cm. This increase of weld height is associated with decreased for weld width shown in Figure 3. At low linear energy and high linear energy welds height are low.

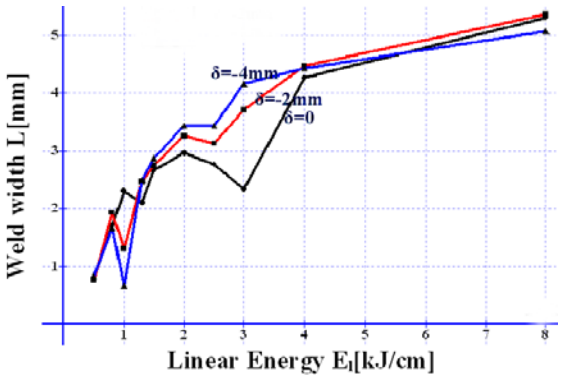


Fig.3Weld width variations depending on linear energy

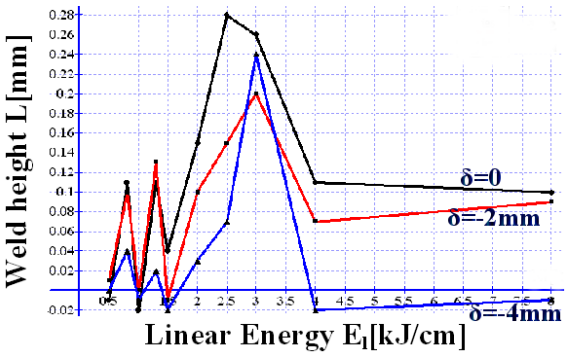


Fig.4 Weld height variations depending on linear energy

3. CRATER OBTAINED AT THE END OF WELD

Figure 5 shows the variation of deviation from circularity of the crater with linear energy. The largest variations of crater dimensions were obtained for the focus to surface. Near linear energy 3kJ/cm is observed a maximum. This signifies a strong deformation of the crater. Deformation of the crater is due to melt motion in the welding pool. Deformation of crater has minimum values d at the beginning and at the end of the experimental area.

Figure 6 shows the variation of crater area with linear energy. Crater area increases with linear energy. This increase is close to a logarithmic function for three values of defocus. The highest values for the crater area are obtained to focus the laser in depth piece $\delta = -2\,mm$. In this situation are favored vaporization and melt movement leading to crater formation.

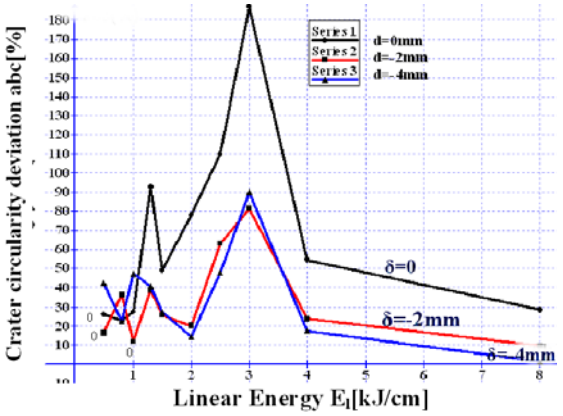


Fig. 5 Variation of deviation from circularity of the crater with linear energy

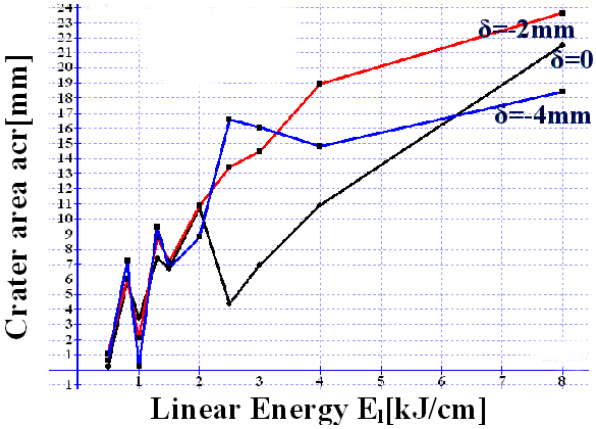


Fig. 6 Variation of the crater area with linear energy

Figure 7 shows the variation of crater depth with linear energy. There is a logarithmic increase tendency to crater depth with linear energy for all three values of defocus. It is limited and rapidly reaches a constant level. The higher values for crater depth obtained for focus on the surface $\delta = 0$.There is a maximum intensity at the surface and promotes melt movement and evaporate of material. It notes the presence of a relative maximum close to linear energy value of 3 kJ/cm.

Figure 8 shows the variation of G ratio with linear energy. G ratio has relatively small

values. It shows that so much of the crater is filled with solidified melt. For all values of defocus is observed a maximum around 1kJ/cm linear energy value.

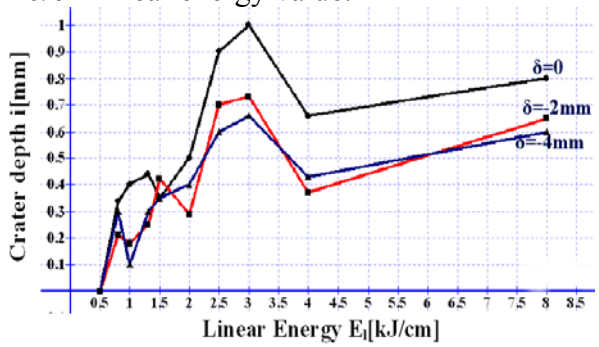


Fig. 7 Variation of crater depth with linear energy

This situation is associated with a strong movement of the melt. On the rest of the experimental field G ratio values are close, they form a constant level..

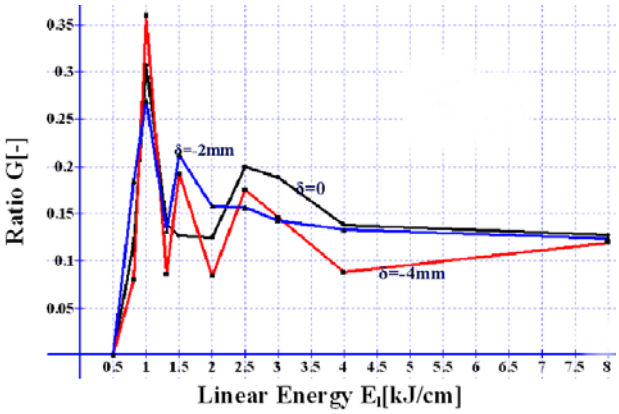
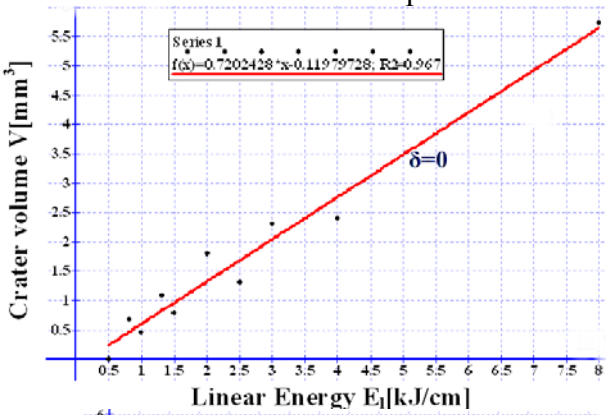
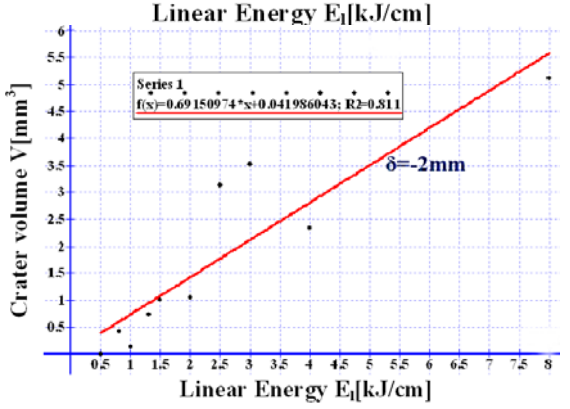


Fig. 8 Variation of ratio G with linear energy

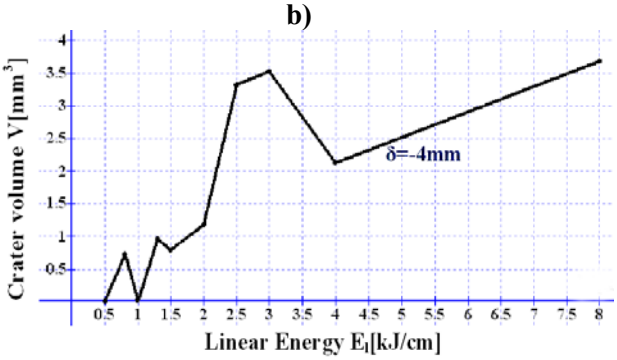
After the main peak were observed that higher values are obtained for the ratio G to focus within the piece for $\delta = -4\,mm$ and $\delta = -2\,mm$, in relation with focus on the surface $\delta = 0$ .It looks as though the focus within the piece that increases the coupling between laser radiation and material this is favoring the melt movement and not production of melt. At high values of linear energy G ratio has higher values for the focus to the workpiece surface



a)



b)



c)

Fig. 9 Variation of crater volume with linear energy at defocusing a) $\delta = 0$, b) $\delta = -2\,mm$, c) $\delta = -4\,mm$

Figure 9 shows the variation of calculated crater volume with linear energy. For all three values of defocus is observed a linear increase in the volume of the crater with linear energy. The volume of the crater has a relatively

uniform reaction to the change in linear energy. This shows the amount of compensation between crater depth and crater area.

3. CONCLUSIONS

The welds surfaces provides information about the dynamics of the welding process. Weld width, weld height and size of the weld crater providing information that interrelated describes the dynamic aspect of the welding process. Linear energy characterizes the conditions for achieving the effect of laser irradiation by combining separate effects of changes in power and welding speed. It noted that:

- Focus on the workpiece surface produced the highest values for the sizes analyzed. In this case the melt movement is strong and also powerful evaporation of irradiated material takes place.

- Effects for focus in piece depth at $\delta = -2mm$ are stronger than those for focus in piece depth at $\delta = -4mm$. From this it showed the contribution of phenomenon keyhole in welding bath to increase the laser radiation absorption by multiple reflections.

- There is a clear tendency to increase weld surface deformation with increasing linear energy.

Reaching a certain maximum for crater deformation was associated with the maximum effects of keyhole welding regime.Using the linear energy as a parameter for irradiation conditions in welding provides the opportunity to observe some important energy balance between the considered sizes. Weld width increases with linear energy while the weld height decreases. The area of the crater and crater depth increases with linear energy while the crater deformation decreases. This shows that it forms a relatively limited amount of melt at a given value of linear energy. This is substantiated by the linear variation of crater volume obtained for all three values of defocus.

For laser welding it is important to obtain a significant amount of melt and the smallest part of the energy transmitted to the material to be used for metal vapor production and movement of melt. To obtain this situation is recommended laser beam focus $\delta = -2\,mm$. Reduce the intensity of the workpiece surface in this case had a favorable effect on the welding process.

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ADVANCED MATERIALS FOR AEROSPACE, COMPOSITE WITH FINE STRUCTURE

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Abstract: *Metal or ceramic composites with reinforced metal or ceramic materials consist the future for material class.The paper propose to present the results and the conclusions of a few researches in this field.*
Keywords: *composite, nano-composite,metallic materials*

1. INTRODUCTION

Mixture of several components, whose properties complement each other, resulting in a material with properties superior to those specific to each component part, defines the composite material.

Delineate the difficulties arising in composite materials based on the idea (often used as an objection) that, practically, almost any material is a composite material are extremely rare because no impurities, no defects, alloying elements or not impregnated, coated, treated superficially covered. The distinction is harder to do if their material is taken into account the atomic and molecular scale.

Depending on the structure of materials can be classified as :

a) crystalline materials:
- polycrystalline(ferrous and nonferrous alloys);
- crystal (metals, oxides, carbides, nitrides, semiconductor and optoelectronics)
- Microcrystalline (alloys subjected to heat treatment such as hardening);

b) semicrystalline (polymer);
c) amorphous and glassy materials (metallic and nonmetallic);
d) composite materials:
- Each component dispersed;
- Pressed powder aggregate;
- Associated material, obtained by surface coating with metallic or nonmetallic substances;
- Layered (obtained by assembling successive or simultaneous).

The superiority of composite materials compared to conventional materials, resulting in Figure 1.1, which is the ratio of tensile strength and density with temperature.

As shown, metal matrix composites are superior to conventional ones, but with lower properties of ceramic composites

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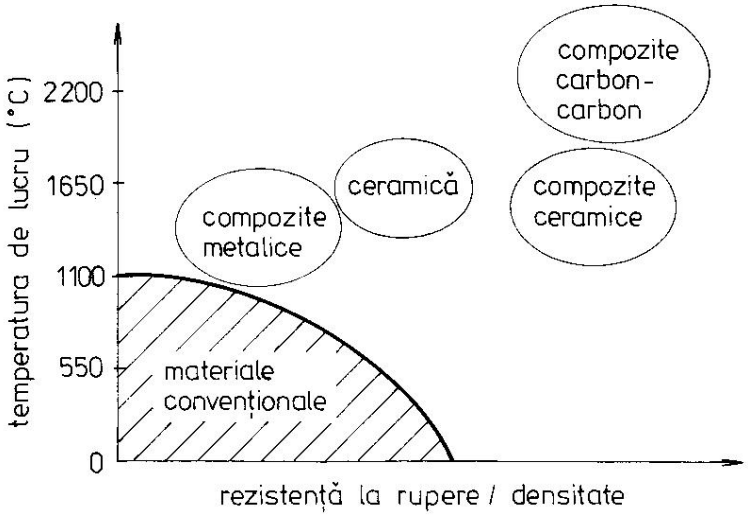


Fig. 1.1 The place they occupy between the composites materials resistant to high temperatures

Resistance-temperature composite materials, corrosion or oxidation is determined primarily by the nature of the matrix. In general, the matrix is deformable composite material, having a lower strength than the composite material. Matrix choice is based on the purpose and the possibility of producing composites. Components operating at high temperatures should not occur expansion differences between the matrix and dispersed component (if metal or alloy cermet). In case of major mechanical stress, modulus reinforcement material must be greater than the matrix material to provide load transfer between components. A very strong adhesion between the composite constituents favor this transfer, leading to increased fragility.

Concerns about the world in terms of technology, have led to technologies shaping next generation of ceramic-metal composite materials:

- by polyphasic sintering process (or cosinterizare) under load or no load;
- by impregnating the porous ceramic with molten metal mass;
- by deposit of very fine particles (nano) on various supports (metal, ceramic composite were even) by electrodeposition method, the adsorption, diffusion, thermo-chemical treatments, etc.. In-depth analysis of processes, it is found that any of the methods used to manufacture composite aggregates and other processes specific phenomena. The result is a composite manufacturing process engineer pluricomplex with specific physical, chemical, thermal, electrical.

In theory composites seem to be two basic models, namely, model Naidich Weyl respectively. Principle schemes for the two models are presented in figures 1.2 and 1.3. Due to the high polarizabilității of oxygen anions and their large size compared with metal cations, can be considered in accordance with Weyl's model that the surface oxide layer is a double-anion, figure 1.2.

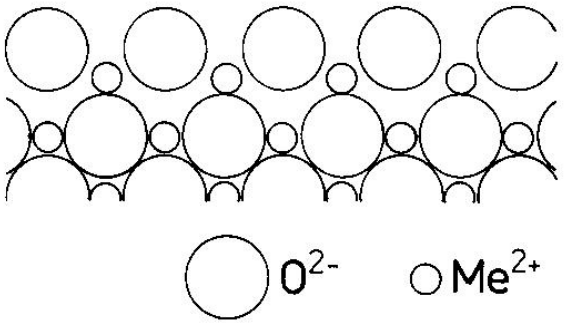


Fig. 1.2 The surface structure of the Weyl phase ceramic-metal oxides.

In the absence of oxygen in the bath metal compound $Me^{2+}O^{2-}$ formation involves the deployment of a reaction:

$$Me + Me'O = MeO + Me' \qquad (1.1)$$

Chemical interaction contribution to the adhesion energy increases with increased production of free energy of reaction (1.1), thus increasing the liquid metal affinity for oxygen. Naidich's model - Fig. 1.3, on the situation in which the metal bath is dissolved oxygen. It forms a compound with the metal surrounding $Me^{2+}O^{2-}$, which is adsorbed at the interface due to electrostatic attraction forces of Me^{2+} cation and the anion layer, the surface oxide paticle.

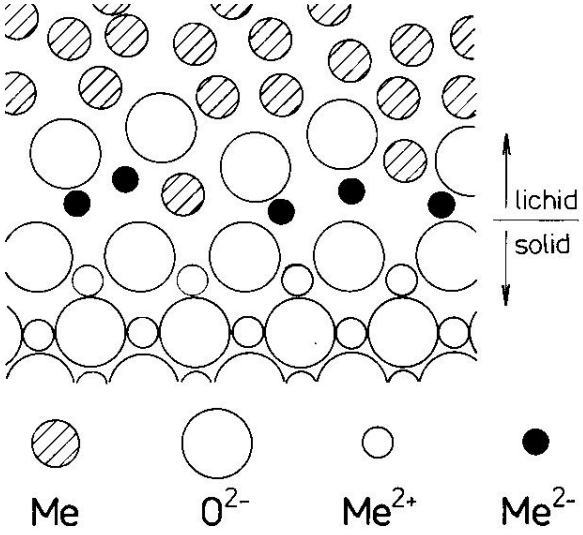


Fig. 1.3 Naidich's model for liquid metal-oxide ceramic interface.

The increased metal affinity for oxygen, the solubility of the compound $Me^{2+}O^{2-}$ drops and activity at the interface increases. For sufficiently high oxygen content in the melt formed a continuous layer of metal oxide to the substrate surface. Adhesion energy is approximately equal to the energy required to destroy the ionic bonds between the two oxides.

Active metals forming strong links with ceramic materials, making them usable for metal or alloy elements. Customize these models for making ceramic-metal composite is presented in figures 1.4 and 1.5.

Figure 1.4 is represented schematically by the solid solution formation of connections,Cr_2O_3, reduction occurs, followed by the appearance of metallic chromium exudate, or substitution unoxidised metal chromium and chromium metal-forming solution (in this example nickel-chromium).

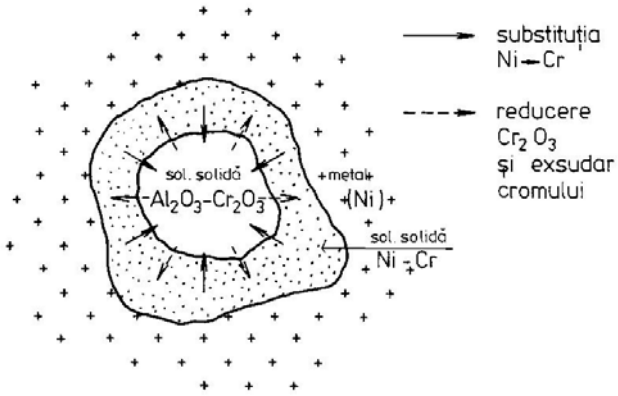


Fig. 1.4 The scheme links the formation mechanism of solid solution.

Another link between the formation mechanism involves the formation of a cermet components spinels intermediate phases, as in the case of cermet (Fe, Ni, Co) - Al_2O_3.

Figure 1.5 is represented schematically by the phase spinels link formation mechanism.

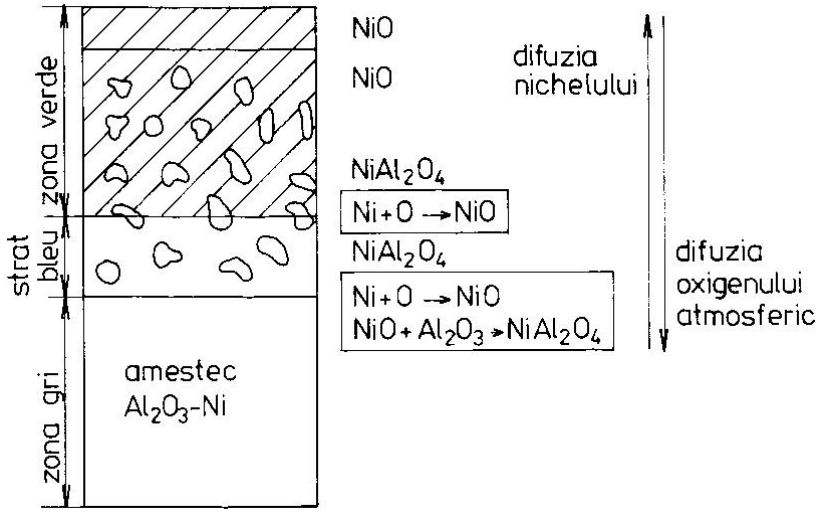


Fig. 1.5 Formation mechanism of the phase diagram link spinels

2. Experimental research results

Distribution of aluminum in the ceramic composite made by impregnating aluminum can highlight thin section due to metal opacity, it appeared black on photomicrography.

Aluminum content throughout the ceramic wall thickness is not uniform. Entering the ceramic mass takes place only until a certain depth, and its amount decreases from the periphery inwards (fig. 1.6, 1.7, 1.8).

Microscopically the mass is noted ceramic aluminum penetration through the pores open and total or partial substitution of mineral phases that contain silicon (mull, quartz, vitreous mass).

Marginal area of the composite structure is microcrystalline, consisting of an opaque mass, a uniform, which contains rare relics of corundum (Fig. 1.6a, 1.7a).

Composition, the interior wall mass content is remarkable decrease opaque (metal) and ceramic mass relics increase the structure and composition can be recognized (Fig. 1.6b, 1.7b, 1.8, and b).

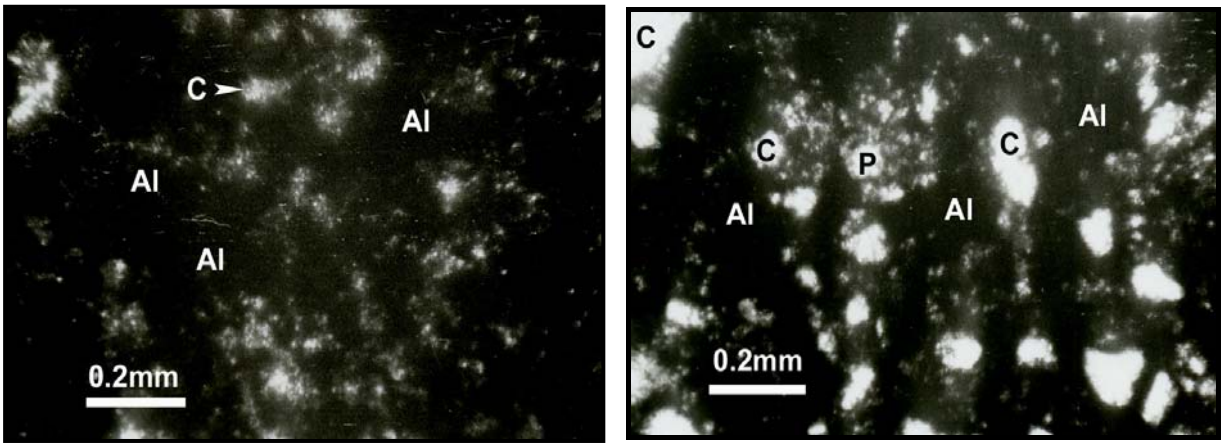
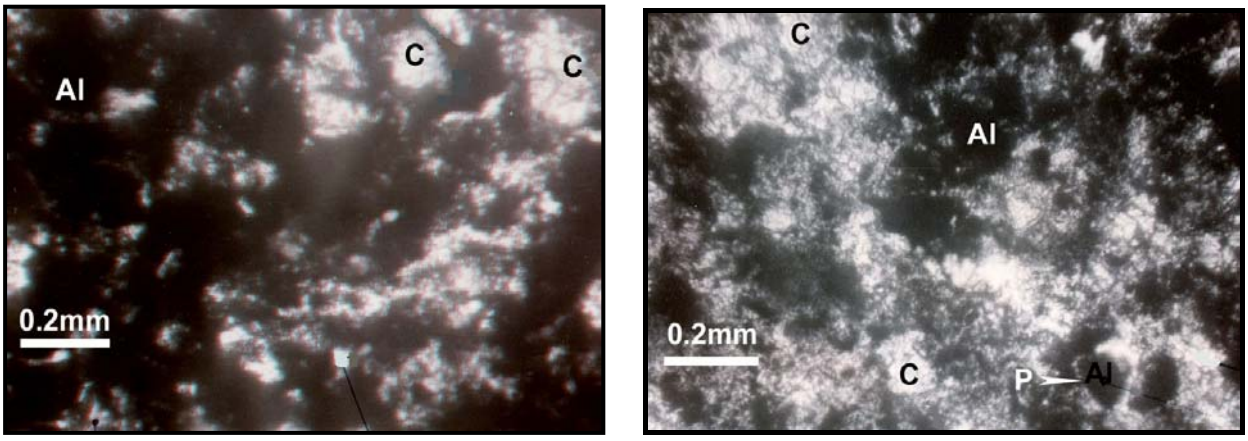
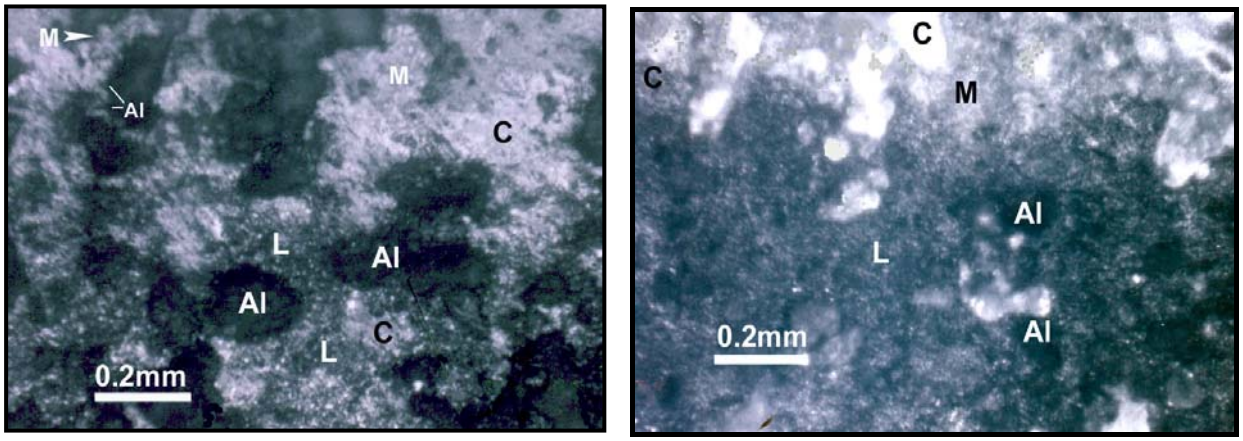


Fig. 1.6. Composite - ceramic-aluminum product R1 + Al (transmission polarizing microscopy). Microcrystalline structure consisting of an opaque metal mass (Al) ceramic relics occur ± matrix composed of tiny pores (P)(see b). Most clastelor are represented by corundum (C). The texture is compact. a) The exterior of the composite - 1N; b) central area of the composite - 1N.



a b

Fig. 1.7. Composite - ceramic-aluminum product R2 + Al (transmission polarizing microscopy). Microcrystalline structure consisting of an opaque metal mass (Al) occur relict crystals formed ceramic matrix ± sometimes with pores (P) (see b). Most clastelor are represented by corundum (C). The texture is compact. a) The exterior of the composite - 1N; b) intermediate zone of the composite - 1N.



a b

Fig. 1.8. Composite - ceramic-aluminum product R2 + Al (transmission polarizing microscopy). Microcrystalline structure consisting of an opaque metal mass (Al) ceramic relics occur in aggregates of crystals formed and the matrix (L). Most clastelor are represented by corundum (C), reporting to mull (M). The texture is compact. a) The term close to the center. Observe the unit mull corrosion by aluminum (top left) - 1N; b) central area of the composite - 1N.

Metallographic microscopy study of the structure allowed the predominantly metallic phases. Metallographic preparations were made from all sorts of evidence: impregnated with aluminum, nickel and copper. Microphotographs were conducted on samples and free of damage caused by chemical attack (Fig. 1.9 and 1.10).

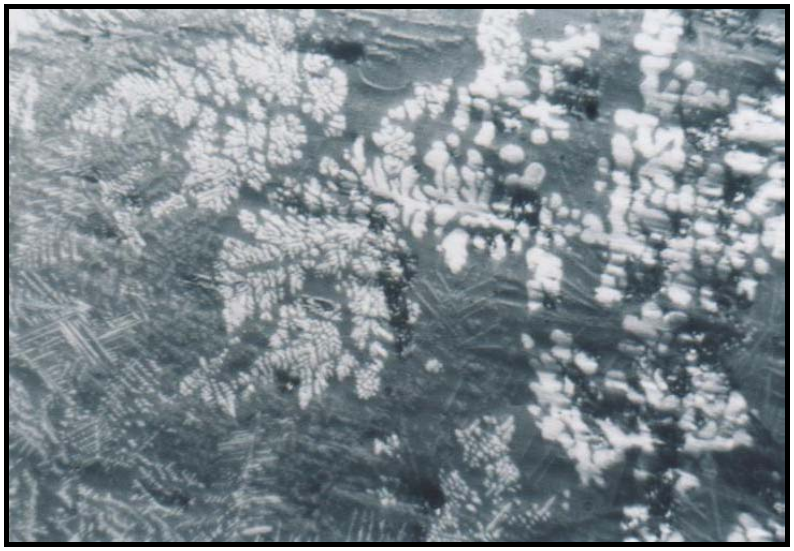
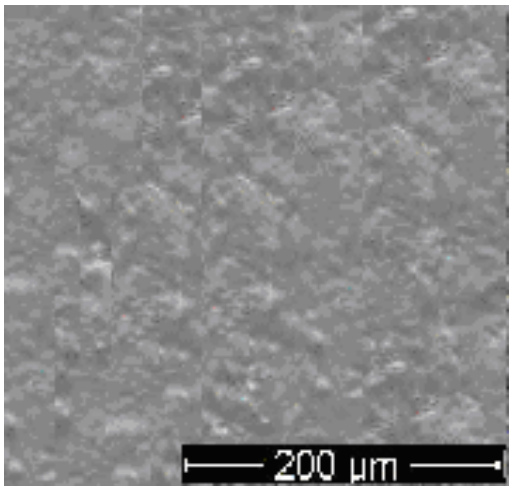


Fig. 1.9. Table R1 ceramic impregnated with copper zone of transition between the coated and impregnated; 250X

Fig. 1.10. Sample appeal $FeCl_3$+HCl chemical mass-R1 ceramic impregnated with Cu, marginal zone; 250X

SEM microstructures surface for Cu- Mo coatings are presented in fig.1.11



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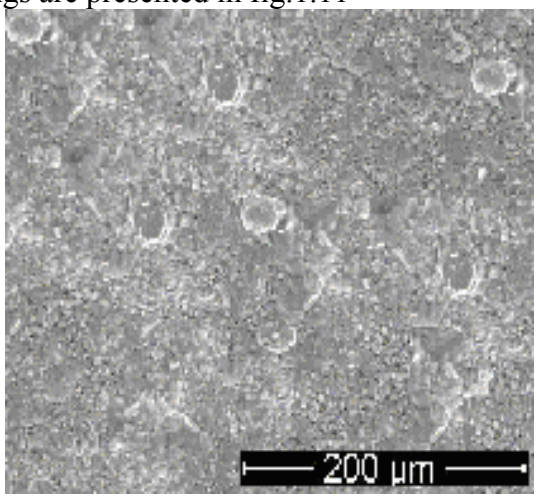
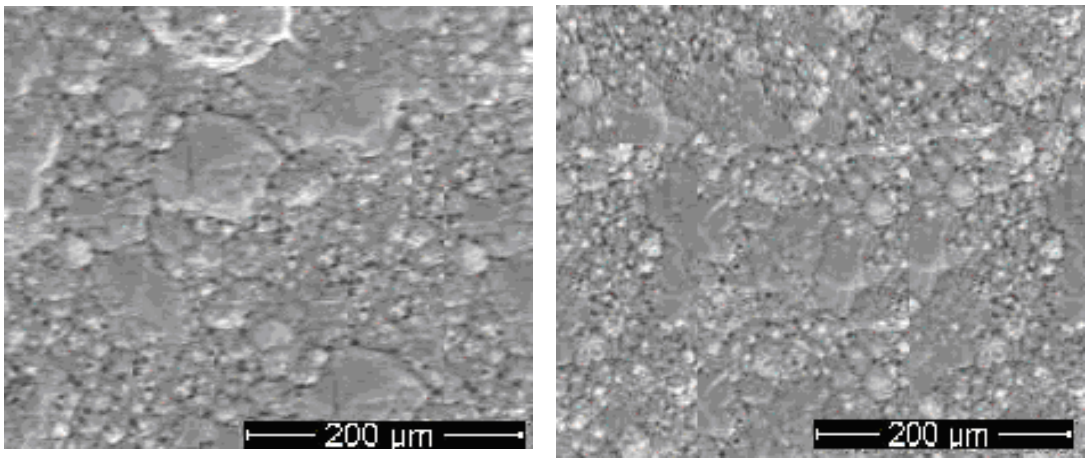


b



c d

Fig. 1.11. SEM surface microstructures for Cu-Mo coatings size 3µm, 90min, 500rpm, i= 1,5 A / dm^2 : a) pure b) Cu-Mo, 20g / L, c) Cu-Mo 40g / L, d) Cu-Mo, 60g / L, magnification x 500

CONCLUSIONS

From the figure for nano composites made by electrodeposition, our analysis reveal their fine structure.

Metallographic microscopy study of the structure allowed the predominantly metallic phases highlighting the fact that metal has penetrated into the pores of the ceramic material.

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VIBRATING METAL MELTS SOLUTION COMPACTION WALL CASTINGS

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ABSTRACT: *Compacting casted parts and reducing the blister on the solidification of alloys are equally interests in improving the quality, characteristics and reducing manufacturing costs by increasing the removal result index from blister compaction.*
Theoretical and experimental research conducted by the authors has lead to obtain beneficial results in this respect.
This paper presents the results and conclusions drawn from this research.

1. INTRODUCTION

The structure and physical-mechanical characteristics of a casted metal material are influenced by its density and compactness.
At the alloys solidification it can occur discontinuities, due to the shrinkage phenomenon, characteristic of most alloys and to the pronounced decrease in solubility of gases in the melt, at crystallization temperature.

2. THE STUDY

Obtaining a compact metal material is provided if the v speed of the alloy penetration into capillary channels of the biphasic zone is equal to the contraction speed v_{contr}.

$v_{contr} = \alpha \cdot m \cdot R$ [m/s] (1)

where: α - contraction coefficient of the alloy at solidification;
m - ratio between the liquid mass volume from the biphasic zone and this zone's volume;
R - rate of occurrence of solid phase [m/s].

In ordinary conditions, the v speed is expressed as such:

$$v = \frac{r^2}{8\eta} \cdot \frac{P_e + P_m - P_g + \frac{2\sigma}{r}\cos\theta}{l}, \text{ [m/s]} \qquad (2)$$

where: r - radius of the capillary channel [m];
P_e – external pressure [Pa];
P_m – metalostatic pressure [Pa];
P_g – channel gases pressure [Pa];
σ - superficial tension of the alloy [N/m];
θ - wetting angle [rad];
η - dynamic viscosity of the alloy [Pa·s];
l - length of penetration of the alloy in capillary channels [m].

From the equality of the two speeds $v=v_{contr}$ results:

$$\frac{r^2}{8\eta} \cdot \frac{P_e + P_m - P_g + \frac{2\sigma}{r}\cdot cos\theta}{l} = \alpha \cdot m \cdot R \qquad (3)$$

from where:

$$l = \frac{r^2\left(P_e + P_m - P_g + \frac{2\sigma}{r}\cdot\cos\theta\right)}{8\eta \cdot \alpha \cdot m \cdot R} \qquad (4)$$

Mechanical oscillations decreases the superficial tension σ at the liquid-solid interface wetting angle θ and imprints the alloy a maximum initial speed $v_i = A\omega$.
Mechanical vibrations action produces in the biphasic zone a dendrite fragmentation,

reducing the length of capillary channels to be covered by the liquid alloy to fill the gaps caused by shrinkage and increase the speed of the liquid alloy flow in these areas, improving supply conditions in micro-cavities.
Also, vibrations determine a macro-blister concentration and a reduction of the porosity in the hot spots, an effect explained by increasing the melt flow.
Mechanical vibrations applied in liquid metal alloys introduce new forces that determine changes in the macrostructure and macro-blister of the casted parts.
The size, shape and position of micro-blister can be determined theoretically by plotting isotherms of solidification in the walls of the casted parts.
Macro-blister is located in those areas of the wall where the liquid alloy solidifies last and alone. Macro-blister consists of one or more concentrated cavities in clearly defined areas, they result from the solidification of large volumes of liquid alloy. Macro-blisters are called as well concentrated blisters. The alloy layers that isolate the blisters between them and cover them in the top part are called decks. The main macro-blister is found in the upper part to the casted part compared with the casting position, while the secondary macro-blister is found in the lower part or in hot spots in the thermal axis zone.
Macro-blister is determined using technological evidence, while micro-blister by applying methods of flaw (X or gamma rays) or by determining the density of samples cut from the casted part wall.
The volume, shape and position of the macro-blister and micro-blister in the walls of the casted parts are influenced by several factors which at their turn depend on the technological nature of the alloy, the nature of the mold, the casting conditions and the casted part geometry.

The total volume of the blister is:

$$V_r = V_{MR} + V_{mr} \quad (5)$$

in which: V_{MR} - the macro-blister volume;
V_{mr} - micro-blister volume.

The factors which influence the blister are the following:
- alloy's nature;
- form's nature;
- casted part geometry;
- casting conditions.

Avoiding the process of developing a micro-blister is impossible, but the routing of the contraction process in order to obtain a macro-blister with as smaller as possible volume and with an optimum distribution in the part's wall is possible.

3. ANALISES, DISCUSIONS, APPROACHES and INTERPRETATIONS

The development of the alloy was made in a crucible furnace, heated by burning a natural gas flame. After melting, the temperature was increased and maintained at 800^0C.
For casting and solidification of the samples were used metal forms.

Fig 1. Alloy's solidification

Fig. 2 Extraction of vibrated samples from the mold

Among physical properties, density is directly related to the development process and represent the unit volume's mass.
From the performed measurements performed we can remember the following:

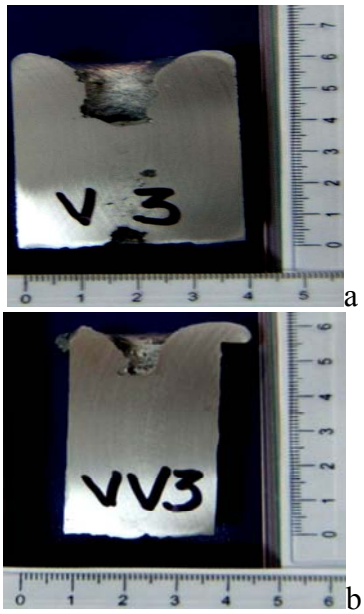
- sample casted from non-vibrated alloy, solidified in outdoor air; (O)

- sample casted in non-vibrated alloy, solidified under the influence of vibration after casting until solidification; (V)
- sample casted from alloy vibrated in pot, solidified without vibration (O')
- sample casted from alloy vibrated in pot, solidified under the influence of vibration after casting until solidification. (VV)

a

b

Fig. 3 Blister aspect for different situations
a- non-vibrated; b- the vibration of melted alloy (only in pot, before casting)



a

b

Fig. 4 Examples of section blisters
a- solidified under the influence of vibration after casting until solidification; b- vibrating the alloy in the pot and during casting until solidification.

Vibrations determine macro-blister concentration, a decrease of porosity from the liquid alloy, to manage the formation processes and structure compacting with small crystals which present the best physical and mechanical characteristics, including increased density of casted alloys with those advantages. Measurement results are presented in Table 2 for an aluminum alloy type ATSi12.5 Mg0.25.

Table 2. The measurements results on non-vibrated, vibrated samples

No.	Sample	Sample mass [g]	Volume [cm^3]	Density [g/cm^3]	Density increase thought vibrating [%]
1	O	30,9044	11,6	2,66	-
2	V	31,9044	11,4	2,79	4,88
3	VV	30,8544	10,9	2,83	6,39

Mechanical properties are also determined by the macrostructure because of the existence of chemical heterogeneity, crystalline or mechanical or discontinuities that play the role of power and micro-concentrators, by size, crystal form, nature and morphology of structural constituents.

Table 3 shows the values obtained by carrying out systematic evidence of resistance to

fracture, yield, and elongation at break for the four types of casting:

- casting in gravitational field (O);
- casting after the liquid alloy vibrating in the mold (O'');
- vibrating after casting in the mold until solidification (V);
- sample from the liquid alloy vibrated in the pot casted in the mold and vibrated until solidification (VV).

Table 3. Values for tensile strength, yield, elongation, weakening the fracture toughness for the cast alloy AlSi12.5Mg0.25 of samples realized during research.

No.	Sample type	R_m [MPa]	$R_{p0,2}$ [MPa]	A_u [%]	Z [%]	HB [MPa]	Observations
R1	O1	170	102	3,5	2	87.5	Un-worked sample
R2	O2	176	101	3	2,04	88,6	The split inclusions 0.5 mm
R3	O3	175	103	3,2	2,2	87,3	
R4	O'1	185	111	4,2	5,8	89,3	Un-worked sample inclusions in the area from feeder
R5	O'2	93,8	-	-	-	-	Defect in structure, blister with a diameter of 1.5 mm
R6	O'3	186	112	5	-	90,6	
R7	V1	295	162	4,4	3	105	
R8	V2	296	162	4	2,7	104,3	
R9	V3	295	160	3,9	2,7	106,3	
R10	V4	294	170	3,9	-	103,1	
R11	V5	294	165			103,2	
R12	VV1	150	-	-	-	-	Defect in structure
R13	VV2	295	147	5,6	3	99,3	
R14	VV3	294	145	4,2	1,5	98,6	
R15	VV4	290	150	2,1	2,1	97,2	
R16	VV5	285	151	4	2,8	97,3	Turning diameter of 50 mm, sample in the thermal axis

Following research which refers to treating metal melts with mechanical vibrations, highlighting the fact that they have positively influenced the structure obtained after solidification and on mechanical properties, in the sense that it improves them. The values obtained are much higher than those obtained in the classical variant.

The mechanisms by which these vibrations act on the liquid phase during solidification and melting are complex. Explanation and understanding of these mechanisms is of great theoretical and especially practical importance, allowing us to define appropriate technology for treatment of melt with vibrations.

Figure 5 shows the variation of the degassed alloy hardness under the influence of vibration (50Hz) in the casting pot. It is noted that thought gas elimination was achieved a material compaction, evidenced by increasing the hardness by about 5 percent compared with the gross alloy.

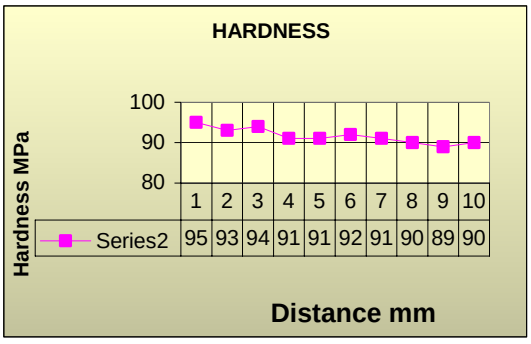


Fig. 5 HB-hardness variation on the radius for alloy AlSiMg vibrating pot, gravitational casting for the ϕ20mm disc, sample O'2

4. CONCLUSIONS

The contour analysis of the contraction gap leads to the conclusion that under the natural action of vibration is reduced the blister depth and its lower part is rounded.

For the alloys with high contraction, prone to cracking, it was observed that due to mechanical vibrations the micro-blisters decrease reducing axial porosity.

Under the influence of mechanical vibration decreases the total volume of macro-blister and focuses on the superior side, reducing the volume of liquid alloy for feeders.

The main favorable technological effects obtained by applying physical-mechanical treatments, consisting of increasing compactness and improving the structure of castes parts.

It also finds a sharp increase in hardness values by 25 percent compared to a gravity cast alloy (static), a slight decrease in the hardness towards the thermal axe, at the same diameters or different diameters of the samples a longer vibrating time leads to chopped microstructures and higher hardness values.

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VIBRATING THE COOLING MELTS METAL FINISHING SOLUTION STRUCTURES

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ABSTRACT:*The influence of purifying processes by metallic melts degassing and refinement it is not a recent technological news. The processes of local undercooling, nucleation, crystallization and solidification of metallic melts represent a future technical solution in quality increase of castings. The work presents the results of some research experiments in this field.*

INTRODUCTION

At high undercoolings appear many centres of crystallization embeding all impurities. At low undercooling, crystals grow in dendritic form, and impurities are also embeded by the growth of branches I and II type.
Analysis of the thermophysiscs conditions of crystallization pressure development shows that is has a peculiar role in ingots and castings solidification. To identify the influence rate of different parameters on the movement process or impurities embedding, we will show how forces influence in the area of stranger particles for the alloy in solidification progress (fig.1).

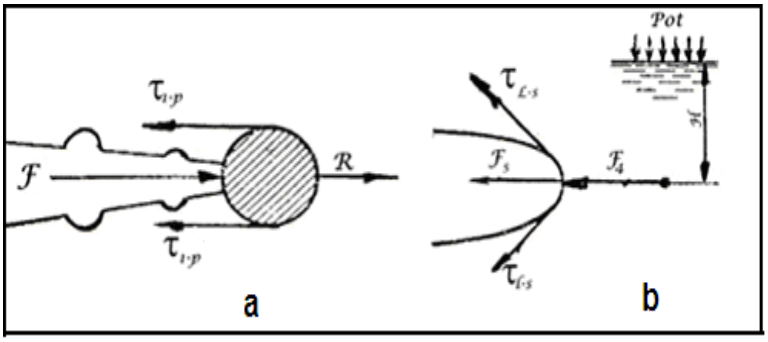

Fig.1. Representation of forces action in area of stranger particles in the liquid alloy :a) interaction with particle; b) exceeding the ferrosstatic pressure

METODOLOGY

Greatest effects of ultrasonic cavitation are those observed in the metals crystallization process.
More higher the nucleation speed and lower the growth speed is, more finer the grains structure will be. Number of grains is determined by relation:

$$N=\sqrt{\frac{n^3}{c^3}} \quad (1)$$

n – crystallization centers
c – growth speed.
The cavitation will appear in ultrasonic melts, if the acoustic pressure exceeds a specific value (table 1) feature to every metal.

Table 1. Values of P_t and P_c for some metallic materials

Material	Threshold power P_t [W]	Incepient power of cavitation [W]
Aluminium	400	400
Bismuth	60	50
Cadmium	400	-
Lead	250	200
Antimony	300	300
Tin	350	250
Zinc	500	-

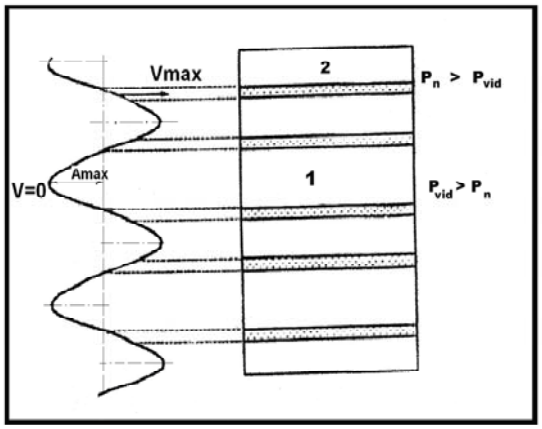

Fig. 3. Distribution of elastic wave in molten liquid mass : 1 – compression zone; 2 – dilatation zone

RESULTS

Microstructure of the sample obtained without vibration is presented in fig.4.a. Characteristic elemenents can be observed: columnar and equiaxed crystal, shrinkage, inferior cone formed by individual crystals precipitation zones. Obtained sample by vibration action in crystallization period has a different macrostructure than the control sample fig.4.b.

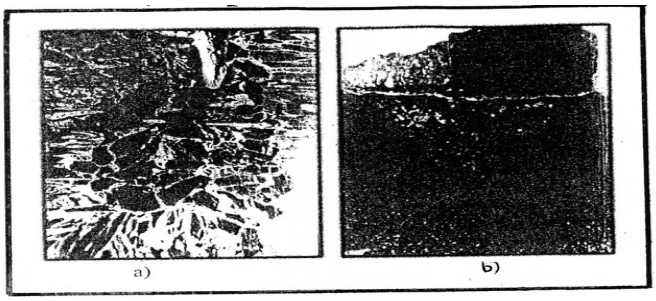

Fig. 4. Aspect of microstructure in a salol sample: a) without vibration; b) after vibration

CONCLUSIONS

In fig.5.a are presented the typical diagrams recorded during the crystallization process of samples without vibration, and fig.5.b shows the diagrams by vibration action with a frequency of 94Hz and amplitude 1mm. OA sector corresponds to the thermostatic period of molten mass, and AB corresponds to the cooling period. At the beginning moment of crystalization latent heat of phase transformation is released, and thus, it is explained the bounce of temperature of BC sector. CD sector corresponds to the cooling of solid phase.

Comparative analysis of crystallization process diagrams (thermograms) of ingot in control experiments and by the vibration action indicates that vibration in beggining state of process (AB sector) contributes to temperature equalization in the whole wolume of sample.

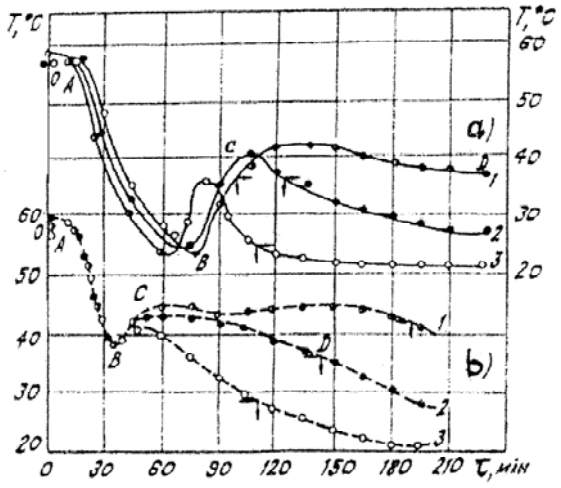

Fig.5. Solidification diagram of salol sample: a- no vibration; b - vibration

In fig.6. it's been highlighted the dependence of maximum undercooling with elastic oscilations frequency. It can be noticed that an oscilations frequency takes place, which leads to the decrease of maximum undercooling zone of molten mass (hatched section).

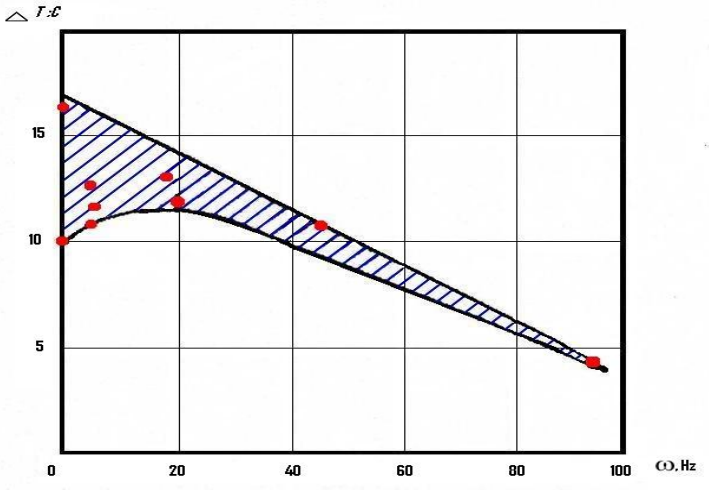

Fig.6. Dependence of molten mass undercooling with elastic oscilations frequency

Main effect of forced oscilations is the movement of waves by pressure and depression which alternates forcing the cyclic movement of alloy mass, with formation of extra crystallization centers and dendrites fragmentation.

Once the amplitude increases, it increases the proportion of equiaxed crystals and decrease the columnar ones. Alloy vibration during all the solidification time, leads to the decrease of grains by about three times. Influence of mechanical vibrations at metals casting are characterized by:

- increase of undercooling degree by increase of alloy - mould heat transfer;
- creating new nuclei for fragmentation of forming solid phase;
- activity of crystallization surfaces;
- at high solidification rates and small temperature gradient it appear nuclei in whole casting section, when the mould can continuously remove the crystalliyation latent heat;
- mechanical vribrations decrease the thermal gradient and increase the solidification rate favoring endogenous growth;
- the decrease of distance between dendritic branches leads to shorter time of homogenization thermal treatment;
- materials with fine grains are recomanded as materials subjected to plastic deformation;
- improvement of properties results from the fine distribution of microporosity and secondary phases during blocking the dislocations at grains bonders;
- columnar crystals zone can be eliminated for non-ferrous materials: Al, Cu, Sn, Zn, etc. And especially for their alloys (bronze, brass);
- mechanical vibrations influence the interphase surface tension (solid – liquid) by decreasing it, which leads to the decrease of minimum radius of nuclei from which they can't melt anymore but develops.

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SPECIAL MULTY-LAYER MATERIALS OBTAINING USING NONCONVENTIONAL METHODS

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Abstract: *The theme propose to treat some aspects about the employment the welding by explosion mechanism in obtaining new materials used in special industries.*

Keywords: *welding, explosion, materials*

1. INTRODUCTION

Several mechanisms have been submitted, in order to define the process of welding through explosion, beginning with the first phases in the research of the phenomenon. Some of these mechanisms suggest that the process, is fundamentally, one of melting.

It is taken into consideration that at the welding-interface, the kinetic energy transforms into thermic energy (accompanied by an energy dissipation), which acts as source of heat, enough to cause bilateral dissolves through the interface, the diffusion of the shells occurring later. This diffusion of the metals into liquid state, takes place gradually, concerning the structure of the welded metals and the distance from the interface.

According to the studies concerning the waves at the welding-interface, "the whims" and the marks of melted and solidified metal cannot be explained through the mechanism of welding in the solid state, or by the dissolving mechanism.

The deformation of the granules at the interface and the appearance of the waves defines that the phenomenon of welding through explosion is based on a hydrodynamic process of inflows.

2. THE TEXT OF THE PAPER

The scientists have experimentally established that during the process of welding, important transversal tensions (of detrusion) form on the interface, resulting an effect of warming of the interface. This phenomenon could lead to an adequate warming of the superficial shells to produce the welding and can also explain the appearance of the waves at the interface [1].

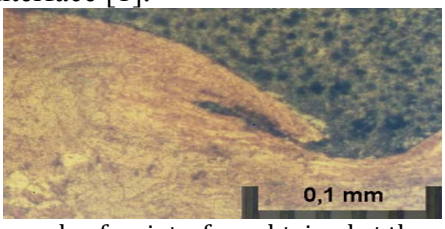

Fig. 1. Example of an interface obtained at the plating through explosion through explosion of the metallic layers

The new testing procedures have revealed that, at the collision of the welding pieces, only a very thin layer of melt forms on the interface. The assigned value of refrigeration of the remained melting layer is 10^5 ^{0}C/s, this

value is so high because of the line of contact between the components.

The existence of amorphous layer, inside the welding zone, has been taken into account for different metallic combinations and explained by the scientists as being the material reason of welding through explosion's fundamental mechanism [2], [4].

The welding mechanism with jet configuration is able to incorporate the influence of the main technological parameters and can somehow envisage a "working" domain for the welding parameters, for any metallic combination.

According to these assertions, it is generally accepted that the well-known phenomenon of the formation of the jet in d point is a collision, it is a fundamental condition for the process of welding through explosion. It deals with, because the formed jet represents the agent that cleans mechanically the welding areas, removes the impurities and the oxides, allows that the atoms of the two materials collide at interatomic spaces, thus resulting the welding through explosion.

As defined in the specialty language, the *p* pressure resulted by every metal in the collision point, is obtained by the following formula:

$$p = \rho \ u \ D \qquad (1)$$

where: p is the pressure of the shock at the interface between plates;

ρ - the volume body of the material;

u - the material speed of which the materials form the interface move;

D - the speed of the shock wave inside the material, this speed is approximately equal with the speed of the sound (the speed of the longitudinal waves).

Besides the dimension of the impact speed between the mobile and the fix material, the welding through explosion it is only possible if at the level of the impact and collision interface exist plastic leaks. In practice, this condition is defined that the speed of the collision point, sometimes named the welding speed, must have a lower value that the speed of the sound inside the value.

Also, so that the welding process could be obtained, the angle of dynamic collision β must excel a minimum value. This angle has very low values.

The study to obtain some layered materials through the unconventional process mentioned above, it is essential also because of the energetic independence provided by the technology, such as the energy to detonate explosive load is adequate.

To obtain the process of plating through explosion, after the construction of half-finished materials and bringing them to desirable sizes, the covers of the explosive loadings are being built, with the function to maintain the geometric sizes of the explosive loadings, under the explosive's character and its granulation. In this instance, the boxes belonging for the explosive loadings, have been made of carton.

Determined the testing conditions, the assembly of the technologic system to create the process of plating through explosion begins. Therefore, across the base plate the spacers are put.

The spacers are mechanic elements with the function to create the best distance between the plates, for the process of plating succeed.

The experimental technological system, created to realize the process of plating through explosion is shown in figure 2 [2].

To obtain a multilayer metallic structure with private characteristics, by the process of plating through explosion, has been tried to create a multi-layered metallic material, underlying aluminium alloy plates type 3105, 3 millimeters thick; between these plates is inlayed a stainless steel fibre, with the role of consolidation [2].

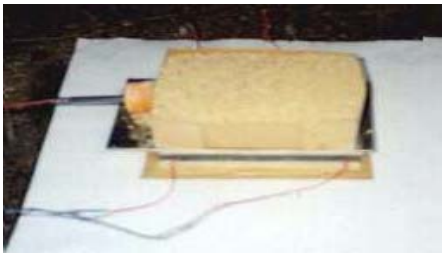

Fig. 2. Lateral angle of the experimental assembly used for the process of plating through explosion

Studying the speed area during the assemble process, an important distinction is being observed, comparatively with the adapted mode which acknowledges the immediate transfer of the impulse from the explosive to the mobile plate, and the moving with constant speed, without causing kinetic energy loss, till the moment of impact.

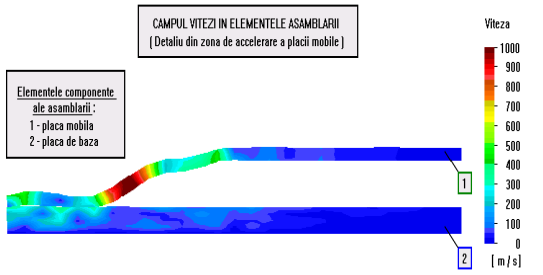

Fig. 3. Speed area during the assemble process

In figures 4 are presented the time functions of the normal speeds on a mobile plate in some control joints [2].

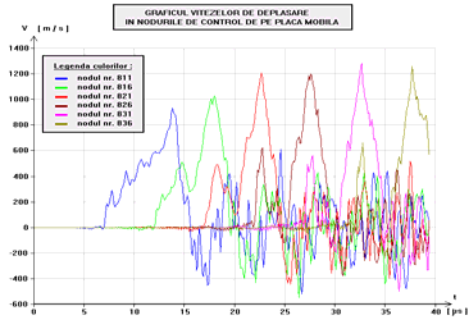

Fig. 4. Image of moving speeds in the control joints of a mobile plate.

From the calculation obtained by the simulation of the process of plating through explosion using the method of finite elements, can be observed the sequential phases of lining through explosion procedure , at time t [µs].

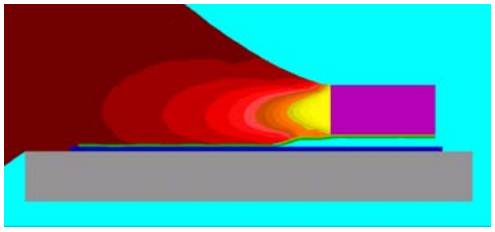

Fig. 5. Sequential phases of lining through explosion procedure , of time t [µs].

3. CONCLUSION

From the above, it can be concluded that trends in the field of research is to obtain new multi-layer materials with high mechanical properties able to satisfy the most demanding technical requirements imposed by the peak.

Types of materials submitted, including those obtained by using explosive cladding process once again underlines the fact that the layered materials are those that due to the properties they own, can meet the requirements largely [2].

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THE INFLUENCE OF REINFORCED FIBERS ON CHARACTERISTICS COMPOSITE STRUCTURES

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Abstract: *This subject proposes to treat some theoretical and experimental aspects on obtaining new composites materials with special properties and purposes using reinforced fibers.*

Keywords: *reinforce, composite, fiber.*

1. INTRODUCTION

Composite materials are part of composite materials. Composite materials are the first materials whose internal structural layout design a man, not only in their molecular chain, but giving them preferential directions favorable resistance.

Each class has properties and material characteristics of its own: the metals are generally tough and ductile, but their mass density is often high, plastic, lightweight, have low stiffness and mechanical properties and environments are often fragile, ceramics have modulus and high tensile strength, but they are inherently fragile.

Combining various types of materials that are normally immiscible and controlling the morphology and distribution, to obtain composite materials whose properties are different from those of basic components**.**

In case of composite materials is appropriate to use the concept of synergy, which is the result produced by the combination unit and convenient dosing characteristics of components.

2. THE METHOD

This paper shows the characteristics held by a textual obtained by the conventional laminated steel cladding by explosion. Schematic and principle, this process is shown in fig. 1.

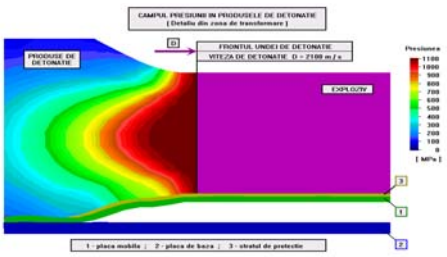

Fig.1. Explosive cladding

Because the two metals to be welded, they must be brought together by the force equilibrium interatomic distance, and because it is necessary to realize that they are not present in the outer layers of oxides and impurities, those which will be welding.

Joint strength will depend on the nature of metal combined, the crystallographic

orientation of the interface, diffusion and recrystallization of metal parts.

The mechanical properties of metallic multilayer structures obtained by the explosive cladding are determined and calculated based on the matrix and fiber properties.

Isotropy properties will be influenced by fiber orientation in relation to outside forces seeking material. Generally, when the composite material is subjected to the action of external forces, because the link between fiber and matrix, produces a load transfer from matrix to fiber. The existence of the link between fiber and matrix is that the traction at the interface between the two components is equal to the matrix deformation of the fiber.

In contrast, the deformation increases with the distance matrix of fiber and, after overcoming the action of the fiber diameter (daf), the matrix deforms freely. Load transfer between matrix and fiber, the difference in elongation of the two components of the composite material are the result of the difference values of elasticity modules of the matrix and fibers.

For example, consider the simple case of metal matrix composites reinforced with long continuous fibers. Follow the model calculation to be presented is not only true for metal matrix composites but for all the composites, regardless of the nature of the matrix, provided only that elemetele continuous fiber reinforcement to be long.

When applying force in a direction parallel to the direction of orientation of fibers, composite material is considered in equilibrium, the total force F is applied to the sum of the forces applied to the force applied fiber matrix.

Usually, when discussing the resistance of a material, uses the term stress (force per unit area) instead of force.

So, the force acting on fiber is voltage multiplied of sectional area perpendicular to the direction of driving force.

3. CONCLUSIONS & ACKNOWLEDGMENT

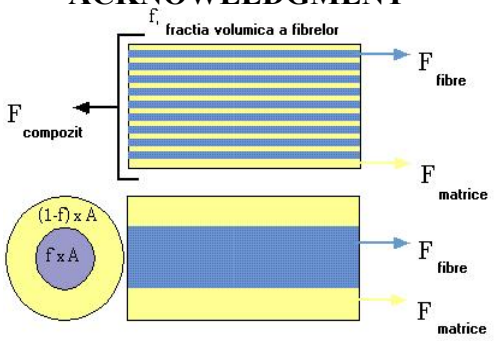

Fig.2 Representing the forces acting on the fibers and matrix

Use Hess's law is possible as long as the voltage is low values (below the elastic) and the behavior of the material is linearly elastic.

Thus, Hess's law can be applied to metals, ceramics and most polymers, but can not be applied elastomers (rubbers).

When applying force in a direction perpendicular to the direction of orientation of fibers, the composite material will behave in a different way than if presented above (Fig. 3).

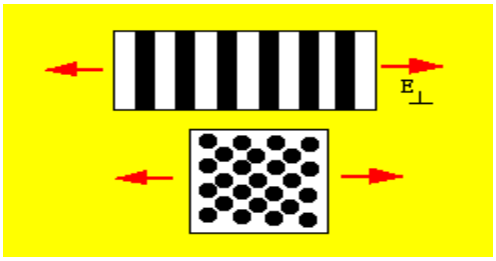

Fig. 3 - Forces acting on the fibers and matrix

The fundamental difference between the two composite load models is that, if the first case we deal with equality of deformations in the second case the law of equal stress fibers and matrix.

If the matrix and fibers have different elastic properties and then they will have different deformations.

In the literature are presented computational models that take into account other problems: fiber orientation relative to the direction of the forces, the compressive behavior of composites, etc.

III. CONCLUSIONS

From the above, it emerges the importance of the explosion cladding process in obtaining new materials laminated with special properties.

Application of the defense industries that process, opens a new way of obtaining new materials with special properties for laminated metal special equipment.

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CONSIDERATIONS ON CORROSION AND CORROSION PROTECTION OF SURFACES WORKING UNDER HIGH TEMPERATURE CONDITIONS

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Abstract: *Heat-resistant functional coatings have a substantial influence on the operating properties of materials at high temperatures. The stresses of the turbine components having different destinations are taken into account in the design phase but the technological requirements imposed on construction and materials used have currently limited their development. The temperature represents the essential limit in the construction of gas turbines. By eliminating the structural defects of the heat-resistant coating, the thermal conductivity of the deposited material is improved and also the temperature gradient is reduced. A component of a jet engine, coated with a low porosity heat-resisting layer, deposited by spraying a ceramic material in a plasma jet exhibits an increased durability under mechanical stress at high cyclical temperature.*

Keywords: *the rate of corrosion, the heat-resistant coating, ceramic material, plasma jet exhibits, gas turbines, blades, high resistance to thermal cyclic loads, the functional coatings.*

1. THE CORROSION IN GASES

1.1. Metal corrosion in gaseous environment at high temperature

In this case, the corrosion rate depends on the chemical composition, velocity and environment temperature. The influence of the environmental gas composition on the corrosion depends on the nature of the two phases and it is manifested in the emergence of the aggressive component into the gaseous environment, varying very little with its composition. When replacing a habitual atmosphere by an oxygen one, the corrosion rate of a sample of iron (Fe) at 800-1000 ° C, or a sample of copper (Cu) to 700 ° C increased approximately twice and not five times as it would increase if direct proportionality between the change in corrosion rate and the partial pressure of oxygen. The corrosion of metal increases in air at high temperature in the presence of impurities given by aggressive gases as water vapors, carbon monoxide (CO)or gaseous hydrochloric acid (HCl) . The gas velocity affects the metal corrosion only during the first moments of the phases contact. After the film formation the rate of corrosion is determined by the rate of particles diffusion through the film. Therefore the corrosion rate does not depend on the contribution of the gas convection. At very high flow rates of gas the corrosion enhances due to the erosive destruction of the film.

1.2. Influence of the corrosive environment temperature on the rate of corrosion in gases.

The practice shows that by increasing temperature, the corrosion rate increases according to Arrhenius differential equation:

$$\frac{dy}{dt} = \mathrm{K} = A' \cdot \mathrm{e}^{\frac{Q}{RT}} \quad (1)$$

where: K = constant of the chemical corrosion rate, Q = constants that can be calculated based on experimental determination of the rate of corrosion K of at least two different temperatures T1 and T2.The chemical corrosion rate varies with the inverse of the temperature, a fact verified by practice.

2.THE FUNCTIONAL COATINGS

2.1. Heat-resistant functional coatings

In order to meet their basic use, which is to reduce requirements for cooling, the heat-resistant functional coatings must have a low thermal conductivity, a low density, and a reflective capacity to resist cyclic loading. These are requirements for the two and three-layer coatings of 0.3 mm thickness whose outer layer consists of zirconium oxide, ZrO2 stabilized with different compositions, 12% Y2O3 + 3% MgO, ThO2, CaO. As a metal joining substrate the systems Ni - Cr - Al - Y, Ni - Cr - Fe - B - Si, Co - Cr - Al - Y are utilized. It stands out that Zr, Y, Th, Co oxysulphids consisting of oxides of these metals are barriers to diffusion of sulfur. As a interlayer Cr is applied. In plasma-jet spraying method is mainly used for the heat-resistant coatings.

2.2. Specific of the state of stress under strain and deteriorating conditions of the covered functional components

To be efficient in operation it is essential for coated metals to have a high resistance to thermal cyclic loads. Depending on the ratio of the basic metal characteristics to coating (coefficient of linear extent - α, longitudinal modulus - E, flow thresholds) and also the thickness of layer h, the conditions of developing plastic deformations can be substantially different. To illustrate the above we will analyze the conditions of adaptability and cyclical forming on the basic metal and coating. The notation utilized will be the following: **m** for the ratio of the coating surface to the basic metal surface in the model (component) section, **α1** and **E1** for **α** and **E** values of the coating and **α2** and **E2** for the basic metal values. We apply the linear law of change of the fluid threshold with temperature: σT = σ0 - qt. We consider the temperature of both the basic metal and coating to be the same. In this case, the plastic deformations of the cycles are formed in the coating, when $t_{\max}$ cycle maximum temperature reaches the value tP.

$$t_p = \frac{2\sigma_{OP}\left(1/E_1 + m/E_2\right)}{\alpha_1 m(E_1/E_2) + \alpha_2 + q_P\left(1/E_1 + m/E_2\right)} \quad (2)$$

and in the basic metal when $t_{max} > t_M$,

$$t_M = \frac{2\sigma_M\left(1+mE_1/E_2\right)}{m\alpha_1 + \left(E_2/E_1\right)\alpha_2 + q_P\left(E_2/E_1\right)\left(1/E_1 + m/E_2\right)} \quad (3)$$

The ratio of 2 to 3 is true if the following conditions are met:

$$m > \frac{\sigma_{0P} - q_P t_P k_2}{\sigma_{oM} - q_M t_P k_2};\ m \le \frac{\sigma_{0P} - q_P t_M k_1}{\sigma_{oM} - q_M t_M k_1},$$

where: $k_1 = t/t_M > 1$; $k_2 = t/t_P > 1$

In a more general situation we must use the actual values of the thresholds of fluidity and elastic modulus depending on temperature. Using the ratio of 2, 3 and Kofin's equation: $\Delta\varepsilon_{pL}^{k_0} N_0 = C_1$ (3.1), where: k_0 and C_1= constants, $\Delta\varepsilon_{pL}$= plastic deformation and N_0 = number of cycles to failure, we'll analyze

the conditions of cracks formation in models with coatings, under temperatures which do not lead to extensive creep.

If $t_P > t_M$, then for the given value t_{max} with an equal plasticity of the basic metal and coating, the thermal fatigue cracks will be formed in case of the amplitude of temperature during the thermal cycle Δt which is sufficient for the emergence of $\Delta\varepsilon_{pL} > 0$ in basic metal. Already formed cracks will propagate from the basic metal to the thermal protection layer. If the speed of cracks propagation is small enough when Δt is increased up to sufficient values to form the metal plastic deformation $\Delta\varepsilon_{pL} = \Delta\varepsilon_{pL1}$, during the thermal cyclic deformation process, the cracks occur at first in the basic metal at $\Delta\varepsilon_{pL1}$(after N1 cycles) and only afterwards in the in thermal protection layer (after N2 cycles). During this process the condition ($dl/dN < h/(N_2 - N_1)$) must be met.

If $t_P < t_M$ the cracking will first occur in the thermal protection layer. If $t_M < t_P$ the forming capacity of the thermal protection layer is also substantially lower than in case of the basic metal. When $\Delta t > t_P$ the damage of the thermal protection layer will occur first and only afterwards the basic metal will crack.

When using the ratio of 2 to 3 we must consider the anisotropy of the elasticity modulus. From formula (3.1) $\Delta\varepsilon > \alpha_1 t_p$ $şi$ $\Delta\varepsilon > \alpha_2 t_M$ we get:

$$\frac{N_1}{N_2} = \left(\frac{\Delta\varepsilon - \alpha_2 t_M}{\Delta\varepsilon - \alpha_1 t_P}\right)^{k_0} \frac{C_P}{C_M} \qquad (4)$$

where: $\Delta\varepsilon = \alpha_2 \Delta t$ - full deflection amplitude; C_P / C_M - ratio of the thermal protection layer plasticity to the basic metal at the temperature t_{min} to the k_0.

For the cycle Δt leading to emergence of tensions smaller than the elasticity limit, instead of (3.1) is it recommended to use equations based on the criteria $\sum_{i=1}^{N_0} (\Delta p^{(i)})^{n_0} = C_2(N_0)$ (1.2.2).

The models load in terms of physical and mechanical properties of their thermal protection layer changes depending on thickness and more, when their distribution changes during operation, it can be performed only by numerical methods.

Regarding the theoretical method of calculating the rate of spread for thermal fatigue cracks with coating models, one can say that this problem is not theoretically resolved.

Based on consideration of the difference between the linear expansion coefficients, the modulus of elasticity of the thermal protection layer (α_1, E_1) and the basic metal (α_2, E_2) at t_{min} of the cycle, work [S3] gives a model to calculate the crack growth rate dl / dN to the basic metal after its occurrence in the fragile coating thickness h. The following dependence relation is proposed:

$$dl / dN = A\exp(\Delta K_8) \qquad (5)$$

and the relation for calculating the intensity scale of the deformation coefficients according to $E_1 / E_2, h, l, \Delta\varepsilon t_{Ty}$ and Δεα (Δεα – scale of deformation at t_{min} given by the difference between α1 and α_2, ΔεTy - scale of basic metal deformation during the cyclic heating).

The authors of paper [S1] have obtained a qualitative coincidence between the results of the tested blades with fragile heat-resistant layers and the results calculated by formula 1.5.The composition of the thermal protection layer has a substantial influence on the coefficient of linear expansion. Thus, for NiAl, α = 15 x 10^{-6} [deg^{-1}], for Ni_3Al, α = 8.5 x 10^{-6}[deg^{-1}], and for the condensed coating of the system Ni - Cr - Al when Al content increases from 3 to 30%, α decreases to 13 - 14x 10^{-6} [deg^{-1}].

2.3. Mechanical properties of refractory alloys coated with thermal protection functional coatings

Regarding the heat resistance quality of nickel-based metals we can say that they are less sensitive to notches as the coatings has a little influence over the average level of tension. Studies on coatings influence on the limit of time resistance, which were conducted in standard models under temperature conditions when the corrosion process does not play a significant role, have revealed that usually, differences between coated models and those without coating are not noticeable. Thus, in works [Z1, T1] are given data on the positive influence of the aluminide coatings on the JS6K alloys time resistance at 1000^0 C. However, in outdoor experiments performed on models of 4 mm diameter, made from CrNi70VMoTiYFe alloy at 900^0 C and described in [N2] a substantial time resistance decrease was found for those models having a calorized surface at low temperatures. According to the authors, such behavior is caused by the increased development of cracks under the plastic coating at 900^0 C while for the uncoated models the cracks are impeded to spread after oxidation of their edges.

A number of authors have made attempts to check the time resistance a hostile environment [N2]. In situations where the coating is protective (does not crack during creep) a significant increase in time resistance has been found. In this connection the temperature of the brittle - viscous transition is decisive. We can expect that with the deformation, the strain rate (the test time increasing), and the brittle - viscous temperature fall. If the temperature brittle - viscous is lower than the test temperature, then the coating can have a positive influence on the creep resistance.

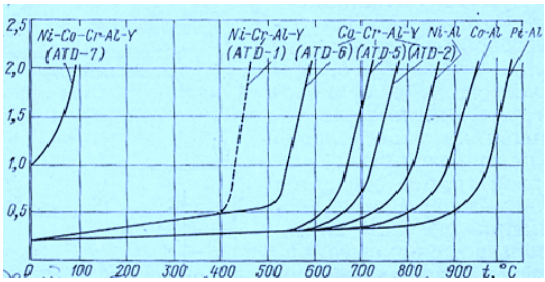

Fig. 1 [N3]. Temperature of a brittle -viscous transition (threshold of breaks) of some coatings from condensed aluminide and obtained by thermal diffusion.

In paper [N3] the plasticity-temperature relationship was studied for coatings made from Co - Cr - Al - Y with different contents of chromium and aluminum, Ni - Cr - Al - Y. The highest fragile - viscous temperature is found to Co - Cr - Al - Y alloys with 15% Cr and 10% Al and to coatings from SIB (Figure 4.16) [N3]. A comparison between the plasticity and the heat resistance of condensed coatings and of those obtained by heat diffusion demonstrates the superiority of the first ones. Similar results were obtained during the models testing of the IMAS - 5S installation : cracking of aluminide and silicon coating was observed when the of e=0,75% at 20^0 C value was reached ,while for the condensed coatings of Ni - Al - Cr - Y no cracks were found until the damage of the mold from EP220alloy.

A number of researchers have studied various phases that determine the structure of aluminide coatings: Ni - Al in which Cr, Mo, Ni Al are dissolved. It was established that NiAl is brittle only up to 650 ^{0}C, much higher temperatures (above 800-900 C^0) containing NiAl coatings are plastic. Molybdenum enhances the plasticity and resilience over time of the nickel aluminide.

A number of researchers have studied various phases that determine the structure of aluminide coatings: Ni - Al in which Cr, Mo, Ni Al are dissolved. It was established that NiAl is brittle only up to 650 ^{0}C; at much higher temperatures (above 800-900^0 C) the coatings containing NiAl are plastic. Molybdenum enhances the plasticity and time resistance over time of the nickel aluminide. When evaluating the uncoated models,

mechanical and thermal fatigue resistance features of refractory alloys with aluminide coatings prove to be superior [T1]. The increase in fatigue resistance of alloys at normal temperatures is noticeable. Paper [N1] describes the thermal fatigue strength of models from different steels with protective coatings: from aluminide with Ni - Cr - Al - Y, with two layers of aluminide and chromium, from aluminide and silicon. The tests were made in liquid bath extending the cycle by 6 minutes. It was established that the number of cycles until the crack formation during the tests under 1088 $\leftrightarrow$ 315 ^{0} C for all tested materials and types of coatings is 1.5 - 3 times higher than that of unprotected models. The higher increase of the thermal resistance during the heating cycle was found in coatings made from Ni - Cr - Al - Y on TAZ8A alloys, 4500-6500 cycles respectively instead of 600-800 cycles for the models without protection. The differences regarding the durability are determined by the influence exerted by the oxidation processes on the thermal fatigue during the cyclic heating of the unprotected models at t_{max} = 1088 ^{0}C. One of the factors that determine the sustainability of the coated models is the difference in the thermal dependence of the expansion coefficient of the basic metal and coating. A positive influence of aluminized coatings (Al and Al + Ti) on the thermal fatigue resistance was also obtained in testing the models of EP220 alloy at t_{max} = 900 ^{0}C and the blades of CrNi60VTi alloy at t_{max} = 1050 ^{0}C. On the other hand, the coatings from azotize / chromium nitride visibly reduce the thermal fatigue durability of the alloy from Cr18Ni9 [G1] austenite in order to increase the wear resistance. Paper[D1] shows that the thermal durability of 6.5 mm diameter models, from JS6K and VJL12U alloy without coating is approximately 30% higher compared with models with Al , NiCr35Al15Y, NiCr10Al16Y coating. The influence of the models surface chromium plating by diffusion on the thermal resistance of the JS6K alloy under the testing conditions at t_{max} =850 ^{0}C. was studied in IMAS -5S facilities. It was established that damage (formation of thermal fatigue cracks) of superficial layer with a hardness of 8500 MPa, which exceeds the basic metal hardness, in some cases occurs after several cycles, which represent 15% of the overall sustainability of the model. The characteristics of this protective coating at high temperatures are effective during the operation time, which is noticeably shorter than the durability of the alloy JS6K. The micro-cracks, which are formed in the surface layer, include the brittle phase and are stopped in the plastic area of the metal.

3. CONCLUSIONS.

During the assessment of the functioning capacity of heat-resistant coatings, the correlation between the electrochemical potential of the coating and the electrochemical potential of the basic metal in a corrosive environment appropriate to the operating temperature is of high importance. If the electrochemical potential of the coating is greater than the electrochemical potential of the basic material then the coating protection particularities will manifest as long as it is compact; after the coating has been damaged in some places, the basic metal corrosion will occur more quickly than if it had been used without coating. The ratio of the two potentials may change depending on the changing of the corrosion products composition, when temperature and time will change. Regarding the usefulness of the practical application of coatings we can say that one should not take into account only data from researches on the

protection peculiarities of these coatings in a proper corrosive environment. The final decision is made, usually based on the results of research on the working capacity of coatings that are performed by testing composites (which consist of core and shell) under static, vibration and thermal cycling loads.

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NANOMANUFACTURING AND THE INDUSTRIAL APPLICATION OF NANOTECHNOLOGIES

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Abstract: *"On the molecular scale, you find it's reasonable to have a machine that does a million steps per second; a mechanical system that works at computer speeds." (K. Eric Dexler)*
The paper presents the powerful nanotechnology which will radically transform and extend the capabilities of practically every area of human endeavor by exploring the ultimate limits of fabrication. This technology is a potential very good answer to all of current critical planetary boundaries, and it hands us the power to destroy ourselves and our home more easily than ever before. The field of nanotechnology is one of the fastest growing and most important scientific developments in the last quarter of a century. The work highlights the potentials of nanomaterials in various technologies for the next decade and pinpoints the challenges for research and development.

Keywords: *nanotechnology; nanotech age; molecular manufacturing, nanorevolution, nanofabrication*

1. THE NANOTECH AGE IS COMING SOON

The term 'nanotechnology' was not used until 1974, when Norio Taniguchi, a researcher at the University of Tokyo, Japan used it to refer to the ability to engineer materials precisely at the nanometre level (Taniguchi 1974). The primary driving force for miniaturisation at that time came from the electronics industry, which aimed to develop tools to create smaller (and therefore faster and more complex) electronic devices on silicon chips. Indeed, at IBM in the USA a technique called electron beam lithography was used to create nanostructures and devices as small as 40 - 70nm in the early 1970s. The size range that holds so much interest is typically from 100nm down to the atomic level (approximately 0.2 nm), because it is in this range (particularly at the lower end) that materials can have different or enhanced properties compared with the same materials at a larger size.
According to futurist and inventor, Raymond Kurzweil, the Nanotech Age is expected to begin between 2025 and 2050, bringing an end to the current Information Age which began in 1990.

Humankind is poised at the precipice of the single greatest innovation in the history of science and technology. Coming is a Nano Revolution that will be at least as transformative as the Industrial Revolution (perhaps much more so), but packed into just a few years. Well beyond present-day nanotech applications, mature"molecular manufacturin"

or ”molecular nanotechnology” will enable us to manifest our dreams (or nightmares). We are nearing the ability to build molecules out of atoms mechanochemically, and to use these molecular building blocks to construct virtually any substance or device we can conceive of. How might mankind enjoy the fraits of an advanced civilization without endangering the viability of planet Earth for future generations? That is the fundamental challenge that we confront in the 21st century. In a time when the comforts and pleasures that can be derived from the products of modern technology are accessible for a significant portion of the world's population, how can we manufacture and deliver those products in an environmentally benign fashion.

2. THE NANOREVOLUTION IN TECHNOLOGY AND INDUSTRY

Current industrial applications of nanotechnologies are mainly in the characterisation of materials, the production of chemicals and materials, precision manufacturing and ICT. In general, these applications represent incremental rather than truly disruptive advances; however, in the longer term it is likely that many manufacturing processes will be influenced by nanotechnologies, just as they are today by ICT. The revolution in technology and industry will be based on systematic control of matter on the nanoscale and will involve : changes in the foundations from micro to nano; creation of a general purpose technology (similar IT);

The versatile character of nanotechnology further enables application in diverse market sectors and branches of industry (Table 1).

Table 1. Examples of nanoscale based new materials and innovative products.

Information and communication technology	New optoelectronic & molecular electronic devices, new computer concepts (quantum computer); Advanced microelectronic (nanoelectronic) devices; Displays; data storage
Engineering materials	Nanostructured materials: metals, ceramics, inter-metallics, nanoparticle-loaded/strengthened polymers (composites), carbon nanotubes as strengthening components
Surface coatings Energy conversion and use	Surface functionality and improvement, including paints and adhesives Photovoltaics, thermovoltaics, fuel cells, hydrogen storage materials, batteries/rechargeables, propellants, additives, lubricants
Sensors/actuators	Materials and devices to generate, transduce, receive and transform mechanical, electrical, optical, chemical, and other signals
Catalytic synthesis	Catalysts, photocatalysts, catalyst substrates, nanoreactors, filters, adsorbents, ion exchangers
Health & cosmetics	Diagnostic and therapeutic systems (biochips,contrast agents, drug delivery), improved implants, biological decontamination agents, cosmetics

Nanotechnology challenges for large-scale facilities responding to industrial-customer benefits are presented in the Table 2.

Table 2 .Challenges for large-scale facilities responding to industrial-customer benefits. Overview of technological tasks

CHALLENGES High quality, high efficiency, low costs	Performance parameters of large-scale facilities as standard measuring technology	BREAKTHROUGH Customer benefit
Automation of measurement and evaluation		High throughput screening
Unique interpretation, validation		Reliability standards
In-situ measuring techniques		Optimisation of fabrication and processing technologies
Combination of measuring techniques		Quantitative structure property relation
Metrology, calibration for laboratory methods		Process integrated non-destructive testing (on-line quality insurance)
Table-top synchrotron On-site nanotech infrastructure, networking		Customer-adapted, one-stop shop

2.1 Nanofabrication techniques

Nanofabrication has three components: nanomachining; nanomeasurement and control; nanomaterials production, Fig. 1.

In nanomachining there are several processes to create nanomaterials, classified as "top-down" or "bottom-up." Table 3.

There are a wide variety of techniques that are capable of creating nanostructures with various degrees of quality, speed and cost. Nanomaterials are not simply another step in the miniaturization of materials. They often require very different production approaches. Although many nanomaterials are currently at the laboratory stage of manufacture, a few of them are being commercialised.

Bottom-up manufacturing involves the building of structures, atom-by-atom or molecule-by-molecule. The wide variety of approaches towards achieving

this goal can be split into three categories: chemical synthesis, self-assembly, and positional assembly. The positional assembly (with its many practical drawbacks as a manufacturing tool) is the only technique in which single atoms or molecules can be placed deliberately one-by-one. More typically, large numbers of atoms, molecules or particles are used or created by chemical synthesis, and then arranged through naturally occurring processes into a desired structure.

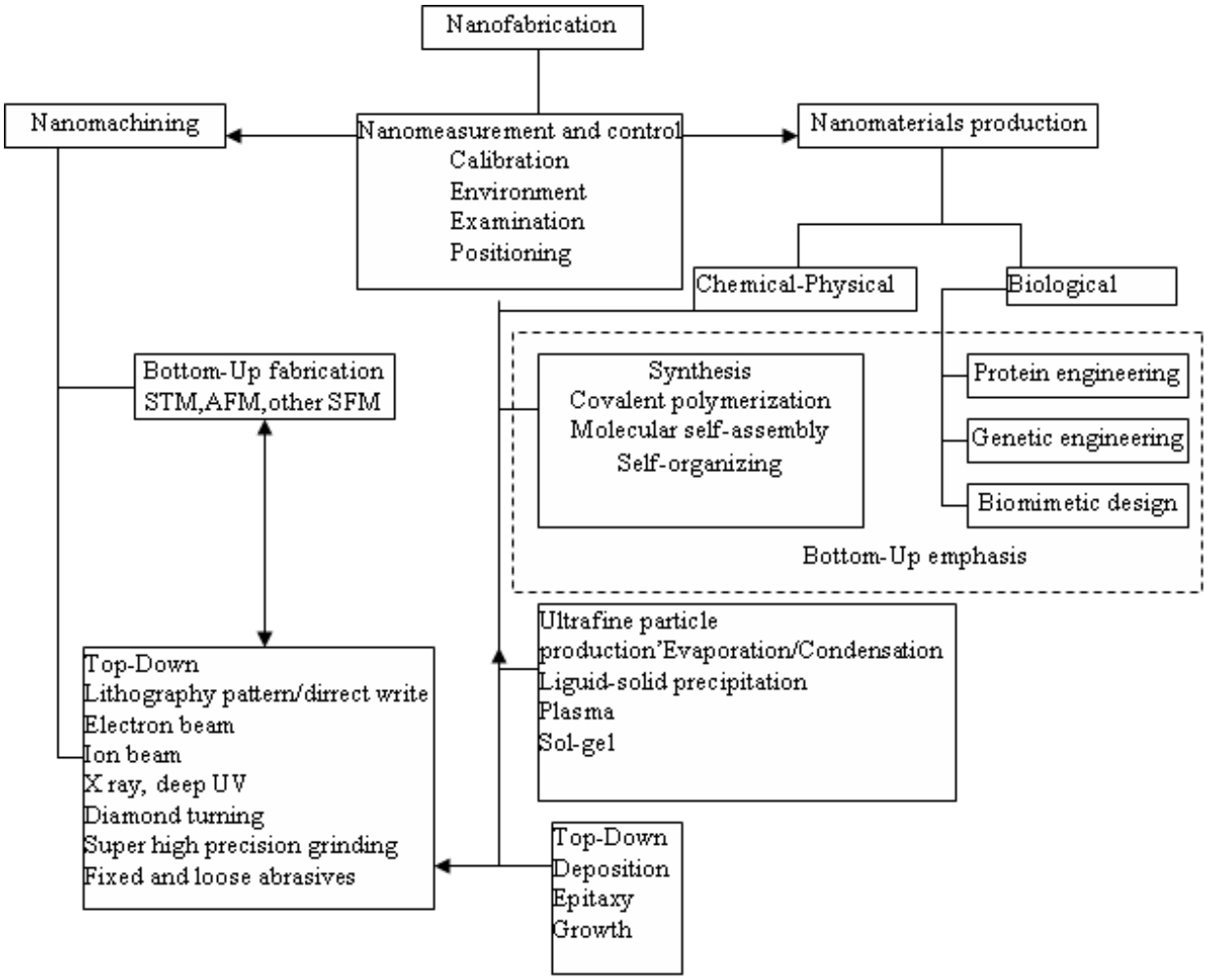

Fig. 1.The components of nanaofabrication

As Fig. 2 indicates, chemical or biological synthesis may work together with probes in the "assembler."

Table 3 The use of bottom-up and top-down techniques in manufacturing

Techniques used in nanomanufacturing			
Bottom-up fields	*1. Chemical synthesis*	*2. Self-assembly*	*3. Positional assembly*
	1.1 Particles Molecules	2.1 Crystals Films,Tubes	3.1 Experimental atomic or molecular devices
	1.2 Cosmetics Fuel additives	2.2 Displays	
Top-down fields	*1. Lithography*	*2. Cutting,Etching, Grinding*	
	1.1 Electronic devices chip masks	2.1 Precision engineered surfaces	
	1.2 Quantum well lasers Computer chips MEMS	2.2 High quality optical mirrors	

One conception of the assembler as a tool for nanostructure fabrication that has been suggested in the literature is a device having a submicroscopic robotic arm(s) under computer control capable of holding and positioning reactive compounds, with respect to molecular

workplaces and devices, to control the precise location at which chemical reactions take place (Drexler, 1992).

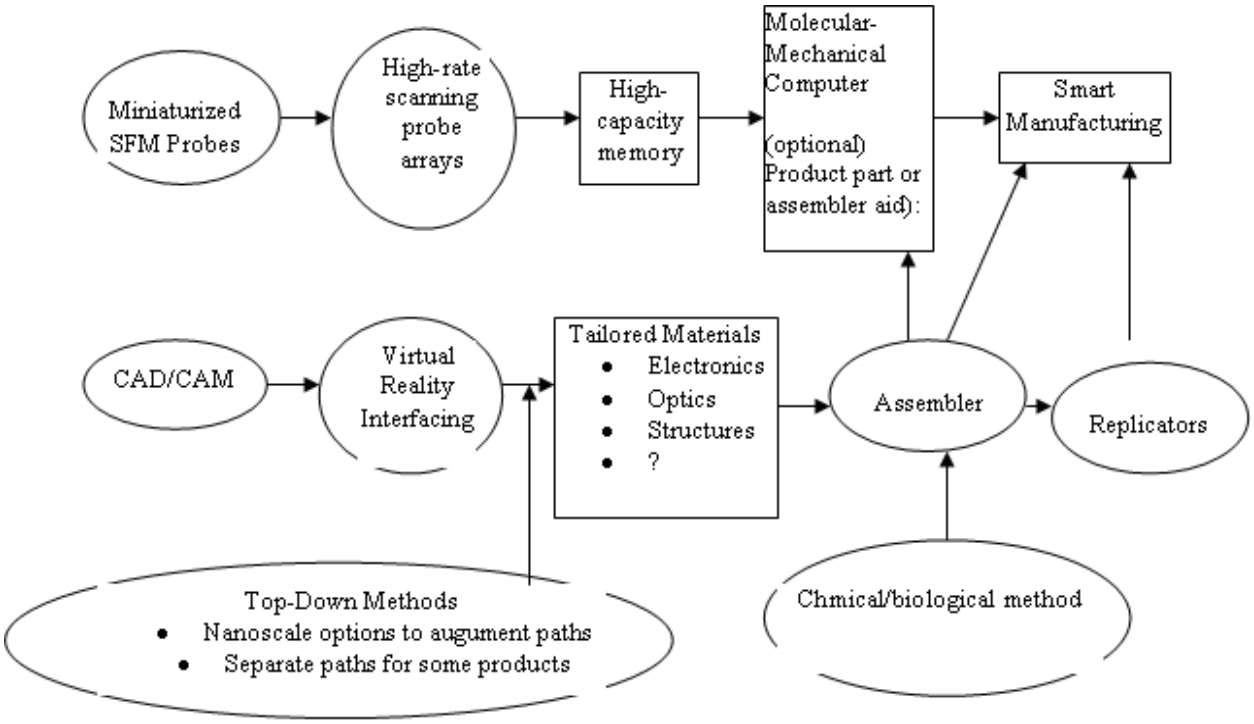

Fig. 2. Use of CAE CAM systems in molecular manufacturing with scanning probes

The world market for nanoparticles is expected to increase during the next few years, to provide perspective, it is worth noting that the global production rate of all chemicals is around 400 M tonnes per annum (European Commission 2001), and so chemicals in nanoparticulate form account for only a tiny fraction of the total (around 0.01%) currently produced. Nanoscalar nanorganic, metallic or semiconductor material often will have multifunctionality, which enables it to be used across many industry sectors. Zinc oxide, for example, will have more commercial use as an optoelectronic material (for displays or advanced solar and photovoltaic cells) where it will be fixed in the final product, than as an ingredient for skincare products, where particles will be free. The use Nano-Particles in Semiconductor Manufacturing is shown in Fig. 3.

2.2 Future researches in nanotechnology

"Assuming advanced molecular nanotechnology becomes a reality, which it appears is a virtual certainty at this point, it

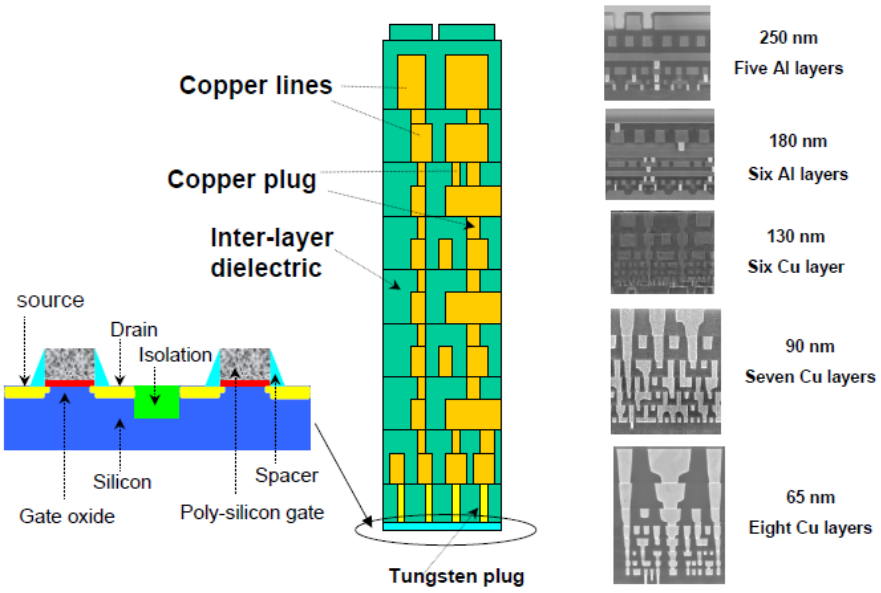

Fig. 3.Trends in the device interconnect [3]

will play a pivotal role in either the survival or extinction of humanity" K. Eric Dexler

In a R&D program nanotechnology researchers are working at the atomic, molecular and supramolecular levels, in the length scale of ~ 1 nm (a small molecule) to - 100 nm range, in order to understand, create and use materials, devices and systems with specific, fundamentally new properties and functions because of their small structure.

The researches a focused in the domains were not possible before: the ability to control and restructure matter at nanoscale; collective effects generate new phenomena and new applications; integration along length scales, systems and applications; sustainable nanotechnology solutions for: clean environment; energy, water, food, mineral resources supplies; green manufacturing, habitat, transportation, climate change and biodiversity.

European industry has recognised its significance to many industrial sectors and that it will bring extraordinary benefits to our industry, economy and welfare in the next decade. In view of its novelty and complexity, the importance for industry to engage in partnership with the scientific community is obvious, requiring highly skilled workforce and the most advanced test facilities to complement in-house R&D activities.

The GENNESYS strategy document [5] is the result of an extensive European-wide study of the needs and opportunities for coordinating future research and development in nanomaterials science and nanotechnology for the advancement of technologies ranging from communication and information, health and medicine, future energy, environment and climate change to transport and cultural heritage. A further focus of this study has been the investigation of the future strategic role of the European research infrastructure, i.e. of the unique analytical potential provided by the European neutron and accelerator- based x-ray facilities in this effort. This study, carried out during 2003 - 2008, brought together leading European scientists and industrial specialists in the fields of materials science, physics, chemistry, biology, and engineering, as well as experts from the neutron and synchrotron radiation facilities. These experts headed thematic task forces with respect to particular research areas - such as information technology, catalysis or functional materials as well as energy and environment issues - and developed roadmaps through numerous informal seminars, workshops and discussion rounds involving colleagues across Europe and the world.

It is expected that nanomaterials will fundamentally change products and how they are produced over the next two to three decades [8].

The main domains where nanotechnology could be applied in the future are the follows:

1. Electronics and communications: bio-nanodevices, neuromorphic engineering in transmitting signals directly from the human organism to a machine, quantum computing, recording using nanolayers and dots, wireless technology, molecular electronics. New devices across the entire range of communication and information technologies will be developed with factors of thousands to millions improvement in both data storage capacity and processing speeds, with reduced costs and improved power efficiency compared to present electronic circuits.

2. Healthcare and life sciences: nanostructured drugs and delivery systems targeted to specific sites in the body, biocompaticable replacements for body parts i.e. biocompatible coatings for implants and nanopolymers for catheters, sensors for lab-on-a-chip, material for bone and tissue regeneration etc. Medical and life science applications may become the most popular and profitable markets for nanotechnology i.e. cancer research diagnostics and treatment. Nanoscale devices can interact with biomolecules and have the potential to detect disease and deliver new ways of treatment.

3. Chemicals and materials: catalysts to improve the energy efficiency of chemical plants, to reduce the exhaust gases of motor vehicles thus lowering the pollution emissions, cutting tools, deep drilling nanomaterials/coatings for petroleum exploration, lubricants, smart textiles.

4. Energy nanotechnologies**:** solar power, clean fossil fuels, new generation nuclear reactors and fusion reactors, new types of batteries, artificial photosynthesis for clean energy, production and storage of hydrogen, energy saving from using lighter materials.

5. Food and agriculture: nanoscale pesticides, targeted nanofoods with greater capability and sustainability, nanoseeds, nanopackaging materials.

6. Transport**:** light-weight vehicles.

7. Processing and manufacturing: tools to manipulate matter at the atomic scale, sintering of nanopowders into bulk materials with specific properties that may include smart sensors to detect failures and actuators to repair the problems.

8. Environment: selective membranes and filters that can remove contaminants, clean water, pollutants from industrial effluents, detection of nanoparticles in the environment, reduced sources of pollution, increased opportunities for recycling.

9. Security**:** detectors of chemical and biological agents, camouflage materials, light and self-repairing textiles, miniaturised surveillance systems.

3. CONCLUSION

In the next decade, nanotechnology R&D is likely to shift its focus to socio-economic needs-driven governance, with significant consequences for science, investment, and regulatory policies

It will be imperative over the next decade to focus on four distinct aspects of nanotechnology development: how nanoscale science and engineering can improve understanding of nature, generate breakthrough discoveries and innovation, and build materials and systems by nanoscale design - "knowledge progress"; how nanotechnology can generate economic and medical Value - "material progress "; how

nanotechnology can address sustainable development, safety, and internațional collaboration -"global progress"; how nanotechnology governance can enhance quality-of-life and social equity - "moral progress".

The nanotechnology priorities in the next decade are the follows: advance partnerships between industry, academia, NGOs, multiple agencies, and international organizations; support precompetitive R&D and system application platforms; promote global coordination; create an international cofunding mechanism for databases, nomenclature, standards, and patents; support horizontal, vertical, and system integration in nanotechnology education and personalized learning; use of nanoinformatics and computational science prediction tools; new strategies for mass dissemination, public participation for creating standing organizations and programs to fund and guide nanotechnology

Meeting the requirements of the following aspects would result in exciting challenges for the nanomaterials industry in Europe: economic aspects; logistic aspects; networking and partnership alliances; technological factors

I have presented new opportunities to develop product features, especially those intangible features of extended products and value-added services.

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THE APPLICATION OF CRYOGENIC TREATMENT ON COLD PLASTIC DEFORMATION STEELS

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Abstract: *In the structure of the tools alloyed steels after the hardening appreciable quantities of residual austenite are kept. The paper studies two parallel ways which reduce the amount of residual austenite, namely by multiple temperings,respectively by less than zero degrees Celsius treatment. Are highlighted some of the benefits of cryogenic treatment related to reducing the total heat treatment time and production costs. The experimental attempts were effectuated on two alloyed steels, which were cold plastically deformed, namely W1.2379 and W1.2767 (according to EN ISO 4957).*

Theoretical considerations

Generally, at the alloyed tool steels after hardening to martensite, in the structure are preserved austenite quantities, called residual, in amounts that can reach and even overcome 40 ... 50%. Because its presence in the structure leads to the hardness and dimensional stability decrease, it is unwanted. Subsequent heat treatment operations, among other goals aimed to reduce the amount of residual austenite in quantities of a few percent, which may not influence in a negative way the effects shown above.

Residual austenite which results after the hardening is due to the fact that the final temperature after the hardening is under the Ms point of the steel. Martensitic critical points decrease simultaneous with increasing the content of carbon and in the majority of the alloying elements, reaching to negative temperatures.

Removal of residual austenite by transforming it into other structures may take place by increasing the temperature of the Ms and Mf points, which is obtained by multiple tempering. During the tempering occurs the precipitation of secondary phases and thus, the impoverish of the solid solution of carbon and alloying elements, followed by the increasing of the martensitic critical temperature, decreasing the residual austenite stability and its transformation usually in martensite;

- decreasing the temperature of the material as more as under Ms, closeness and rarely overcoming the Mf' point, namely the application of cooling below zero degrees, most often between -50 ° C and -120 ° C, depending on the case.

Experimental attempts

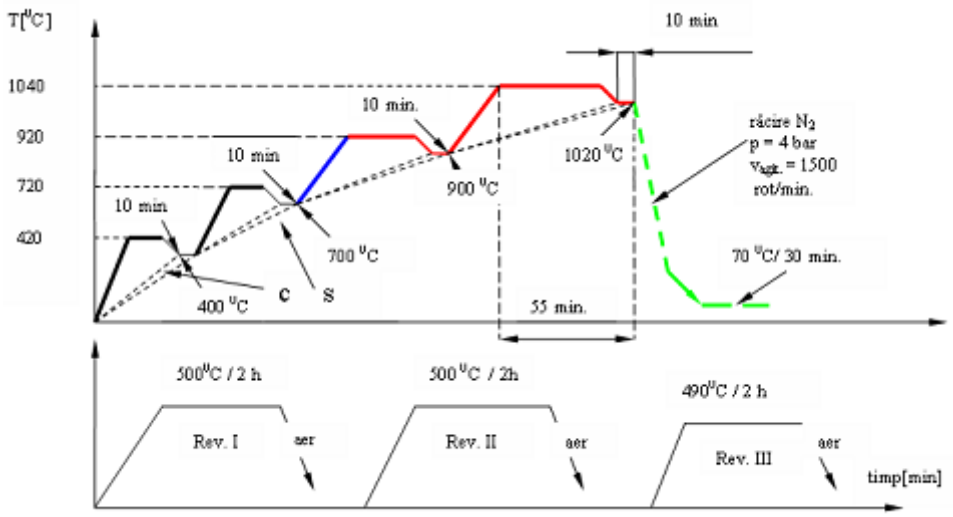
Experimental attempts had the purpose to study the possibilities of reducing the residual austenite and the kinetics of these transformations. The researches were effectuated on samples of two tool steels of cold plastic deformation, which are presented in Table 1.

Table 1

No.	Steel's type (according to EN ISO 4957)	Chemical composition[%]									
		C	Si	Mn	P	S	Cr	Mo	V	W	Cu
1	W1.2379	1,549	0,424	0,376	0,012	0,018	11,87	0,875	0,781	-	0,003
2	W1.2767	0,391	0,329	0,422	0,021	0,018	1,242	1,517	0,226	-	0,009

The samples utilized had a cylindrical shape for measuring the hardness and metallographic study; on these were determined the chemical composition by the spectral analysis method and respectively standard samples for determining the resilience on them.

Samples of both tool steels were simultaneous subjected to regular heat treatment (hardening and tempering) and respectively to heat treatment containing the cryogenic variant (hardening and under-zero degrees treatment), according to the graphs in figures 1 and 2.



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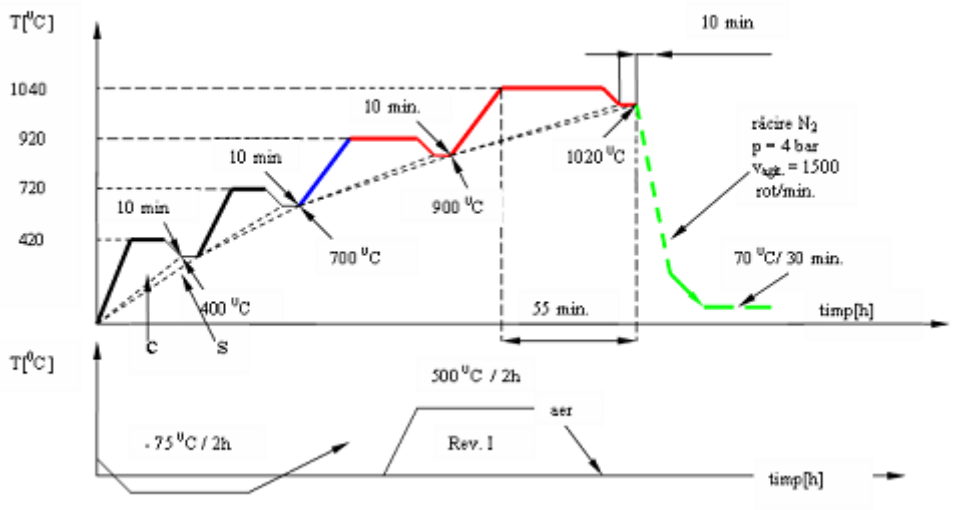
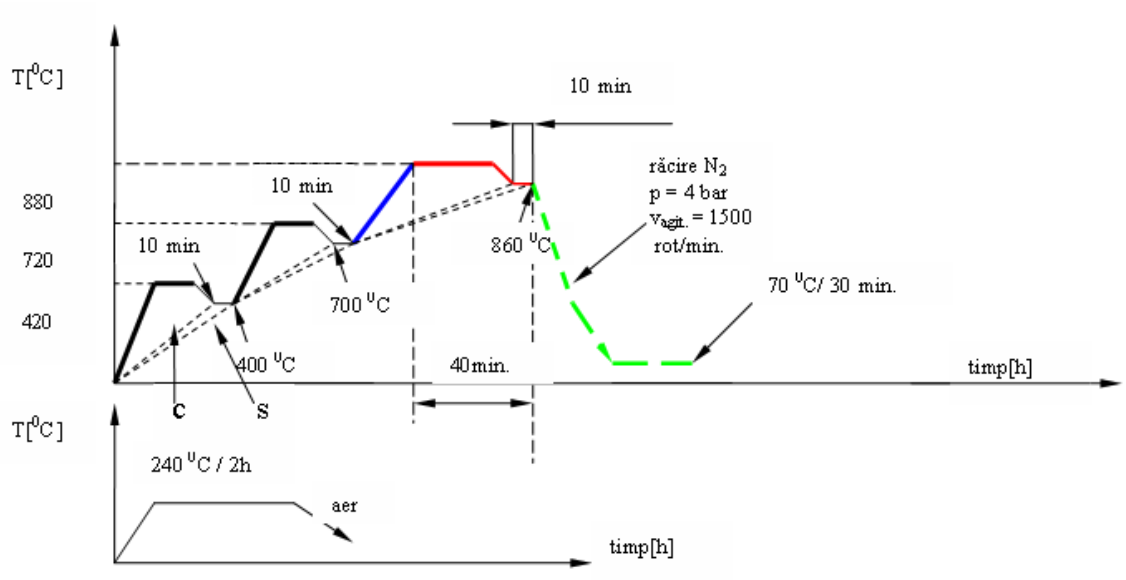


b.

Fig.1. Heat treatments on W1. 2379 steel samples: a) hardening and multiple tempering, b) hardening, under-zero degrees treatment and tempering.



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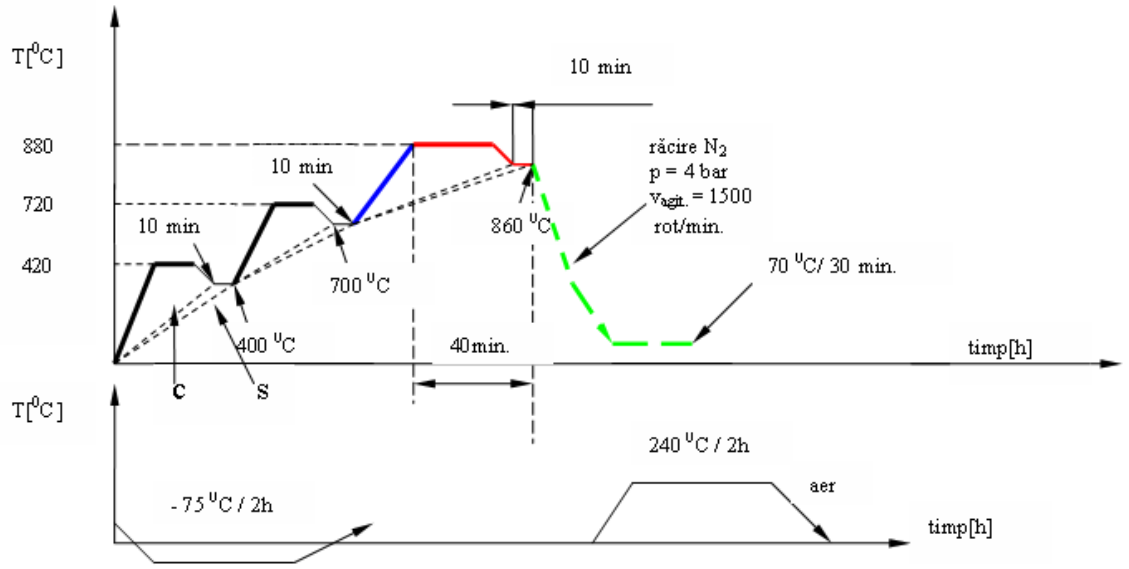

b.

Fig.2. Heat treatments applied to W1. 2767 steel samples: a) hardening and multiple tempering, b) hardening, under-zero degrees treatment and tempering.

It is found that for each steel in both regular and the one with cryogenic treatment, hardening was effectuated in an oven with vacuum.

On treated samples as above, studies were effectuated regarding the structure, the hardness, the amount of residual austenite, the resilience. The obtained results are presented below in Table 2 for W1.2379 steel and in Table 3 for W1.2767 steel.

Practical results obtained

Table 2

No.	Vaccum hardening t[°]	Cryogenic treatment t[°]	Tempering t[°]	Hardness [HRC]	Resilience KCU [J/cm^2]	Residual austenite [%]
1	1020	-	-	63,2...63,5	-	20...25
2	1020	-	1 tempering /525	59,1...59,7	-	20...25
3	1020	-	3 tempering 500/500/450	58...59,1	4,83	<20
4	1020	-75	-	64,3...64,7	-	<15
5	1020	-75	1 tempering/525	59,2...60	4,15	<15

Table 3

No.	Vaccum hardening t[°]	Cryogenic treatment t[°]	Tempering t[°]	Hardness [HRC]	Residual austenite [%]
1	860	-	-	53,3...54,1	5...10
2	860	-	1 tempering/240	48,9...49,4	<5
3	860	-75	-	53,7...54,9	<5
4	860	-75	1 tempering/240	49,1...49,7	<5

Some structures of the studied samples are presented in figures below.

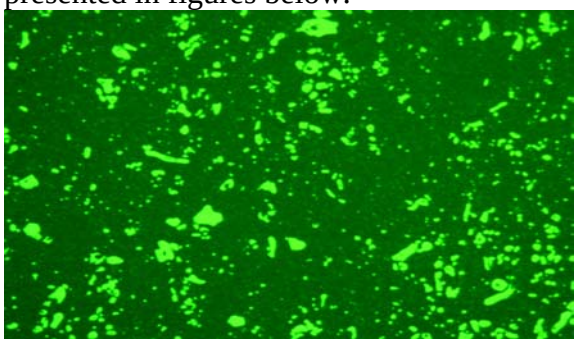

Fig. 3 W1.2379 steel after hardening in vacuum and three consecutive tempering. NitalAttack.200: 1

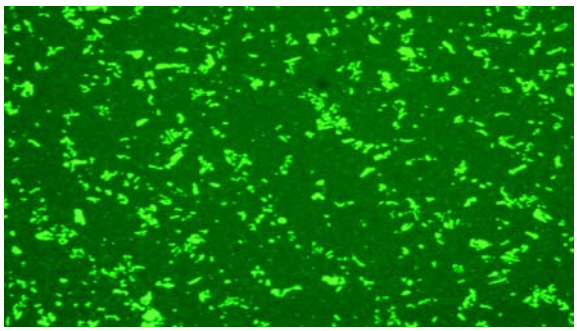

Fig.4. W1.2379 steel after hardening in vacuum, cryogenic treatment and one tempering to 525 ° C. Nital attack. 200:1

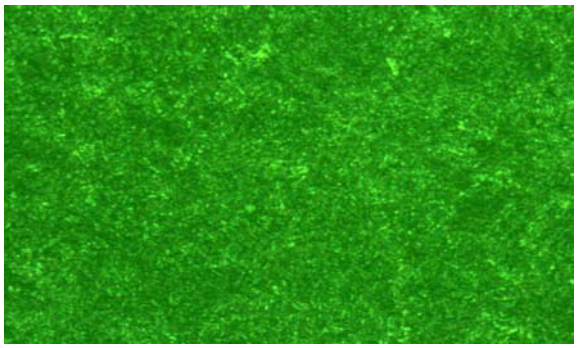

Fig.5. W1.2767 steel after hardening in vacuum and one tempering to 240 °C. Nital attack. 500:1

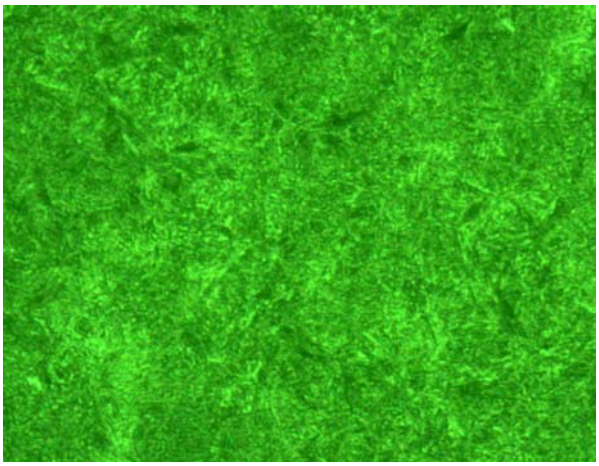

Fig.6. W1.2767 steel after hardening in vacuum, cryogenic treatment and one tempering to 240 ° C. Nital attack. 500:1.

In the above steel structure can be found martensite in different amounts, carbides and residual austenite.

Conclusions

From the above are found the following conclusions:

a) for the W1.2379 steel:

- after quenching are obtained over 63 HRC hardness and in the structure are preserved in appreciable quantities of residual austenite;
- after applying three consecutive tempering residual austenite content decreases with almost 5%. At the same time, it is found also the hardness decrease with 5-6 Rockwell units. The effect of tempering is higher than the one of the residual austenite transformation;
- after hardening and under-zero degrees treatment (without annealing) the hardness increases easily, but the amount of residual austenite decreases substantially; the following tempering has no effect on the residual austenite but the hardness decreases with almost 5HRC;
- the resilience of the treated samples by hardening and three tempering is with about

15% higher than after the under-zero degrees cooling version, which is normal;
- the structure of cryogenical treated sample is finer than the usual treated ones.

b-for W1.2767 steel:
- the lower carbon and alloying elements content favors a more complete transformation at heat treatment, so smaller amounts of residual austenite than the W1.2379 steel;
- both annealing and cryogenic treatment have similar effects on the residual austenite transformation;
– due to lower heat treatment temperatures (both at hardening and tempering) structures obtained are extremely fine.

Cryogenic heat treatment leads to the increase of the hardness and also increases the wear resistance of cold plastic deformation tools.

Due to decrease, (moderate) of the resilience, decreases slightly the shock resistance too, so it is not recommended to the tools working with big shocks. Under-zero degrees heat treatment leads to the elimination of at least one annealing operation (at steels which need three or more tempering), with positive effects on reducing total heat treatment time and production costs.

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POKA YOKE – A TOOL FOR COMPETITIVENESS IN DIE PRODUCTION SYSTEMS

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Abstract. *Currently companies act on a global market. To survive in this market is important to be competitive. The company competitiveness is measured by the levels of performance by making competitiveness products with minimal costs. To control and decrease the costs must make through continuous improvements of the process. A tool that helps to do that is Poka Yoke devices. Poka Yoke is a tool of lean concept, used across processes. Its purpose is to eliminate product defects by preventing, correcting, or drawing attention to human errors as they occur. Poka Yoke devices don't have to be expensive and they are usually very simple. It helps to preventing mistakes before they occur and is the best way to reduce failures and waste, resulting in lowered costs. Poka Yoke helps the company to increase the value added of the product and to follow the road of zero defects.*

Key words: *Lean concept, Poka Yoke, competitiveness, production system, cost reduction, continuous improve.*

1. INTRODUCTION

In present, because of globalization and under cries effect, the system productions are under intense pressure to find new ways to dramatically reduce costs and improve return on invested capital while better serving their more demanding customers.

To accomplish these goals, many production systems implemented the Lean philosophy that espouses the elimination of all forms of waste, continuous improvement, and simplification of business processes.

For the system productions successfully adopting Lean, the motives are to provide superior value to the customer while at the same time improves profitability.

2. LEAN CONCEPT

Lean manufacturing has been a symbol of efficiency and optimal performance since the 1980's, mainly due to its association with the automotive industry and Toyota.

As lean thinking continues to spread to every country in the world, leaders are also adapting the tools and principles beyond manufacturing, to logistics and distribution, services, retail, healthcare, construction, maintenance, and even government. Indeed, lean consciousness and methods are only beginning to take root among senior managers and leaders in all sectors today [1].

The five principles of Lean presented in Lean Thinking are: value, value stream, flow, pull, and perfection.

Literature refers to Lean manufacturing also as "Just-in-time" (JIT), or as "cellular manufacturing" (CM). These terms are often used interchangeably, and the philosophy they describe is the same:

- elimination of waste;
- maximization of efficiency;
- continuous improvement.

A tool use to elimination waste is Poka Yoke concept.

Poke Yoke is a critical component of Lean manufacturing. Simplifying processes, reducing errors, associated waste and costs brings value to operations. In turn, customers who benefit from more efficient manufacturing and less downtime view value-added suppliers as "partners" rather than just interchangeable vendors. Poka Yoke is fool

proofing, which is the basis of the Zero Quality Control (ZQC) approach, which is a technique for avoiding and eliminating mistakes [2, 3].

3. POKA YOKE DEFINITION

Poka Yoke is Japanese term which means mistake proofing. Poka Yoke was coined in Japan during the 1960's by Shigeo Shingo who was one of the industrial engineers at Toyota.

Poka Yoke is a technique for avoiding simple human error in the workplace. Also known as mistake-proofing, goof-proofing, and fail-safe work methods, Poka Yoke are simply a system designed to prevent inadvertent errors made by workers performing a process [4].

A Poka Yoke device is one that prevents incorrect parts from being made or assembled, or easily identifies a flaw or error. Poka Yoke, a means of providing a visual or other signal to indicate a characteristic state. Is a manufacturing technique of preventing errors by designing the manufacturing process, equipment, and tools so that an operation literally cannot be performed incorrectly.

4. CATEGORIES OF POKA YOKE DEVICES

Poka Yoke devices fall into two major categories: prevention and detection.

Prevention gives 100% of the guarantee of good products. It is not possible to produce defective product. Example: The equipment used for the passing elements; element is to be given the party which should be assembled, so that an operator shall not lose time for thinking how it should be fitted, the risk of confusion also was minimized [3].

A detection device signals the user when a mistake has been made, so that the user can quickly correct the problem. The small dish used at the Yamada Electric plant was a detection device; it alerted the worker when a spring had been forgotten. Detection devices typically warn the user of a problem, but they do not enforce the correction [5].

In system production activity from each day by both detection and prevention Poka Yoke devices, though we may not usually think of them as such.

Poka Yoke is an alert method that gives 30% of the guarantee of good products. This method informs about appearance of defect but does not provide and does not produce 100% quality. The most igniting the lamps or activating the alarm, which shall return the operator to rise to an error.

Types of Poka Yoke devices:

- The control gives 100% of the guarantee good products. The control ensures that if it was created defect, it's not coming outside the production line and does not reach to the customer [3].
- elimination: remove the possibility of error
- replacement: replacing an error-prone process with a mistake-proof process
- facilitation: making correct actions easier through mechanisms like color-coding
- detection: inspect product for agreement with standard, successive or self-check
- mitigation: allowing the mistake to occur but minimize the consequences (That's preventing the influence of mistakes) [6].

5. CHARACHTERISTICS OF POKA YOKE DEVICES

Good Poka Yoke devices, regardless of their implementation, share many common characteristics:

- they are simple, cheap and easy to implemented. If they are too complicated or expensive, their use will not be cost-effective;
- they are part of the process, implementing what Shingo calls "100%" inspection, it's not an new operation. Prevent the ability to make a defect / prevent the defect from being passed on;
- they are placed close to where the mistakes occur, providing immediate feedback to the workers so that the mistakes can be corrected.

6. IMPLEMENTED POKA YOKE IN A DIU PRODUCTION SYSTEM

A. Steps for implement PY

- develop team;
- create Error Proofing Implementation Sheet;
- identify and describe defect;
- determine location the defect was found & made;
- identify root cause;
- current process and deviations from standards;
- propose and implement improved process;
- measure;
- standardize.

The generator mechanism to create a Poka Yoke can see in figure 1 [7].

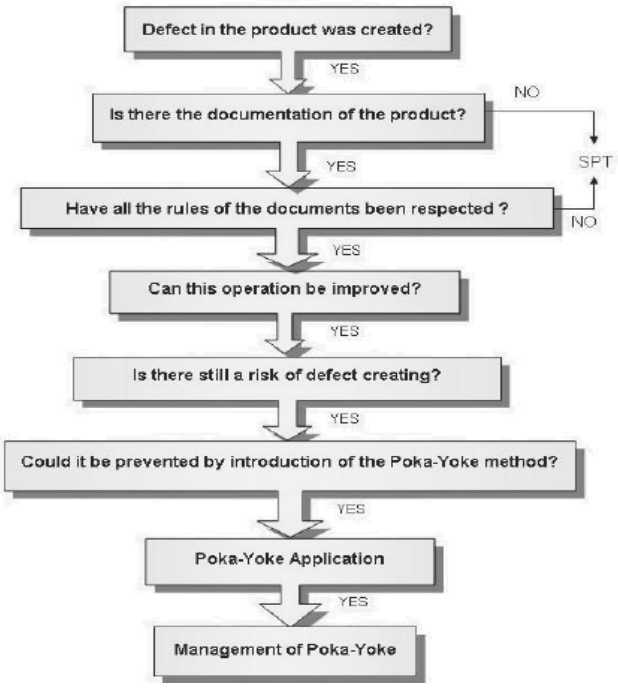

Fig. 1 The generator mechanism to create a Poka Yoke

B. Examples of Poka Yoke in a die production system

Judged by these criteria, the "small dish" solution to the missing-spring problem is an excellent Poka Yoke device can see in figure 2 [5].

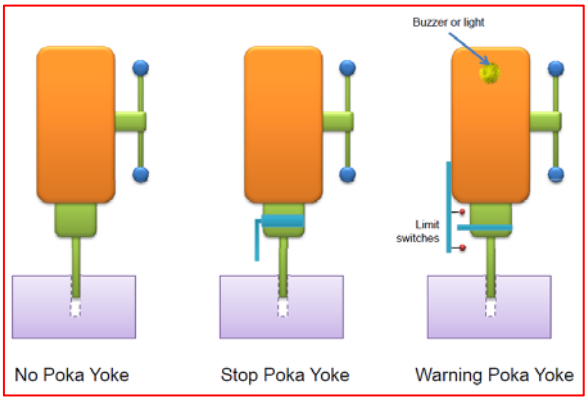

Fig. 2 Poka Yoke at the drill operation

It's a Poka Yoke device because:

- it was simple;
- it was cheap, involving only the cost of a small dish;
- it provided immediate feedback about the quality of the work; corrections could be made on the spot.

These Poka Yoke reducing rework because it's a:

- warning Poka Yoke: operator is alerted when a mistake is about to made;
- control Poka Yoke: the Poka Yoke device actually prevents the mistake from being mad.

Another Poka Yoke example is Bar-code scanning at the check-out lane to eliminate errors and increase speed or an automatic generating of labels.

If the label editing is done manually, the operator inputs the data character by character, the possibility of wrong testing exist.

A Poka Yoke is automatic generation of labels with a special program (in order of production-related).

The operator takes over from system the command and the remaining fields of the label are automatically generated.

The cost of Poka Yoke device can see in figure 3 [6].

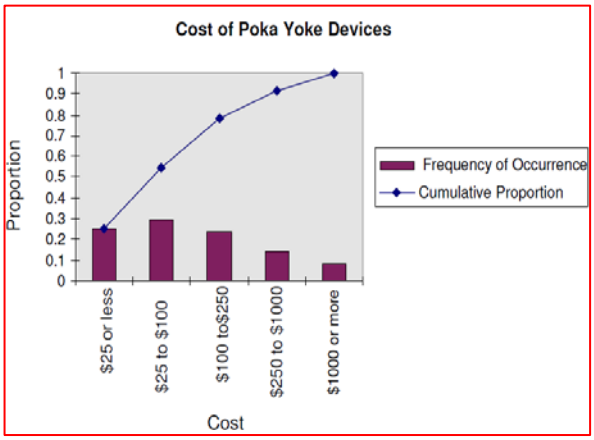

Fig. 3 The cost of Poka Yoke device

7. CONCLUSIONS

Poka Yoke shows how finding mistakes at a glance helps to avoid defects. The aim of Poka Yoke method is to eliminate or minimize human errors in manufacturing processes and management as a result of mental and physical human imperfections. For the main part is to eliminate errors independent. The main idea of this method is preventing causes, which may result in errors and use relatively cheap control system for determining compliance of the product with the model. It is a simple principle that can be implemented by anyone at any time, and can lead to massive savings in both time and money.

Poka Yoke is at its best when it prevents mistakes, not when it merely catches them. Since human errors usually stem from people who get distracted, tired, confused or demotivated, a good Poka Yoke solution is one that requires no attention from the operator. Such a Poka Yoke device will prevent the occurrence of mistake even if the operator loses focus in what they are doing.

In the described organizations Poka-Yoke method in connecting with the quality methods ensure of high quality of produced engine elements, as well as by the continuous monitoring process all allow to minimize cost, and sharing not great effort to improve.

Use of Poka-Yoke requires strong basis in the overall quality management. Necessary are clear indications to distinguish between a defective and correct product and therefore company regularly carry out training crew. The method Poka Yoke requires an immediate reaction and the correction as well as a result in the operation. Errors arise from various reasons, but most of them can be prevented if only people are be able to identify the problem at the time of formation, define the causes and make appropriate corrective steps. Prevention of defects in the process before their appearance is the best way of defects reduction and thus reduces the costs. References

It's important to use Poka Yoke in a die production system because:

- it helps people and processes work right the first time;
- it stresses on techniques that can drive defects out of products and process and thus make it impossible to make mistakes. This substantially improves quality and reliability;
- the use of simple Poka Yoke ideas and methods in product and process design can eliminate both human and mechanical errors;
- Poka Yoke does not need to be costly.

Using Poka Yoke has a lot of benefits for die production system:

- enhanced productivity;
- the highest level of quality can be achieved;
- lowers quality cost;
- lowers rework;
- enhanced customer satisfaction.

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IMPLEMENTED TPM TO INCREASE THE COMPETITIVENESS DIE PRODUCTION SYSTEMS

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***Abstract**. In a global market a competitive production system provides a good place in keeping customers and winning new markets and customers. The production system must find the necessary tools to increase competitiveness by decreasing costs, increasing the quality of products and processes, higher flexibility to the market requirements. One of the tools that ensure the increased competitiveness of the production system is the implementation of Total Productive Maintenance (TPM Total Productive Maintenance).*

***Key words:** production system, Total Productive Maintenance, competitiveness, change over.*

1. INTRODUCTION

Currently there is a clear trend towards market globalization and to save what determines an increasing interpenetration of national economies.

Globalization is a process that takes place with amazing speed, includes almost all countries of the world and has been determined and encouraged by the fast technology progress.

The main feature to operate on a global marketplace is competitiveness.

Competitiveness is a system of production capacity to act in a competitive market. The notion of competitiveness is much broader than quality, productivity, profitability, etc. which encompasses it. Always, at any level in any field, quality, productivity, profitability, etc. are just faces of competitiveness [1, 2, 3, 4].

According to OECD (Organization for Economic Co-operation and Development), "Competitiveness is the ability of businesses, industries, regions, nations or supranational complexes to provide input to the profitable production units and a relatively high level of use on a sustainable basis, given that they are exposed to free competition "[5].

2. THE COMPETITIVENESS OF THE DIE PRODUCTION SYSTEM

The competitiveness of a mould making production systems and competitive as any production system, are measured the same as any production systems competitiveness, analyzing the competitiveness of each of the activities of its departments. Some activities are more important than others, depending on the activity of the production system and thus belonging departments have a greater role. If production systems that made moulds for casting and forging ,organizing the supply, production, delivery, business activities and how it intertwines in the concept of

sustainable development in business activities, are some activities that can make the production system, a system competitive, or the contrary.

3. TPM DEFINITION

TPM means Total Productive Maintenance and is a system of maintenance to covering the entire life of the equipment and the total human resource.

TPM is a tried and tested way of eliminating waste, saving money and making factories better places to work. It gives operators the knowledge and confidence to manage their own machines.

TPM is a long term process to increase skills, raise efficiency and achieve zero losses.

4. STEPS FOR IMPLEMENTED TPM

TPM is not just a concept it's a TPM requires effective leadership from the start. That is part of the meaning of "total" in Total Productive Maintenance. Without effective leadership that links TPM efforts to the business and holds people accountable for performing highly specified work, equipment performance and reliability will continue to decline and TPM initiatives will be short-lived [5].

A die production system to be competitiveness must understand the maintenance was not only responsible for "fixing things" – not for preventing problems.

Viewing maintenance as a non-value-adding support function, often subject the maintenance department to severe cost-cutting; this usually results in higher costs due to decreased equipment effectiveness and a lower competitiveness.

To implement TPM in a die production system must following 12 steps:

Step 1: Announcement of TPM. Top management needs to create an environment that will support the introduction of TPM. Without the support of management, skepticism and resistance will kill the initiative [6].

Step 2: Launch a formal education program. This program will inform and educate everyone in the organization about TPM activities, benefits and the importance of contribution from everyone. Can use flyers, posters, billboards s.o.

Step 3: Create an organizational support structure. Can start through o project. The team project will promote and sustain TPM activities once they begin. Team-based activities are essential to a TPM effort [7]. The team project needs to include members from every level of the organization – from management to the shop floor. This structure will promote communication and will guarantee everyone is working toward the same goals [8].

Step 4: Establish basic TPM policies and quantifiable goals. Analyze the existing conditions and set goals that are SMART:

- Specific: clear about what, where, when and how the situation will be changed;
- Measurable: the ability to quantify the targets and benefits;
- Attainable: capacity to achieve the objectives (knowing the resources and capabilities available to the production system) ;
- Realistic: the ability to get the change reflected in the objective;
- Time-based (in Time): determining the time period during which each objective will be achieved. Practical way to implement TPM is workshops.

Step 5: Outline a detailed master deployment plan. This plan will identify what resources will be needed and when for training, equipment restoration and improvements, maintenance management systems and new technologies.

Step 6: TPM kick-off. Implementation will begin at this stage and it will be follow like a project with stage, gates and millstones.

Step 7: Improve the effectiveness of each piece of equipment. Project teams will analyze each piece of equipment and make the necessary improvements. First stage must be the observations.

Step 8: Develop an autonomous maintenance program for operators.

Operators' routine cleaning and inspection will help stabilize conditions and stop accelerated deterioration. Must realize standard maintenance instructions with specific pictures.

Step 9: Develop a planned or preventive maintenance program. Create a schedule for preventive maintenance on each piece of equipment divided on each shift.

Step 10: Conduct training to improve operation and maintenance skills. The maintenance department will take on the role of teachers and guides to provide training, advice and equipment information to the teams.

Step 11: Develop an early equipment management program. Apply preventive maintenance principles during the design process of equipment [9].

Step 12: Continuous improvement. As in any lean initiative, the organization needs to develop a continuous improvement mind-set.

The modalities to measure the TPM are the following: the indicators like OEE (Gage), maintainability, reliability, availability (down time loss), efficiency, quality rate (defect loss), performance (speed loss).

5. OEE AN INDICATOR OF TPM

The modalities to measure the TPM are the following: the indicators like OEE (Gage), maintainability, reliability, availability (down time loss), efficiency, quality rate (defect loss), and performance (speed loss).

OEE breaks the performance of a manufacturing unit into three separate but measurable components: Availability, Performance, and Quality. Each component points to an aspect of the process that can be targeted for improvement. OEE may be applied to any individual Work Center, or rolled up to Department or Plant levels. This tool also allows for drilling down for very specific analysis, such as a particular Part Number, Shift, or any of several other parameters.

It is unlikely that any manufacturing process can run at 100% OEE. Many manufacturers benchmark their industry to set a challenging target, 85% is not uncommon.

The components of OEE are related in figure 1:

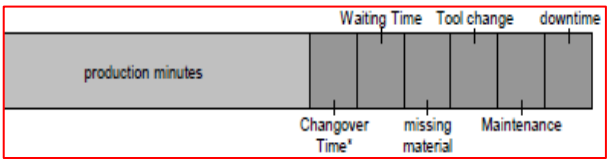

Fig. 1 The components of OEE

6. DECREASING CHANGEOVER TIME TO A GRINDING MACHINE IN A DIE PRODUCTION SYSTEM

A production system that produces molds is characterized by a production of unique and rare pieces of small series. For this reason the handle different commands from a clients, the system should be able to adjust quickly the production to the client's request. The Indicator that measures that is called processing time.

At the grinding machine used for the grind round mold plates the round the transformation time is very high. A TPM workshop is held to analyses the values changeover time throughout the year. High values are resulting, that values are constant month by month although the changes are the same.

A 5Why analyses are made and the conclusions are that the changeover time is too high (Figure 2) because for the product changes are required too many operations (Figure 3).

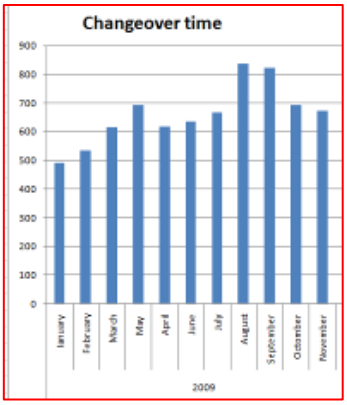

Fig. 2 Changeover time at grinding machine

Fig. 3 The grinding machine segments on plate's machine

A brainstorming is organized and deciding to replace the car with some new segments. The new pistons adapts easy to the new diameter of the engines die. Fix the car plate and the work piece is placed on them without the need for additional fixation (Figure 4).

New segments are designed, are given for execution, are mounted on the machine table and tested.

Fig. 4 The grinding machine new segments on plate's machine

After this test the results are a much better changeover time and the decision to implement these new segments. The Changeover time before and after implementation is found in Figure U. It shows a decrease of processing time (Figure 5), a growing number of transformations (Figure 6) and a considerable decrease of the minutes / no changeover (Figure 7).

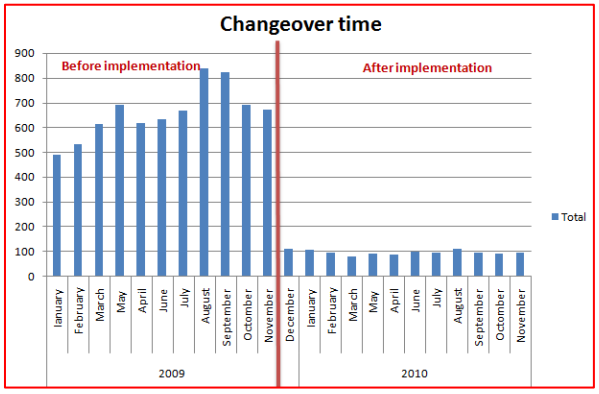

Fig. 5 The changeover time value before and after the implementation of the new segments on plate's machine

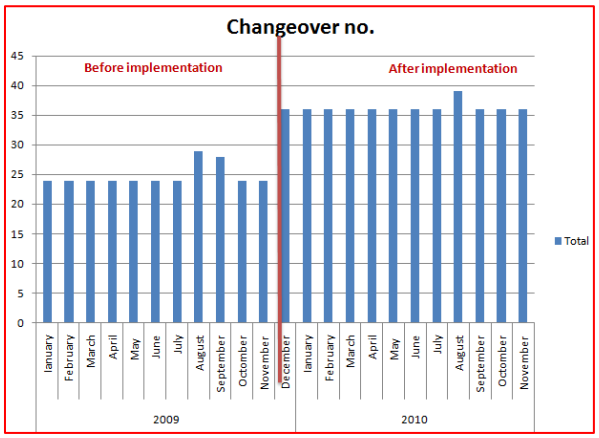

Fig. 6 The changeover no. value before and after the implementation of the new segments on plate's machine

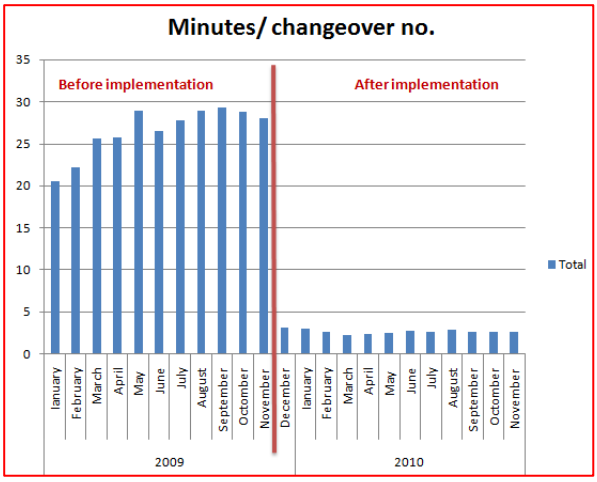

Fig. 7 The changeover minutes reported to changeover no. value before and after the implementation of the new segments on plate's machine

7. CONCLUSIONS

Increasing competitiveness implies the use of methods and principles to help the production system to become more competitive than other production systems which operate on the same market.

TPM is a Lean Instrument; with the implementation of TPM in the production system it becomes competitive by achieving maximum equipment efficiency throughout the lifecycle and significantly reducing costs.

Introducing TPM requires a well-established plan, materialized through a project and a well specialized team. A successful implementation requires the involvement and training of all employees, including the management.

Increased competitiveness through TPM is a good opportunity to raise operator's skills and know-how, to foster improvement suggestions.

TPM increase the competitiveness of production system through:

- a optimum productivity of machines, a reduction of the costs incurred and a reduction in the time for the return on investment;
- minimize the under-utilization of equipment: cause of losses (including financial);

The conservation of equipment through close observation of the factors for keeping (an operational condition of machines).

The TPM are following through OEE indicator.

The example describes a workshop of decreasing changeover time.

Reduction of change-over costs, an easy production of smaller lot sizes/prototype parts combined with an increased number of changeovers, urgent orders can be quickly produced, Set-Up becomes easy, no special skills are needed. Indirectly improved productivity (increased efficiency, less waste, less machine defects), improved flexibility.

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MECHANIZATION AND CONTROL OF THE WELDING FOR AUTO SEATS STRUCTURE

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Abstract: The paper presents the fabrication technology for metal frame chairs of the rear seatback Dacia Sandero car.

The achievement is made using welded construction mechanization devices, which allows fixing the metal frame and wire mesh. In order to avoid rejects, caps were fitted with sensors connected to the welding station machine, which validates the points of welding in place. Welding is done by pressure points using welding clamps, whose action is blocked if the welding point was incorrect. The control system of welding points removes scrap and validates the correct welding process.

Keywords: *car seats, control devices, system validation of mechanization devices.*

1. INTRODUCTION

The Dacia Sandero car seats in the front and back are welded rear pressure into points.

Seats in the rear seat backrest of the car are manufactured Sandero Design legally in three variants: RSB 40, RSB 60, RSB100.

The paper presents the process of manufacturing the valves of the rear backrest RSB100 type of project B90 (Sandero).

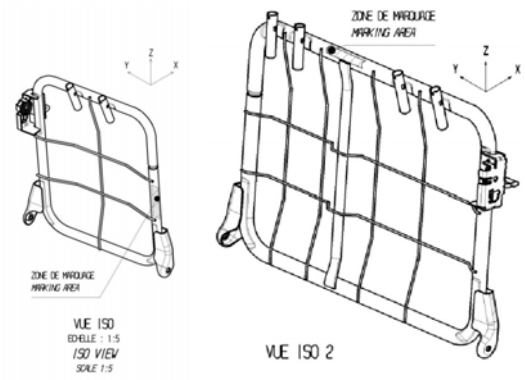
Pressure welding technology in the points is completed by the validation of welding points, using a control system that avoids welding scraps and confirm that it was well executed.

2. STEEL STRUCTURE COMPONENY CAR SEATS.

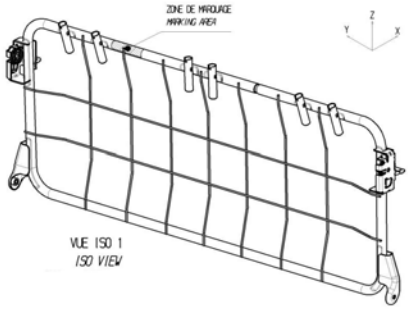
The three types of auto parts backrest are shown in Figure 1.

The building consists of a metal frame made of pipe that are welded fasteners, hinges, reinforcement bar and wire mesh to secure a trim.

Preparing reinforced backrest for variant RSB 100 requires the execution of 24 welding seams on the front of the weld reinforcement and 18 points on the main tube axis.



a) RSB 40 b) RSB 60



c) RSB 100

Fig. 1 A car in three versions Backrest.

Welding is done using a clamp device for determining the positioning elements and components of rear seat backrest, shown in Figure 2.

In the process of welding operators working with certified welders and validated according to current regulations.

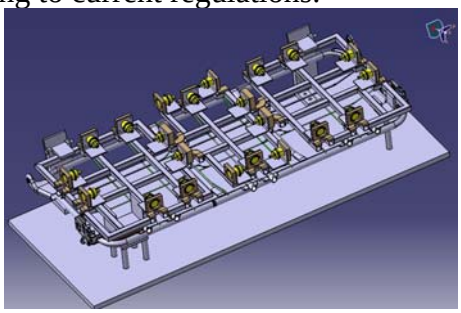


Fig. 2 Device for fixing.

Fig. 3 Settlement framework in device

Fig. 4 Metal head in up pozition

3. MANUFACTURING TECHNOLOGY

Before the start of preparatory work to run these operations:

- Opens valve on compressed air column. Press the button next to the gauge. Check this compressed air - 4 bar;
- Valves are opened round-trip from the cooling water supply columns and the welding tongs;
- It continues with the TPM checks according to the job position;
- It continues with the execution of a sample which is subject to testing and destructive testing is performed;
- If the result is consistent (surrender shall be made by wire breakage) to begin the work. Otherwise, it informs the head of a team; In mass production begins execution by placing backrest frame;
- In mass production begins execution by placing backrest frame;
- Pneumatic pressing and fix the clasp left four pneumatic driven to the left;
- Place the back of the net for RSB 100, ensuring that it is positioned on aluminum limitatorii positioning and limiters;
- Fix pneumatic pressing left latches corresponding net;
- The lock down cover song (Fig. 4);

Execution of welding operation is done in stages as follows:

- Net frame welding is executed according to the sequence indicated in the welding procedure. The device rotates as needed;

- After taking the number of points, automatically unlocks the metal cap;
- Lift the metal cover upright (Fig. 5);

After welding control operations are performed as follows:

- Is checking visual the 18 points of welding and their position to be on the tube axis;
- Check visual presence and appearance of the 24 welding seams on the front of reinforcement;
- It eliminates part of the device and visually check the presence and appearance of the 8 welding seams on the back of the reinforcement;
- Check this visually marking the right bottom bracket. The text must be clearly marked;
- Arrange for all the support, the finished parts warehouse. Welding is performed with a source and welding clamps.

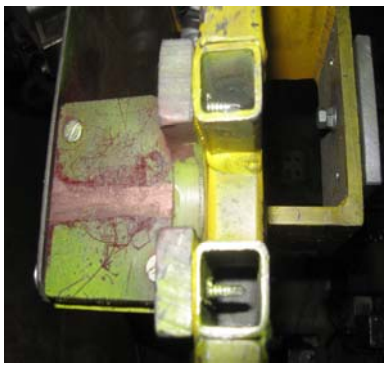


Fig.5 Detector for workpiece.

Fig. 6 Details including plastic wear plates, due to friction welding electrodes.

Note the wear on the friction caused by plastic welding gun electrodes points. Were attached to plastic parts to avoid direct contact with the metal electrodes.

4. DESTRUCTIVE TESTING OF WELDED STRUCTURES RESISTANCE POINTS

After completion of the first reinforcements to the beginning of each shift, is taken samples to be tested under the destructive ISO 10447 2006 - Resistance welding — Peel and chisel testing of resistance spot and projection welds.

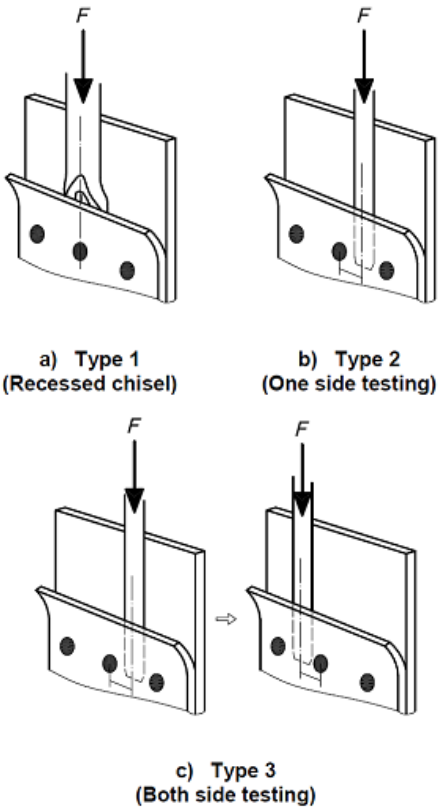
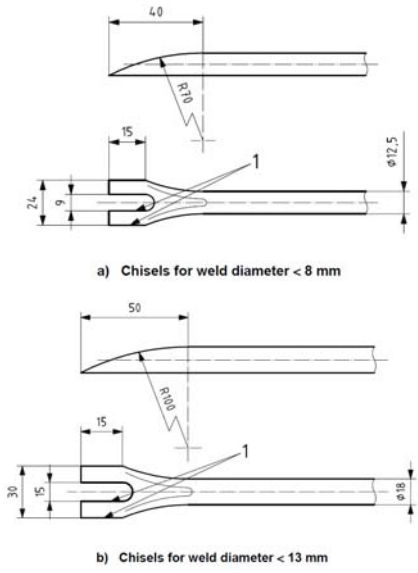


Fig.7 Chisel routine test on resistance spot and protection welded joints.



c) Tools used for testing.

Fig.8 tools used in the production flow for destructive tests.

In Figure 7 are presented by combining three types of points which are measured by welding adhesion tested using different types of chisel-type tools, shown in Figure 8.

4. CONCLUSIONS.

Spot Welding for Sandero seat backrest is made using a series of mechanized devices, using sensors of position and helping to prepare the development of weld quality.

Using an auxiliary frame enables the execution of welding points only in avoiding rebuturiile locuriile well established.

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SPECIALIZED DEVICES FOR POSITIONING AND FIXING, THE MECHANIZATION OF WELDING OPERATION

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Abstract: *The paper presents the main fixtures, mounting and positioning for mechanization of welding operations. I presented a series of devices: the lever, sliding piston, screw type linear paw clamping, and clamping screw and joint angle 90°.*

These devices were manufactured and tested in the Laboratory of Mechanization and Automation of Welding Processes in the Faculty of Materials Science and Engineering, University of Brasov.

Using of the device brings the following advantages: high productivity, elimination of physical effort, implementation of new welding technologies, eliminates scrap; materials and energy savings, reducing production costs.

Keywords: *device, mechanization, levers, screw, welding.*

1. INTRODUCTION

To perform auxiliary operations of welding technological process using fixture, grip and detachment which provide the process in good condition. Mechanical equipment may be universal for a large number of specialized products or performance of a single landmark. Installations and equipment for fixing and mounting of parts used in all phases of constructions welded technology. Positioning and fastening devices are based on elements of rising up, screw, lever or eccentric.

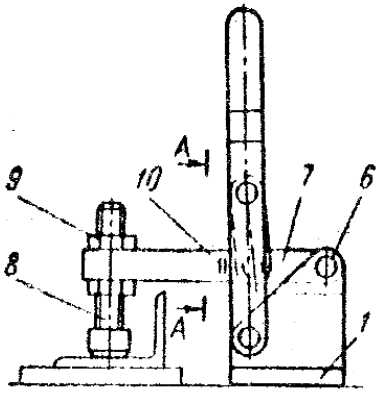
2. THE PRINCIPAL MECHANIZATION OF WELDING OPERATIONS.

2.1 Lever devices.

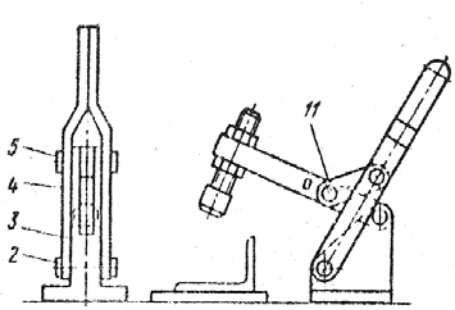
It is used in a wide variety of construction schemes and is widely used because of rapidity of action. Clamping action occurs after the passage lever in neutral. Figure 1 shows a manual lever clamps articulated:

a) working position, b) initial position.

Section A-A



a) working position



b) initial position

Figure 1

Figure 1 shows the clamping element consisting of a basic body which, through the joints, was mounted on axis 2 and 3 and arm lever 7 on the ax 6. Lever arm and the ax are interrelated with plates 4, mounted on the axes 5 and 11. At the end of the lever 7 is mounted screw press 8, whose length is adjusted by nuts 9. On the left arm movement, the plates 4 push the lever 7 and screw 8 hit the piece. When the arm is moving opposite, the lever rotates around the axis 6, the screw is up and release the piece.

In the locked position, the longitudinal axis of the arm has to overcome the vertical position. Gathering of the piece is done when the arm 3 makes with the plates 4 a relatively small angle. Arm race is limited with help of pawl 10. Because the variation of the work piece thickness substantially change the angle of the arm 3 and plates 4, then the screw 8 size it must be adjusted whenever needed. Otherwise it is possible dissolution of the levers articulated clamping elements limiting their use.

In Figure 2 and 3 are a series of clamping devices with levers made and used in the Transylvania University laboratory.

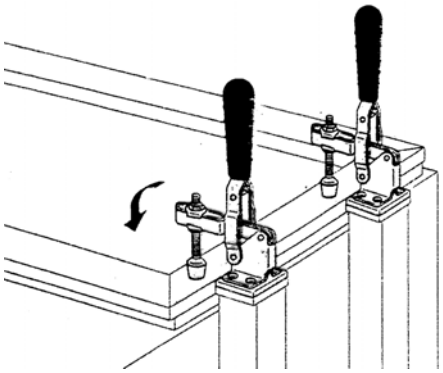


Figure 2

Figure 3

2.2 Sliding clamps with piston .

The device is making one side squeezing on the work pieces welded with the actions of system with the piston in the figure 4. In figure 5 you can see the lever clamps and clamping piston device.

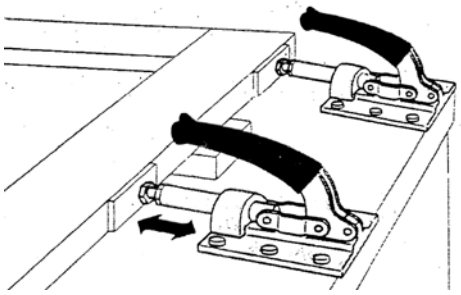


Figure 4

Figure 5

2.3 Elements with screw clamping.

These devices have a wide use in tight fitting and welding devices because of universality, safety in operation, simplicity of construction and the forces decrease compared with raising the necessary forces. The disadvantage consists in reduced productivity of assembly, threads in this vulnerability

results in welding metal splashes and wearing the threads. To calculate the clamping screw elements may use the following relationship is indicative of sizing the diameter of the screw:

$$d1 = \sqrt{\frac{1.27 * Q_2 * z}{\sigma_a}}$$

Where:

Q_2 - is gathering force, considered the action screw axis water in kg/f;

z - coefficient whose value is 1.4 for the screw with pallet and 2 screw without pallet;

σa - permissible compressive stress in kg f/mm^2

The d1 diameter value obtained is rounded to the next higher standard diameter. Then determine all other dimensions of the screw. Screw length needed depends on the race. Screws that require a great effort working on additional account verification torsion. When necessary, check stranger force developed using the following formula, ball-head screw set for driving and pallet :

$$Q_2 = \frac{P * l}{[r_m * \tan(\alpha * \varphi) + \frac{1}{2}\mu * D]}$$

Where:

l – length of the handle, in mm;

rm - the average radius of the screw in mm;

α - angle of inclination of the thread;

φ - angle of helical low friction surface;

μ - coefficient of sliding friction on the front surface of the screw;

D - diameter of the ring of contact between screw and pallet, in mm;

Figure 7 shows a clamping device screw angle to 90 degrees. The advantage is that this device is mounted on a screw joint allows positioning at 90 degrees to parts of different thicknesses.

Figure 6

Figure 7

The device is made of aluminum, the mobile-oriented and driven by a ball joint tightening a screw.

3. Applications

Figure 6 is shown the device to capture two pieces to be welded. Gripping is made between both fixed and mobile jaws with clamping screw.

Mechanization devices used in this paper are special welding processes such as MIG MAG welding, arc welding.

In Figure 7 the device is to perform a takings corner angle 90 degrees, which allows the combination of two pieces of different thicknesses. Raising achievement is movable jaw operated by a screw.

4. Conclusions.

Clamping devices and clamping screw levers have a wide application in welded constructions because they are easy to use.

Mechanization devices can be defined as methods to analyze, organize and manage the means of production to achieve optimal utilization of all productive resources, mechanical, materials. The ultimate objective is to save human efforts mechanization.

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4.4 RENEWABLE ENERGY AND ENVIRONMENT

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IMPACT OF LOW-E GLASS AND INSULATING SPACERS ON CONDENSATION

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Abstract: *Low-emittance (low-E) coatings are microscopically thin, virtually invisible, metal or metallic oxide layers deposited on a window or skylight glazing surface primarily to reduce the U-factor by suppressing radiative heat flow. Different types of low-E coatings have been designed to allow for high solar gain, moderate solar gain, or low solar gain. Condensation happens when moisture in the air suddenly cools and condenses on a cold window. Although it is difficult to prevent this on the outside of a window, by installing well insulated double glazing window (Low E), condensation problems on the room-side can be greatly reduced. Condensation is defined as the physical process by which a gas or vapour changes into a liquid. If the temperature of an object (e.g. grass, metal, glass) falls below what is known as the 'Dew Point' temperature for a given relative humidity of the surrounding air, water vapour from the atmosphere condenses into water droplets on its surface. An improvement that can be made to the thermal performance of insulating glazing units is to reduce the conductance of the air space between the layers. Originally, the space was filled with air or flushed with dry nitrogen just prior to sealing. In a sealed glass insulating unit, air currents between the two panes of glazing carry heat to the top of the unit and settle into cold pools at the bottom. Filling the space with a less conductive, more viscous, or slow-moving gas minimizes the convection currents within the space, conduction through the gas is reduced, and the overall transfer of heat between the inside and outside is reduced.*

Keywords: *Low-E, condensation, spacer, argon-gas, high performance, window*

1. INTRODUCTION

Low-emittance (low-E) coatings are microscopically thin, virtually invisible, metal or metallic oxide layers deposited on a window or skylight glazing surface primarily to reduce the U-factor by suppressing radiative heat flow. The principal mechanism of heat transfer in multilayer glazing is thermal radiation from a warm pane of glass to a cooler pane. Coating a glass surface with a low-emittance material and facing that coating into the gap between the glass layers blocks a significant amount of this radiant heat transfer, thus lowering the total heat flow through the window. Low-E coatings are transparent to visible light. Different types of low-E coatings have been designed to allow for high solar gain, moderate solar gain, or low solar gain.

In heating-dominated climates with a modest amount of cooling or climates where both heating and cooling are required, low-E coatings with high-, moderate- or low-solar-gains may result in similar annual energy costs depending on the house design and operation. While higher solar-gain glazings perform better in winter,

lower solar-gain glazings perform better in summer. In cooling-dominated climates, the priority is to lower solar gains. [4]

2. WINDOW TECNOLOGIES: LOW-E COATINGS

2.1 Double-Glazed with High-Solar-Gain Low-E Glass

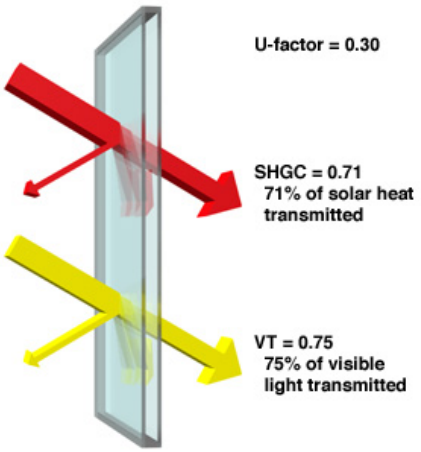

Fig.2.1.Characteristics of a typical double-glazed window with a high-solar gain low-E glass with argon gas fill

This figure illustrates the characteristics of a typical double-glazed window with a high-solar gain low-E glass with argon gas fill. These windows are designed to reduce heat loss but admit solar gain. High-solar-gain low-E glass products are best suited for buildings located in heating-dominated climates and are the product of choice for passive solar design projects. High-solar-gain low-E glass is often made with pyrolytic low-E coatings, although sputtered high-solar-gain low-E is also available. [2,4,5]

2.2 Double-Glazed with Moderate-Solar-Gain Low-E Glass

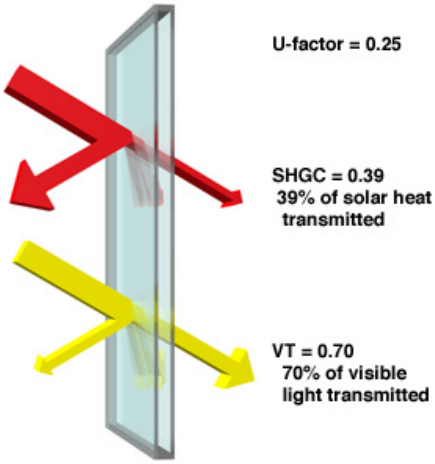

Fig.2.2.Characteristics of a typical double-glazed window with a moderate-solar-gain low-E glass with argon gas fill

This figure illustrates the characteristics of a typical double-glazed window with a moderate-solar-gain low-E glass with argon gas fill. These windows are often referred to as spectrally selective low-E glass due to their ability to reduce solar heat gain while retaining high visible transmittance. Such coatings reduce heat loss and let in a reduced amount of solar gain making them suitable for climates with both heating and cooling concerns. Moderate-solar-gain low-E glass is often made with sputtered low-E coatings, although pyrolytic moderate-solar-gain low-E is also available. [2,4,5]

2.3 Double-Glazed with Low-Solar-Gain Low-E Glass

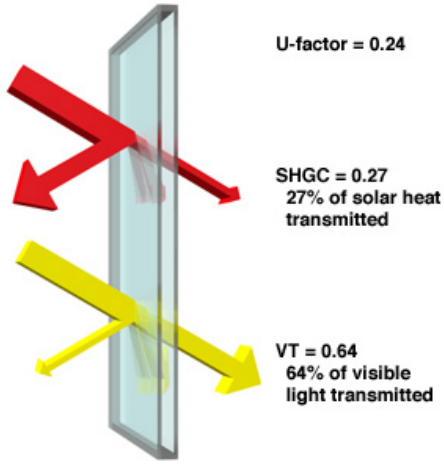

Fig.2.3. Characteristics of a typical double-glazed window with a low-solar-gain low-E glass with argon gas fill

This figure illustrates the characteristics of a typical double-glazed window with a low-solar-gain low-E glass with argon gas fill. As with moderate-solar-gain low-E glass, these windows are often referred to as spectrally selective low-E glass due to their ability to reduce solar heat gain while retaining high visible transmittance. Compared to most tinted and reflective glazings, this low-E glass provides a higher level of visible light transmission for a given amount of solar heat reduction. Variants on low-solar-gain low-E coatings have also been developed which may appear slightly tinted. This type of low-E product reduces heat loss in winter and substantially reduces solar heat gain both in winter and in summer. Thus, low-solar-gain low-E glazings are ideal for buildings located in cooling-dominated climates. Low-solar-gain low-E glass is typically made with sputtered low-E coatings consisting of either two or three layers of silver (also called double-silver or triple-silver low-E). [2,4,5]

2.4 Window Technologies: Argon or Krypton Gas Fills. An improvement that can be made to the thermal performance of insulating glazing units is to reduce the conductance of the air space between the layers. Originally, the space was filled with air or flushed with dry nitrogen just prior to sealing. In a sealed glass insulating unit, air currents between the two panes of glazing carry heat to the top of the unit and settle into cold pools at the bottom. Filling the space with a less conductive, more viscous, or slow-moving gas minimizes the convection currents within the space, conduction through the gas is reduced, and the overall transfer of heat between the inside and outside is reduced. Manufacturers have introduced the use of argon and krypton gas fills, with measurable improvement in thermal performance. Argon is inexpensive, nontoxic, nonreactive, clear, and odorless. The optimal spacing for an argon-filled unit is the same as for air, about 1/2 inch (11-13 mm). Krypton is nontoxic, nonreactive, clear, and odorless and has better thermal performance, but is more expensive to produce. Krypton is particularly useful when the space between glazings must be thinner than normally desired, for example, 1/4 inch (6 mm). The optimum gap width for krypton is 3/8" (9mm). A mixture of krypton and argon gases is also used as a compromise between thermal performance and cost. [3,4]

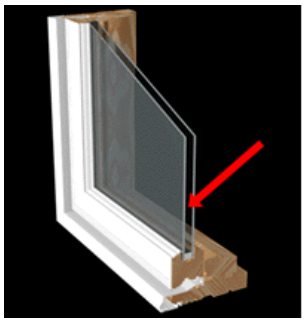

Fig.2.4. Gas fills

2.5 Window Technologies: Low Conductance Spacers. The layers of glazing in an insulating unit must be held apart at the appropriate distance by spacers. Because of its excellent structural properties, window manufacturers started using aluminum spacers in the 1960's and 1970's. Unfortunately, aluminum is an excellent conductor of heat and the aluminum spacer used in most standard edge systems represented a significant thermal "short circuit" at the edge of the insulating glass unit (IGU), which reduces the benefits of improved glazings. In addition to the increased heat loss, the colder edge is more prone to condensation. To address this problem, window manufacturers have developed a series of innovative edge systems to address these problems, including solutions that depend on material substitutions as well as radically new designs. One approach to reducing heat loss has been to replace the aluminum spacer with a metal that is less conductive, e.g. stainless steel, and change the cross-sectional shape of the spacer. These designs are widely used in windows today. Another approach is to replace the metal with a design that uses materials that are better insulating. The most commonly used design incorporates spacer, sealer, and desiccant in a thermoplastic compound that contains a blend of desiccant materials and incorporates a thin, fluted metal shim of aluminum or stainless steel. Another approach uses an insulating silicone foam spacer that incorporates a desiccant and has a high-strength adhesive at its edges to bond to glass. The foam is backed with a secondary sealant. Both extruded vinyl and fiberglass spacers have also been used in place of metal designs. There are several hybrid designs that incorporate thermal breaks in metal spacers or use one or more of the elements described above. Some of these are specifically designed to accommodate three-and four-layer glazings or IGUs incorporating stretched plastic films. All are designed to interrupt the heat transfer pathway at the glazing edge between two or more glazing layers. Warm edge spacers have become increasingly important as manufacturers switch from conventional double glazing to higher-performance glazing. For purposes of determining the overall window U-factor, the edge spacer has an effect that extends beyond the physical size of the spacer to a band about 64 mm wide. The contribution of this 64mm wide "glass edge" to the total window U-factor depends on the size of the window. Glass edge effects are more important for smaller windows, which have a proportionately larger glass edge area. For a typical residential-size window (0.8 by 1.2 meters), changing from a standard aluminum edge to a good-quality warm edge will reduce the overall window U-factor by approximately .02 Btu/hr-sq ft-°F.

A more significant benefit may be the rise in interior surface temperature at the bottom edge of the window, which is most subject to condensation. With an outside temperature of 0°F, a thermally improved spacer could result in temperature increases of 6-8°F (3-4°C) at the

window sightline--or 4-6°F (2-4°C) at a point one inch in from the sightline, which is an important improvement. As new highly insulating multiple layer windows are developed, the improved edge spacer becomes an even more important element. [3,4]

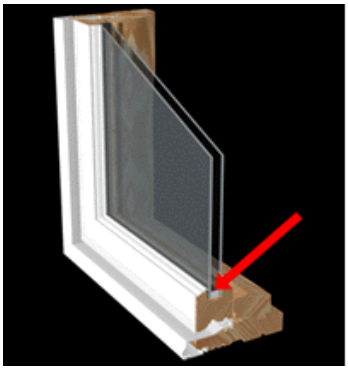

Fig.2.5. Low Conductance Spacers

3. CONDENSATION

Condensation happens when moisture in the air suddenly cools and condenses on a cold window. Although it is difficult to prevent this on the outside of a window, by installing well insulated double glazing window (Low E), condensation problems on the room-side can be greatly reduced. As the room facing pane of an insulated double glazing window stays warmer, the air that comes into contact with it does not cool and condense.

There are three main ways to improve thermal insulation, and thus reduce condensation, in a double glazing window :

- By using Low-E glass;
- By upgrading from an aluminium edge spacer to a warm edge spacer bar;
- By substituting a dehydrated air cavity filling with an inert gas, such as argon.

Condensation is defined as the physical process by which a gas or vapour changes into a liquid. If the temperature of an object (e.g. grass, metal, glass) falls below what is known as the 'Dew Point' temperature for a given relative humidity of the surrounding air, water vapour from the atmosphere condenses into water droplets on its surface. This "dew point" varies according to the amount of water in the atmosphere (known as humidity). In humid conditions condensation occurs at higher temperatures. In cold conditions condensation occurs despite relatively low humidity.

The principal cause of condensation on glass on the inside of a building is a high internal humidity level coupled with a low outside temperature which cools the inside surface to below the dew point, particularly around the edges. Bathrooms, kitchens and other areas where humidity levels are high are particularly susceptible to this problem. In order to control this form of condensation, consideration should be given to improving the heating and ventilation in these areas. Condensation forms on the outdoor surface of glass when its temperature drops below the outdoor dew point temperature. [1,5]

4. BENEFITS: LESS CONDENSATION

High performance windows with new glazing technologies not only reduce energy costs but make homes more comfortable as well. High-performance windows create warmer interior glass surfaces, reducing frost and condensation. High-performance windows with warm edge technology and insulating frames

have such a warm interior surface that condensation on any interior surfaces is significantly reduced under all conditions. [1,4]

4.1 Impact of Low-E Glass and Insulating Sacers on Condensation

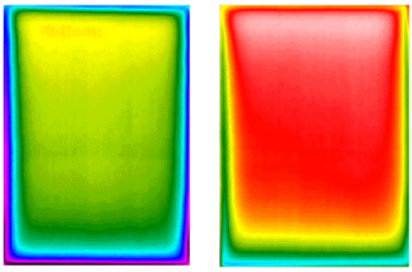

Fig.4.1. Comparison between a conventional clear double glazing and Low-E glass

The adjacent images show interior surface temperature patterns of a clear double glazed unit (left) and an energy-efficient Low-E insulated glazing unit with an improved spacer (right). Under typical winter conditions, (i.e. 20°F outside), condensation on the glass under typical humidity levels is shown by purple and blue. With a conventional clear double glazing (left), condensation occurs in a band a couple inches wide along the edge of the sightline, with more condensation along the bottom than at the top. With the energy-efficient Low-E insulated glass unit (right), condensation will be greatly reduced (a small strip less then 1" high along the bottom). Under extreme winter conditions (i.e. 0°F outside), condensation is shown by purple, blue and green. With clear double glazing, there is condensation over the entire unit. With energy-efficient Low-E glazing, there is only condensation on a band along the bottom and up along the edges. [1,4]

4.2 Impact of Temperature, Humidity and Glass Choice on Center-of-Glass Condensation

The graph shows condensation potential on the center of glass area (the area at least 2.5" from the frame/glass edge) at various outdoor temperature and indoor relative humidity conditions. Condensation can occur at any points that fall on or above the curves. As the U-factor of windows improve, there is a much smaller range of conditions where condensation will occur. These values are based on center-of-glass temperatures. Condensation may occur at lower humidity levels on the glass edge. [1,4]

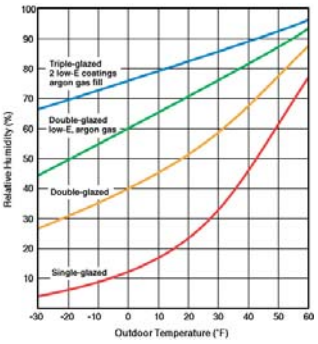

Fig.4.2. The graph for condensation

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INFLUENCE OF MICROCLIMATE ON WINDOWS AND DOORS

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Abstract: *Maintaining the needed air temperature is, probably, the most difficult thing while forming the microclimate in the building. Optimal air temperature in various rooms of the building differs from the point of view of persons well-being, economic reasons and functions of the building. Doors and windows, also walls, floor and ceiling (roof) cause the greatest heat losses. Particularly great heat losses are caused by frames of windows of low quality and improper adjustment of glass. That is why you should pay special attention to windows so that maintaining proper temperature in the building does not take a lot of time, nerves and money. Condensation happens when moisture in the air suddenly cools and condenses on a cold window. Although it is difficult to prevent this on the outside of a window, by installing well insulated double glazing window (Low E), condensation problems on the room-side can be greatly reduced.*

Keywords: *window, microclimate, condensation, optimal, super spacer*

1. INTRODUCTION

It is impossible to imagine comfortable and functional housing without particular conditions of air - temperature, humidity and serenity , which influence not only our physiological state and as a result our health, but also physical and hygienic state of the building. There is no need in saying that people (especially children) who live a building with unfavorable humidity and temperature are more subject to illnesses; dirty air immediately makes a person feel unwell, causes sleep disorders and problems with metabolism. Maintaining the needed air temperature is, probably, the most difficult thing while forming the microclimate in the building. Optimal air temperature in various rooms of the building differs from the point of view of persons well-being, economic reasons and functions of the building. Temperature in the living room, study, dining room and nursery should be about 21-24 degrees; in bedroom, kitchen and toilet -20, bathroom - 24 degrees. It is commonly considered that optimal average temperature for a building should be 20 degrees, and the difference between the temperatures in different rooms, to avoid discomfort while going from one room into the other, should not be more than 3 degrees. Air temperatures higher than the norm make a person less stable to diseases. Approximately such temperatures are used while projecting central heating systems in houses. Unfortunately, the saying theory and practice differ describes the real regime of work of heating devices in the conditions of thermal isolation of a particular room in the house or a flat. In most cases designers do not take into consideration the needed difference in heating of

different rooms, depending on their placement according to the parts of the world or wind directions during cold seasons. For calculations they use average scales of heat loses through doors and windows of the building and average temperature of the coldest month. Definitely, they can not forecast personal sensitivity of people to temperatures while projecting impersonal housing.

Heat retention lagging of the building is an important factor, in other words its protection from heat losses. Doors and windows, also walls, floor and ceiling (roof) cause the greatest heat losses. Particularly great heat losses are caused by frames of windows of low quality and improper adjustment of glass. That is why you should pay special attention to windows so that maintaining proper temperature in the building does not take a lot of time, nerves and money. The ways to winterize windows are well-known: putting wool between frames of the window and then sticking paper tape on it, putting special jointing material on the clasps. The first way, ancient one, is more practical but then the window does not look esthetic; the second is not so time-consuming but not always effective: jointing materials can cause defects of window frames, their locks, the glue destroys the paint and does not always sticks firmly the jointing material. The jointing materials themselves are not always stable enough to frost and humidity, that is why the structure of the material, necessary for proper sealing, is quickly ruined. This disadvantage is particularly common for rubber sealers, sometimes after only one cold and humid winter they fall to pieces.

Multiple glazing consists of frames with two (or more) inbuilt glasses, which are connected with a shoulder along the perimeter. The space between the glasses is filled with dry air, which prevents the glass from weeping and formation of condensate. Vacuum multiple glazing is a more modern way of preventing heat losses. There is no air between the glasses at all and that does not let heat exchange between outside and inside glasses. It should be mentioned though that multiple glazing like usual windows has joints on sash, which may need additional sealing. Effectiveness of window sealing also depends on the adjusted of latches and bolts on the window frame. They should close with noticeable but not abnormal effort, because if the frame is pressed to the sash too hard it can cause obliquity and early wear of the sealer.

The temperature in the room is also influenced by the material of walls, floor and ceiling (roof), and by the material and its quality of the outside and inside joinery. [3]

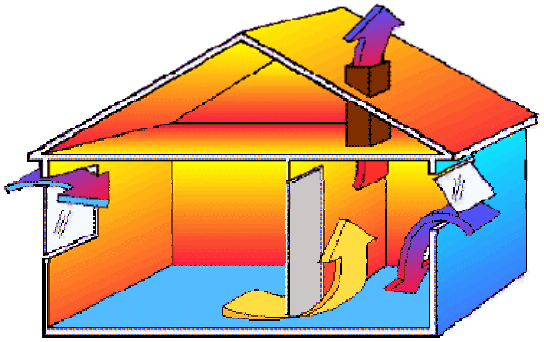

Fig.1.1. Circulation of air in a room

2. CONDENSATION

Condensation happens when moisture in the air suddenly cools and condenses on a cold window. Although it is difficult to prevent this on the outside of a window, by installing well insulated double glazing window (Low E), condensation problems on the room-side can be greatly reduced. As the room facing pane of an insulated double glazing window stays warmer, the air that comes into contact with it does not cool and condense.

There are three main ways to improve thermal insulation, and thus reduce condensation, in a double glazing window :
- By using Low-E glass;
- By upgrading from an aluminium edge spacer to a warm edge spacer bar;
- By substituting a dehydrated air cavity filling with an inert gas, such as argon.

In a properly sealed double glazing window there should be relatively little condensation in the window's inner cavity as dehydrated air and desiccants are used. If there is condensation in the double glazing window's cavity, this is probably due to a seal failure.

Condensation is defined as the physical process by which a gas or vapour changes into a liquid. If the temperature of an object (e.g. grass, metal, glass) falls below what is known as the 'Dew Point' temperature for a given relative humidity of the surrounding air, water vapour from the atmosphere condenses into water droplets on its surface. This "dew point" varies according to the amount of water in the atmosphere (known as humidity). In humid conditions condensation occurs at higher temperatures. In cold conditions condensation occurs despite relatively low humidity.

The principal cause of condensation on glass on the inside of a building is a high internal humidity level coupled with a low outside temperature which cools the inside surface to below the dew point, particularly around the edges. Bathrooms, kitchens and other areas where humidity levels are high are particularly susceptible to this problem. In order to control this form of condensation, consideration should be given to improving the heating and ventilation in these areas. However, another way to reduce the problem is to use high performance double glazing window containing an enhanced thermal insulation glass. Windows manufactured using an energy efficient low-emissivity (or low-E) glass actually restricts heat exchange across the air space between the two panes of glass. This keeps the inner pane of glass warmer thus reducing the instances when condensation can form. In addition, the use of a "Warm-edge" spacer bar made of insulating material will reduce the risk of condensation at the edges.

Condensation forms on the outdoor surface of glass when its temperature drops below the outdoor dew point temperature. Again, windows manufactured with a double-glazing window containing energy efficient low-emissivity glass, have enhanced thermal insulation properties thanks to a high performance transparent coating that reflects heat from radiators or fires back into the room. As a result the outer pane of glass does not get warmed by heat escaping from inside the building through the glass and remains cooler in comparison to less efficient

thermal insulation glass. External condensation only occurs in certain climatic conditions with high humidity levels and/or particularly cold weather. It is possible that external condensation will appear on some windows but not on others. This is due to localised atmospheric conditions such as shelter from nearby trees or buildings, variable air currents and wind speeds and varying levels of nearby vegetation.

Condensation on the outdoor surface of such high performance windows is in no way an indication of a defective unit. Indeed, this can be seen as a positive indication that the enhanced thermally insulating double glazing window are actively reducing heat loss through the glass. This form of condensation can be counteracted through the use of a hydrophilic coating such as traditional self-cleaning glass. Traditionally a self-cleaning glass attracts water across the surface in a "sheeting" effect allowing clear vision through glass that is susceptible to external condensation.

The formation of condensation on the inner faces of the double glazing window is an indication that the air or gas cavity is no longer completely sealed. The desiccant will rapidly become saturated and any damp air penetrating via the seal around the perimeter will reduce visibility by forming condensation on faces 2 and 3. The double glazing window must therefore be replaced as this cannot be reversed. This double glazing window must be replaced in accordance with the terms and conditions of the warranty. [1,2,5,6]

3. VINYL WINDOWS - 100% PVC

Our windows are made from an exclusive, 100% PVC powder compound that is entirely lead-free. This special compound gives the system better resistance to impact and discoloration. The windows are maintenance-free and will not crack, blister or warp. These windows have the highest number of internal air chambers, giving them outstanding insulation and sound abatement qualities, as well as thermal efficiency and increased sturdiness. Fusion welding Corners provide attractive appearance & eliminate the need for adhesive and sealants. There are no imperfections on the completely watertight and airtight surface. Internal walls are also welded for increased overall structural strength A choice of maintenancefree PVC jamb extensions, frame moldings and corner blocks are available to enhance inside finishing.

Many of today's energy efficient windows offer glass packages with "Warm Edge Technology". The problem is that highly conductive metalbased insulating glass spacers are often used in these new windows. A new window can lose up to 50% of its overall stated R-value with a metal-based spacer at the edge of the glass. R stands for the "resistance" of the transfer of heat or cold through a solid object. So, a higher R-value means better insulation against heating and cooling loss. The edge of the insulating glass is the most vulnerable to heating and cooling loss. This usually leads to condensation. It's a problem that looks unsightly, and over time, it will stain wood, peel paint and rot frames. Not only that, but window condensation can

contribute to mold growth, a sinister presence hidden from sight deep inside window and wall openings. In fact, visible mold can often be found in poorly insulated or installed windows. Mold is more and more being linked to child asthma plus increases in general respiratory illness, allergies and outbreaks of fungal diseases. [2,4,6]

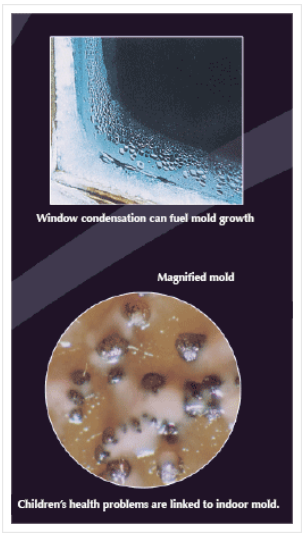

Fig.3.1. Mold effects

4. SOLUTION

Keep moisture off the glass with the warmest inside surface temperatures possible. The primary window condensation culprit is its insulating glass spacer. Traditional metal spacers can conduct heat and cold - causing condensation at the edge of the glass. Convection currents further concentrate cold air along the bottom edge of glass making that area the most vulnerable. Only a warmer edge all the way around will strike at the heart of the problem.

The only edge occurs with super spacer, an insulating foam spacer whose usage helps reduce condensation and allows for comfortable household humidity levels. [5]

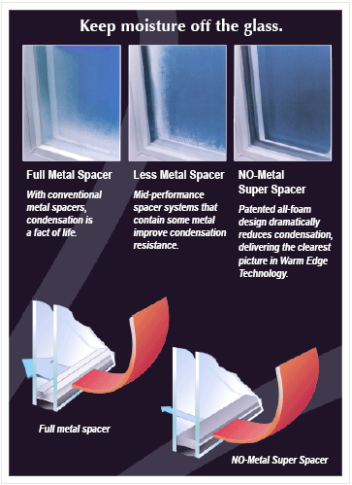

Fig.4.1. Use of super spacer

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APPLICATION OF METEOINFORMATICS FOR THE ANALYSIS OF WEATHER FORECAST DATA

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Abstract: *In the context of the sustainable development, with strict observation of the environment protection required, the meteorological information are used in the spectrum for a modern agriculture, forestry, environment protection and engineering activities, urban climatology, planning in the activity of transportation and creating optimum conditions of loading-delivery, depositing and in the everyday life [1].*

Science 2007 at North University of Baia Mare is running an Oregon Scientific WMR 100 type weather station [2] which follows continuously the climatic parameters from urban area and microclimate.

The main aim of this paper is to survey the importance of meteo-informatics application for environment projects and for ecological research as an environmental project. As prospects for the future, would be to create a computerized network through which to connect personal weather stations, obtaining valuable information from several regions of the country and can, thus clearly distinguish details of the microclimate of each region. Future weather stations are tools that help everyday life of man, as a modern tool, easily accessible and useful.

Keywords: *meteorological information, meteo-informatics, environmental project*

1. INTRODUCTION

Environmental Information and Environmental Information Systems play a major role in environmental decision making. The management and use of Environmental Information Systems (EISs), especially the meteorological information system is very useful in different kind of economical activities.

Knowledge of weather prediction and atmospheric parameters has been concerns since the beginning of human history. If at first the weather was seen as a divine element, then we started tracking atmospheric factors, description of weather phenomena and tried to understand weather as a complete phenomenon.

Weather forecasting is a complex process that binds many parameters which can provide current information on weather for the following days. Weather influences human activity and its prediction allow greater freedom in scheduling of human activities.

2. BRIEF HISTORY

Human interest has manifested since ancient times when scientists began to observe and describe the weather and have also tried to give explanations for most of the weather phenomena. But for the first time weather observations have been made by Aristotle, and the data has been organized in a treaty called the Meteorological Complex. Aristotle studied weather phenomena such as wind, water cycle and condensation.

In the middle Ages, with the development of the first instruments Galileo built the first rudimentary thermometer, Torricelli – barometer and Robert Hooke - anemometer for measuring wind speed, these inventions started the development of meteorology. French scientist Laurent Lavoisier said they could forecast the weather for a day or two by measuring air pressure, humidity and wind speed.

In Romania there is information about the weather since ancient times, but only in 1884 we can really talk about meteorology, when the Romanian Meteorological Service was established under the leadership of Stefan Hepites, becoming one of the oldest scientific institutions in Romania. At the initiative of Stefan Hepites, Romania is among the founding countries of the International Meteorological Organization.

In the modern era, Romania had to adopt information system for meteorological data processing, so in 2004 to join the OPERA system, which is a project for operational use of weather radars in Europe. Nowadays weather information is accessible in different forms, through personal weather stations, internet sites, equipment and measurement instruments that provide information on atmospheric parameters in real time.

3. RESEARCH

The discussion starts with a description of the system, that have been called meteorological station Oregon Scientific WMR-type 100, which operates in the North University of Baia Mare from April 2008, in order to identify and pinpoint the shared attributes of this system and other specific aspects.

The weather station is used for continuous monitoring of weather condition and weather data in order to create a database. The purpose of this monitoring is to continue to issue monthly and annual reports on weather and monthly and annual reports, which are useful in environmental projects, or to describe and understand the urban microclimate.

Regarding the positioning of the weather station, this station was placed on the roof of the North University of Baia Mare. The meteorological station is located at an altitude of 250 m. The main console is located in an office on the 7th floor of the building and placed in the same proceeding with a PC connection.

Oregon Scientific Weather Station WMR 100 is a professional weather station equipped with a rotating central control system which facilitates access to information on the console. This unique console includes a sensor that registers the temperature and humidity. The weather station measures a broad spectrum of meteorological variables and allows wireless connection of 10 different types of sensors along the sensors included in the console. Weather station equipment includes a full outdoor sensor consisting of a thermo-hygrometer, an anemometer with vane, a rain gauge and a barometer. Console base is provided with an atomic clock that adjusts itself automatically.

Fig.1. Oregon Scientific WMR weather station

Recorded weather data are displayed on the main console; it has the possibility to connect to a computer and through a program allows unlimited recording of the data. Recorded weather variables are: temperature

indoor / outdoor, humidity indoor / outdoor, wind speed and direction, average monthly rainfall, daily, annual, atmospheric pressure, dew point temperature, the cooling produced by wind, temperature index and more.

4. DATA PROCESSING

Information obtained from the meteorological station is stored as strings of data. These strings of data containing information on atmospheric parameters, with a frequency of one digit per minute, allow their interpretation with high precision and getting a detailed picture of the weather conditions. Strings of data can be stored in the computer system of gross state indefinitely, given the small size of these files, or can be processed and interpreted.

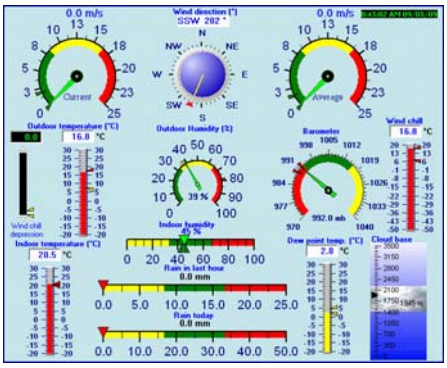

Fig.2. Weather Display® software interface

Data processing can be done in several ways, depending on the urgency and need for information. The fastest processing software offers a computer programme which is used for recording data arrays, namely Weather Display ®, besides providing information on current weather conditions and monthly and annual reports. Still using Weather Display Software ® files are created in a so-called "diary", containing all the data recorded by the meteorological station in the rough.

If a clearer picture of the meteorological parameters is needed, then the data can be processed by using Microsoft Excel. For a calendar month, a log files containing 43,000 rows of data with values for the following parameters:

- Temperature;
- Humidity;
- Pressure;
- Wind;
- Precipitation.

Manually processing of a large amount of information would take time and energy, but these values, by using the computer system, are processed quickly and efficiently, obtaining detailed graphics and easy to interpret. Also using programs in concordance with environmental informatics strategies, such as Surfer or GIS, we can obtain maps with real values, which have a special importance both for engineering and environmental protection activities and for communities.

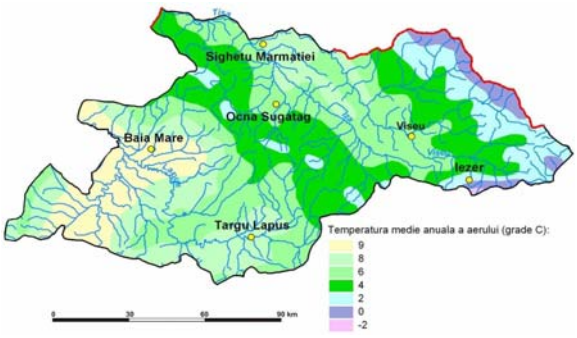

Fig.3. Characterization of the air temperature (Source: www.cjmaramures.ro)

Fig.4. Characterization of the air humidity (Source: www.cjmaramures.ro)

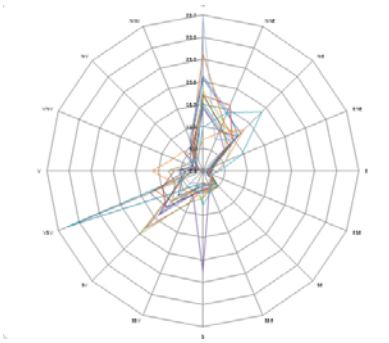

Fig.5. Detailed histogram of wind directions

As integrated part of the "environmatics" or environmental informatics, the meteo-informatics seems to play a major role in environmental decision making, being one of the most important applications for the analysis of weather forecast data. Much more, the development of these systems is tightly connected to the environmental awareness of the last three decades.

5. RESULTS

To get a clearer picture on the computer processing of the data we present some results obtained. Parameters most difficult to interpret and predict are those tied to the wind and temperature, but spectacular results are being obtained with the help of the computer system.

Temperature is one parameter that influences most the human activities and life. Temperature forecasting is difficult because it depends mainly on other meteorological factors. For an accurate prediction of these values one had to interpret the temperature from several points of view, such as:

- The evolution of daily, monthly, seasonal and annual temperature;
- Maximum and minimum daily, monthly, seasonal and annual maximum and minimum temperatures and extreme temperatures;
- Comparisons between multi-annual values.

We get raw information that is processed and stored for interpretation and subsequent use.

Wind is an important parameter because it is responsible for transport and the dispersion of pollutants in nature. In practice, it is sometimes necessary to collect and process information about wind direction and intensity in real time and manual processing of such information in a timely manner is very difficult, if not impossible, but with a computer, we can get information quickly and save precious time and energy.

If the values are wrong, we can easily identify and remove them quickly, without having to repeat the calculation.

6. ADVANTAGES AND DISADVANTAGES

The main advantages of "meteo-informatic systems" are:

- Easy to use;
- Autonomous systems;
- Data is processed quickly and efficiently;
- Information can be stored on long term, without being compromised, and can be accessed easily at any time;
- Provides a clear picture of the phenomena due to high frequency data recorder.

Some disadvantages of: "meteo-informatic systems" are:

- Can interfere with data recording errors or misleading;
- Still are expensive;
- Require staff for operation and maintenance.

7. APPLICATIONS AND PERSPECTIVES

"Meteo-informatic systems" became usable in terms of research recently, but their efficiency and ease of use has led to an increasing rate of their use. Weather stations are used in most projects, thus making it easier to retrieve data about the weather. North University of Baia Mare has been successfully applied on information obtained from weather station in a number of areas, such as:

- Microclimate research – projects;
- Research urban climate – database;
- Research on soil-tailings – project.

As prospects for the future would be to create a computerized network through which to connect personal weather stations, obtaining valuable information from several regions of the country and can, thus clearly distinguish details of the microclimate of each region. Future weather stations are tools that help everyday life of man, as a modern tool, easily accessible and useful.

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RESEARCHES ON ENVIRONMENT MANAGEMENT – PRINCIPLE OF SUSTAINABLE DEVELOPMENT

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Abstract: *This paper presents the new approach to environmental management and its attempt to place it in the perspective of sustainable development. Also, there are described some aspects regarding the principle of sustainable development and an example concerning identification process of environment factors, respectively the assessment and improvement process of environment management system.*

Keywords: *environmental management, sustainable development, environmental aspects assessment.*

1. INTRODUCTION

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts [1]:

- the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

Sustainable development is maintaining a delicate balance between the human need to improve lifestyles and feeling of well-being on one hand, and preserving natural resources and ecosystems, on which future generations and we depend (figure 1).

Sustainable development implies economic growth together with the protection of environmental quality, each reinforcing the other. The essence of this form of development is a stable relationship between human activities and the natural world, which does not diminish the prospects for future generations to enjoy a quality of life at least as good as our own.

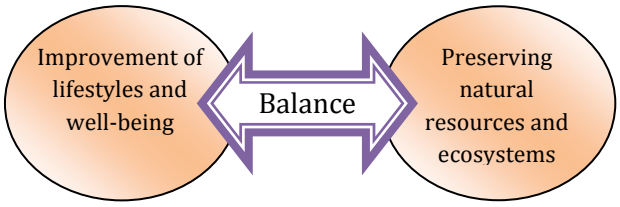

Figure 1. Sustainable development

The goal of sustainable design is to find those constructive solutions, which will ensure on the one hand the welfare and on the other hand the coexistence of the three groups that make up the global ecosystem (inorganic elements, living organisms and people). Achieving sustainable design goal is through education in a conceptual framework that has three levels: principles, strategies and methods. Each of these principles includes a

unique set of strategies, whose study leads to a better understanding of the interaction with the environment [2].

In this manner, implementing an environmental management system will allow managing more efficient of all resources.

2. SUSTAINABLE DEVELOPMENT - CONCEPTS

To implement the reality of this general concept that is sustainable development requires scientific substantiation of the relationship between man and nature and process of human intervention, justification for allowing development of predictive models capable of monitoring and intervention methodologies real time.

The point of concentration and size depend on the local sustainability efforts, including resources, political action and individual outstanding features of the community.

Sustainable development can be regarded as a society and economy adapt to the great problems facing humanity today: climate change, water shortage, drought, desertification, depletion of resources, waste, biodiversity loss, population growth, poverty, migration etc. For prevention, combating and elimination of their repercussions, to ensure economic development, social progress and human development are necessary to initiate and support concrete actions, specific and measurable objectives summarized, subject to national strategies for sustainable development.

The concept of Sustainable Development consists of four stages in correlation, but separate:

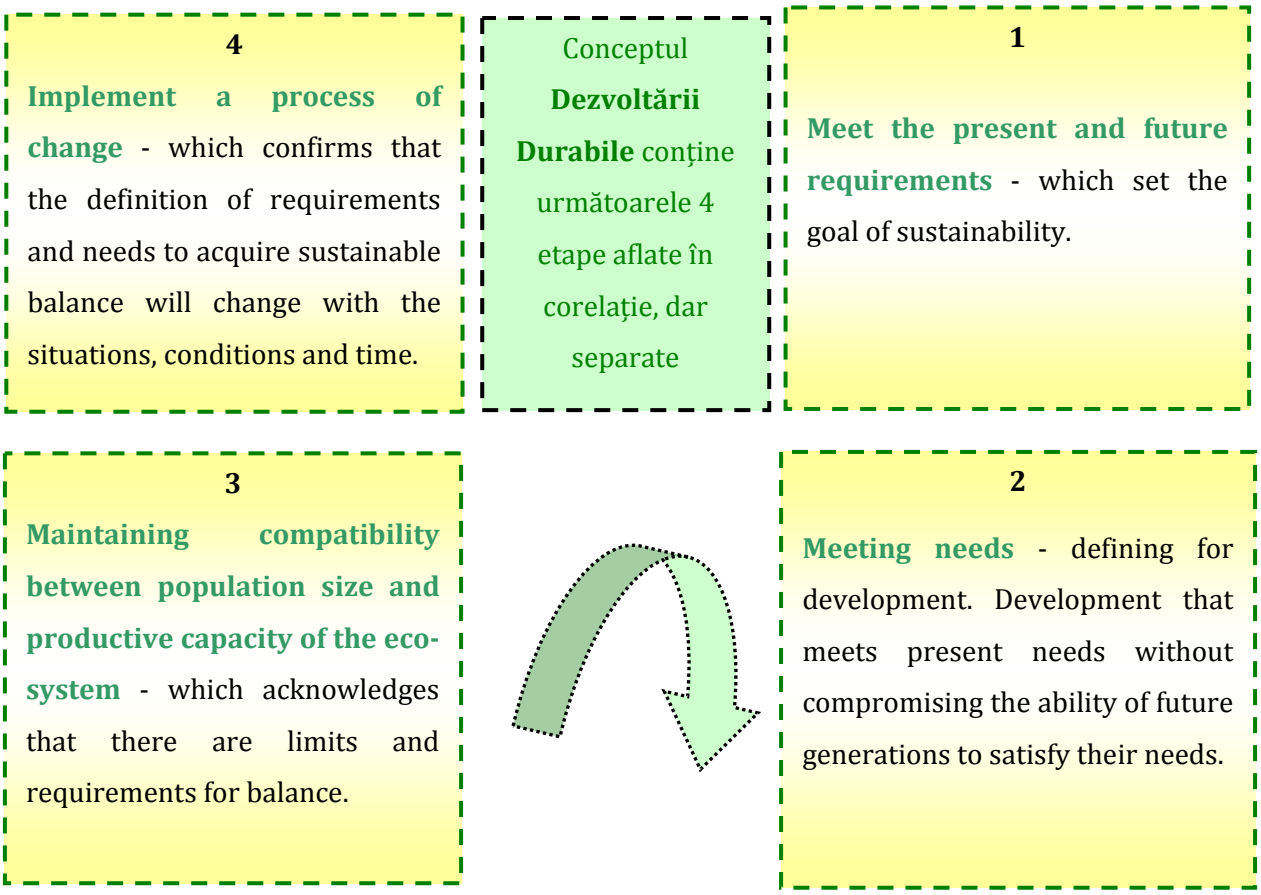

Figure 2. Sustainable development stages

3. ENVIRONMENT MANAGEMENT SYSTEM

ISO 14001:2004 is designed to address the delicate balance between maintaining profitability and reducing environmental impact; with the commitment of the entire organization, it can enable to achieve both objectives.

Figure 3. Environment management system

An Environmental Management System (EMS) is a framework developed by an organization to help improve its environmental performance by considering environmental considerations when making decisions and managing risks.

The first step to putting together an EMS is to make a commitment and develop an environmental policy; the second is to set goals, objectives, and targets for the environmental management program [6].

4. ENVIRONMENTAL ASPECTS ASSESSMENT

The assessment process consist of periodic identification and evaluation of the environmental aspects and related significant impacts of the activities, products and services associated with the major facility operations.

The following diagram illustrates the recommended order of steps for this process [7]:

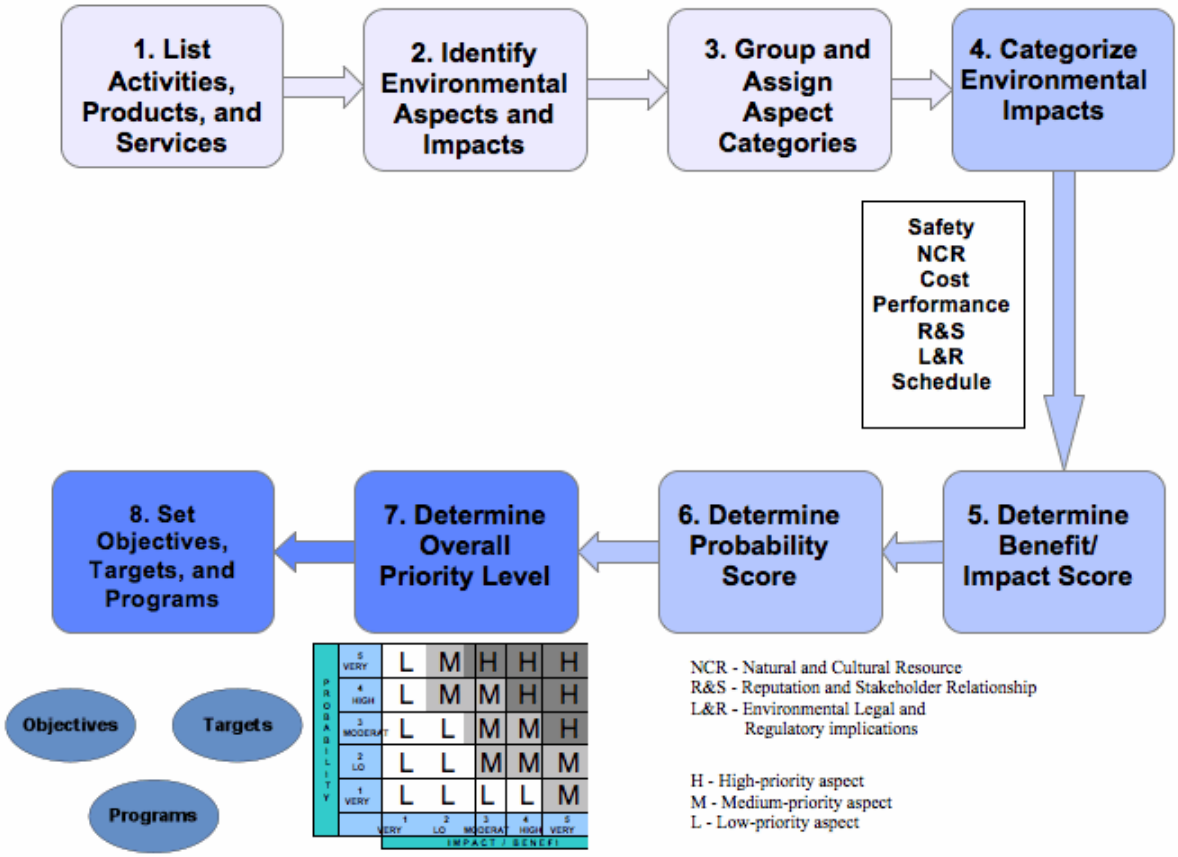

Figure 4. The assessment process of environmental aspects

5. CONCLUSIONS

The concept of sustainable development it helps us to understand our world and ourselves. The problems we face are complex and serious and we cannot address them in the same way we created them. Nevertheless, we can address them.

The concept of sustainable development covers all forms and methods of socio-economic development, whose background is primarily a balance between these elements of socio-economic and natural capital.

In figure 5 are present in all main indicators characterizing the results obtained from a process of sustainable development approach.

An integrated model of economic development process of the system reflects all aspects of its operation. Evaluation of sustainable development through the system is entirely sustainable development coefficient, which is calculated on the coefficients of economic stability, social and environmental. Development version is fully achieved, the maximum coefficient of stability is the most stable (at a value of coefficients of economic stability, social and ecological higher than 1). Thus, the stability criterion can be formulated as maximizing the full factor of stability.

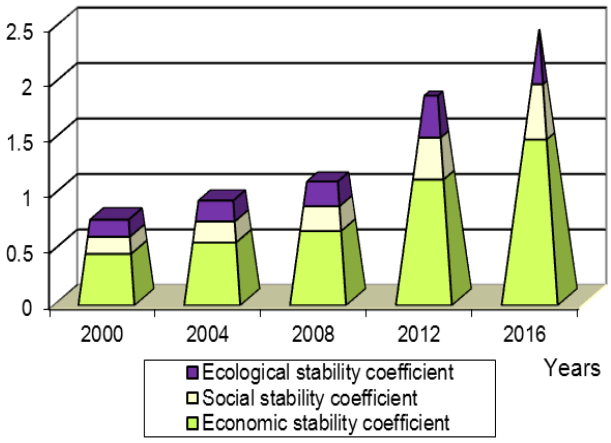

Figure 5. Evaluation model of sustainable development

The benefits of implementation of an environment management system are:

Improving environmental performance achieved by top management commitment

- Reducing costs through energy and water use efficiency and reducing the amount of waste generated;
- Reducing the risk of accidental pollution and other emissions into the environment and hence reduce the cost of cleaning the environment or environmental fines authorized bodies;
- Compliance with the law by identifying legislative changes over time and needed addressing;
- Improving the image of the organization by controlling the environmental impact;
- Improving the business focus on environmental issues.

Dominance of economic priorities against the changes occurring in the environment has brought humanity face a real threat of ecological crisis and the need to review the guidelines state. Therefore, sustainable development strategy is particularly important at this time.

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TECHNICAL ASPECTS OF CAPTURE INSTALATION OF FLY ASH FROM THERMAL POWER STATIONS

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Abstract: *Fly ash is comprised of the non-combustible mineral portion of coal. When coal is consumed in a power plant, it is first ground to the fineness of powder. Blown into the power plant's boiler, the carbon is consumed — leaving molten particles rich in silica, alumina and calcium. These particles solidify as microscopic, glassy spheres that are collected from the power plant's exhaust before they can "fly" away — hence the product's name: Fly Ash. Fly ash is generally captured from the chimneys of coal-fired power plants, whereas bottom ash is removed from the bottom of the furnace. In the past, fly ash was generally released into the atmosphere, but pollution control equipment mandated in recent decades now require that it be captured prior to release.*

Key words: *Fly ash, equipment, collected, thermal power station*

1. INTRODUCTION

The installation that will be presented is achieved and assembled at CET Brasov. The installation is designed to operate in automatic mode, without damage the-production process and respecting all environmental requirements.

The fly ash collection is made by boilers 1 and 2 area, to the function either of the boiler 1, either of the boiler 2, or simultaneous operation of two boilers.

The fly ash transport by storage silo is made with machines equipped with special containers, with load capacity of 25t.

The load of fly ash from storage silo is made by the driver vehicle, which is instructed in this sense. The installation is designed it can be used non-stop.

2. THE CONSTRUCTION OF THE INSTALLATION FROM CAPTURE THE FLY ASH

The layout is presented in Figure 1. At choice and placement of of all components to be considered:

In the case of the appearance of accidental defects, the installation from capture the fly ash to be equipped with safety elements (flap valve). This elements permit the troubleshooting without affecting the production process of the plant.

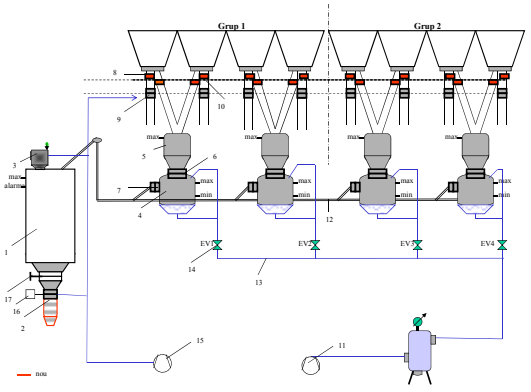

Fig.1. The layout of installation from fly ash recovered

1 - storage silo, 2 - joystick Beumer type BF401 for uploaded fly ash, 3 - filter type OSF-K, 4 - steel container for ashes collected from to the electro RI, 5 - RII steel container intermediate, 6 - Inflatek valve dn = 200mm to enter the container, 7 - dn = 100mm Inflatek valve out of the container, 8 - lance Sibar (safety), manual l = 400mm, 9 - pneumatically operated lance sibar l = 200mm, 10 - lance sibar (belts), manually operated l = 200mm, 11 - electrocompressor for transfer the fly ash of container in storage silo, 12 - pipes for ash collection and storage in containers, 13 - transfer tubing from the container of ashes in RI storage silo, 14 - valves, 15 – electrocompressor to actuation pneumatic control, 16 - valve, 17 - manually sibar.

- The dimensioning of tanks RII and RI 4 and 5 position in figure 1, were made so that to ensure a efficiency of capture by minimum 0.85. the metallic construction of RI and RII containers is attached with screws from concrete M16 on the platform.
- The dimensioning of compressors, valves and piping were performed so that, they can collect a minimum amount of ash 25-30t/hour.

The silo storage of fly ash figure 2 has a capacity for 150 t, and is located near the electrostatic precipitators.

The technical characteristics of storage silo are: vertical cylinder is made of sheet 5 mm, with a diameter of 6000mm and height of 7800mm, cylinder is composed of sections fixed with bolts. The cone trunk are 4300mm height, and is located at the bottom of the cylinder. structure is supported on four metal legs with caisson section.

Fig. 2. Storage silo

The total height of silo is about 18,00 m and the weight of the silo empty is 13t. the full weight of silo with fly ash γ=0,72 is 150t.

According to HG no. 1231/2008 is fall into the category of importance C, namely the normal importance. According the Normative P100 92 the construction is located in seismic zone D where the seismic coefficient is Ks = 0,16, the corner period Tc = 1 sec., the reduction coefficient of seismic effects is Ψ = 0,65, coefficient of dynamic amplification β = 2,5, coefficient of equivalent modal ε = 1 results that the global seismic coefficient is c = 0,312 respectively the seismic load is S = 49t. Under these conditions to anchor the bolts are necessary 8M48/ leg on S355.

The above considerations has adopted the anchor variant of silo of armed concrete structure, anchor necessary for the transmission of horizontal load (seism, wind) at armed concrete structure. The foundation take the gravitational load from silo.

3. CONCLUSIONS

Fly ash is generally captured from the chimneys of coal-fired power plants, whereas bottom ash is removed from the bottom of the furnace. In the past, fly ash was generally released into the atmosphere, but pollution control equipment mandated in recent decades now require that it be captured prior to release.

Ash handling refers to the method of collection, conveying, interim storage and load out of various types of ash residue left over from solid fuel combustion processes.

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RESEARCH ON THE FLY ASH CHARACTERISTICS FROM THERMAL POWER STATIONS

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Abstracts: *The term "fly ash" is often used to describe any fine particulate material precipitated from the stacks gases of industrial furnaces burning solid fuels. The amount of fly ash collected from furnaces on a single site can be vary from less than one ton per day to several tons per minute. The characteristics and properties of different fly ashes depend on the nature of fuel and the size of furnace used.*

Keywords: *fly ash caracteristics, artificial pozzolan, granulometry, etc.*

INTRODUCTION

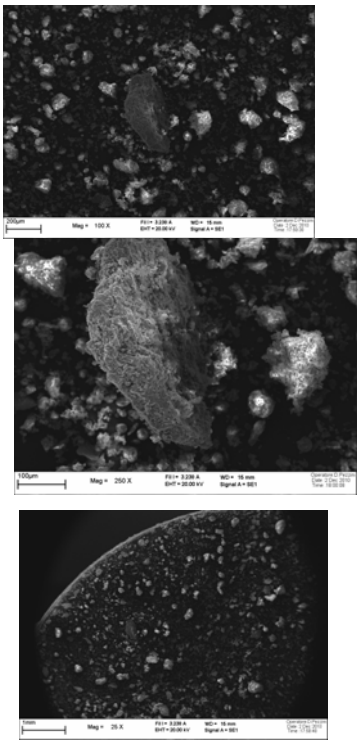
Fly ash is an artificial pozzolan produced when pulverized coal is burned in electric power plants. Fly ash is generally captured by electrostatic precipitators or other particle filtering equipment, before the combustion gases to arrive at the exhaust flues of power stations. The characteristics of coal, including the sterile content, extraction mode and the grinding technologies and burning it, and the manner to evacuation / collection at fly ash determine their characteristics. Knowing the characteristics in very important to establish the areas of use in various fields.

Fig.1. *Natural size of fly ash*

1. EXPERIMENTAL METHODS AND RESULTS

In a first step has been determined the physical characteristics as the appearance and the form. Depending on the nature of coal and combustion conditions, may have a variable color of the fly ash from gray to brown (figure 1).

To analyze in detail the appearance and the form of the grains of fly ash, we realized a microscopic study. The microscopic structure of fly ash was determined with SEM Model LEO 1450 VP.



SEM of fly ash ***Fig. 2.***

In figure 2 can be observed the granules have irregular the form, characteristic of the fly ash results of the burn of lignite, they have a spongy structure, agglomerated in large groups, hydraulically inert. They are usually empty, but sometimes present attached the particles of aluminum-silicate, Fe, Ca, K, etc (figure 3).

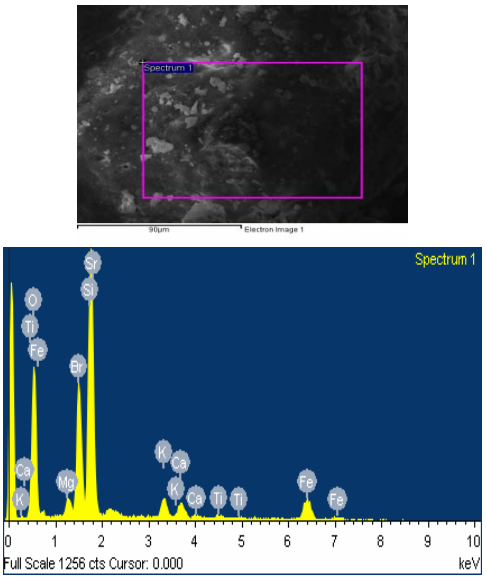


Fig. 3. *SEM-EDS of fly ash*

In terms of granulometry the fly ash fall in a range between 0.2 and 200µm. In figure 4 is present the curve of granulometry of the fly ash. The determination was made practical by sifting a certain amount of material through the set standard.

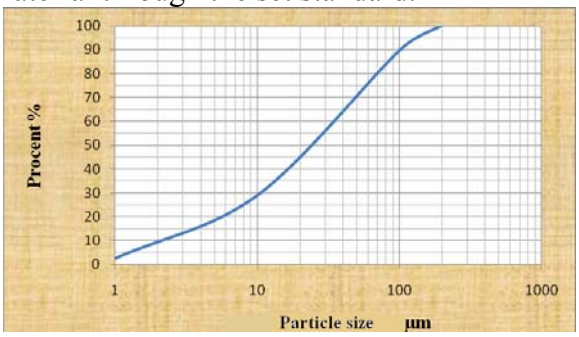


Fig. 4. *Curve of granulometry of the fly ash*

Regarding the chemical characteristics we performed determinations on the oxide composition.

The oxide composition was determined by XRF method (X-Ray Fluorescence) with spectrometer XRF BRUKER S8 TIGER. The results achieved are presented in Table 1.

Table 1. *The oxide composition of fly ash*

Nr. proba	Compoziție chimică %							
	SiO_2	**Fe_2O_3**	**Al_2O_3**	**CaO**	**MgO**	**SO_3**	**Na_2O**	**K_2O**
1	54,12	8,86	22,02	6,05	2,52	0,87	0,98	2,4
2	54,18	8,89	22,03	5,97	2,54	0,98	0,42	2,41
3	55,42	8,28	23,33	3,94	2,59	0,96	0,64	2,77
4	55,00	8,96	21,89	6,13	2,60	1,37	0,54	2,46
5	54,13	8,56	22,13	4,86	2,59	1,36	0,62	2,66
6	54,36	8,23	22,03	5,96	2,56	0,98	0,42	2,45
7	54,42	8,12	22,12	5,56	2,51	1,23	0,39	2,36
8	55,13	7,56	23,0	5,13	2,48	1,02	0,32	2,21

As can be seen the sum of the dominant components SiO_2, Al_2O_3, Fe_2O_3 and CaO is more high 70%, which certifies the good hydraulic capacity of fly ash, proprietary that provides a high degree of recovery.

To elucidate the molecular structure of fly ash we examined in the IR spectrum (Figure 5) in the form aqueous emulsion with polydimethylsiloxane with Nicolet FTIR spectrometer.

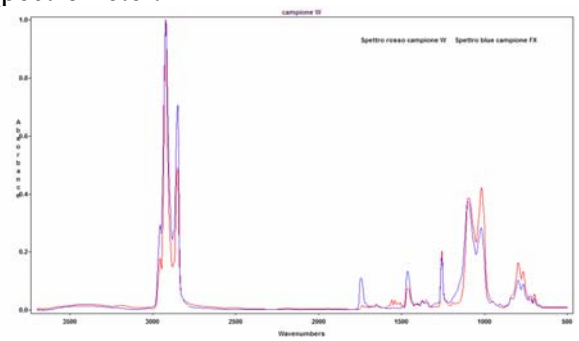


Fig. 5. *IR spectrum of fly ash*

Is observed that, in the sample of the fly ash is present a pic at 1746 cm^{-1} specific of ester group.

This properties demonstrates the good capacity of ashes to be used in various fields such as raw materials or materials added.

2. CONCLUSIONS

The fly ash used in the determination is generally homogeneous, the main chemical components were within limits (table 2).

Components	**Variation limit %**	
	Minimum	**Maximum**
SiO_2	49	56
Al_2O_3,	19	23
Fe_2O_3	4	9
CaO	4	7

Ash from thermal plants is present and prospective major industrial waste which, due to the chemical composition and hydraulic properties can be sources of new raw materials recovered in various fields.

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THE ROLE OF PLM IN ECOLOGIC DESIGN OF ELECTRONIC DEVICES

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Abstract: *For many durable goods, including electronics, there are a variety of other design considerations related to total product life cycle. Considering the life cycle of products, the decision makers have to obtain the greatest economic and environmental benefits and identify the specific ecologic potential for each phase of electronic product life cycle. The article focuses on serious environmental and human health impact of electronic devices production.*

Keywords: *product life cycle , ecological, environmental impact*

1. INTRODUCTION

Over the past ten years, more and more discrete manufacturers have deployed Product Lifecycle Management (PLM) solutions to optimize product development and enhance bottom-line performance. Life cycle thinking is the most effective way to cover the environmental impacts of products as a whole. Product design has an important role here as issues related to energy efficiency, material selection and recyclability are already decided upon at the beginning of the life cycle.
Life Cycle Management (LCM) is a unique framework of concepts, techniques, and procedures with the goal of creating sustainable development.
Rather than focusing specifically on environmental, social or economic impacts and/or benefits, LCM combines a variety of tools and approaches to look at all of these factors, how they are interconnected and how to best address these issues throughout the product or material's life cycle.
How these factors are weighted and balanced will depend on what is important to the organization responsible for the management and what is deemed the most important issues throughout the product's or material's life cycle. Environmental issues will continue to increase in importance. In the long run, only responsible companies and brands will succeed.
Information and Communication Technology and mobile technology can also be used to combat climate change. For instance we could replace the possibility of loading music from the Web instead of buying physical CDs, which are produced, packed, stored and transported.
Electronics and electrical industry has grown rapidly in recent years on condition that it was necessary to revisit the rules on ecological issues - waste, hazardous substances or energy

efficiency. It becomes increasingly clear that any Watt in addition to minimum necessary energy products will contribute to realization of a negative impact over environment.
All these issues must necessarily be taken in account when we design new products and more specifically, to project products. An important role plays, in this regard, Directives and their implementing regulations issued by European Commission which are mandatory for our country, as a member of the European Union. The profile standards have an important role in practical application of the European Union Directives and Regulations. Product life cycle management must be considered from the first stage - the choice of materials- until to waste management, under condition of products functions in the best regimes in terms of energy consumer, so throughout their duration, to provide the conditions to achieve high quality products at a lower cost price and having in mind the need to protect the environment.

2. INDUSTRIAL DEVELOPMENT AND ENVIRONMENTAL IMPACT

As it is known, the profit is the main strategic objective of industrial development in market economy conditions. The profit does not exclude, on the contrary, stimulates the achievement of superior quality at acceptable cost prices within competition market.
Limitation of resources, raw materials and energy and the need to protect the environment

3. ENVIRONMENTAL IMPACT DURING THE LIFE CYCLE

Considering the products lifecycle, the decision makers could obtain the greatest economic and environmental benefits and identify the specific potential for each phase of product lifecycle. [4]
During the entire lifecycle, the electronic products are in continuous interaction with the environment, undetaking from the environment materials resources and energy necessary for products manufacturing or discharge its into the environment.
have recently imposed new strategic objectives such as:
- Saving material resources;
- Energy savings;
- Pollution prevention;
- Avoid waste production.
A basic role in promoting these new strategic goals belongs to the design and development activities. Standardization is specifying the specific requirements and appropriate verification methods for these strategy. Up to date, environmental requirements were related especially to the way in wich environment is affecting the products functioning. In order to not harm the environment, the situation was changed, and we added new conditions imposed on the products.
This explains the creation of the new Technical Committee TC 111 within the International Electrotechnical Commission called „Environmental Standardization electrical and electronic products and systems "(having "Romanian mirror": The Technical Committee for National Standards No. 19) whose international standards are including requirements for environmental impact of electrotechnical and electronic products. The objective for the economy energy is reflected first, by a more rational use of electricity consuming products, and secondly by the construction of new energy sources „cleaner" in terms of environmental pollution.
The linkage between the product standards and environmental impact during the entire lifecycle of products can be seen in Figure 1

The main stages of electrical and electronic products lifecycle are:
- Purchase materials;
- Product implementation;
- Packaging and distribution;
- Installation, operation, maintenance and development;
- Reusing products, recycling and materials or energy recovery;
- Final procedures.
These stages and their impact on the environment can be seen in Figure 2.

4. ECOLOGICAL DESIGN OBJECTIVES

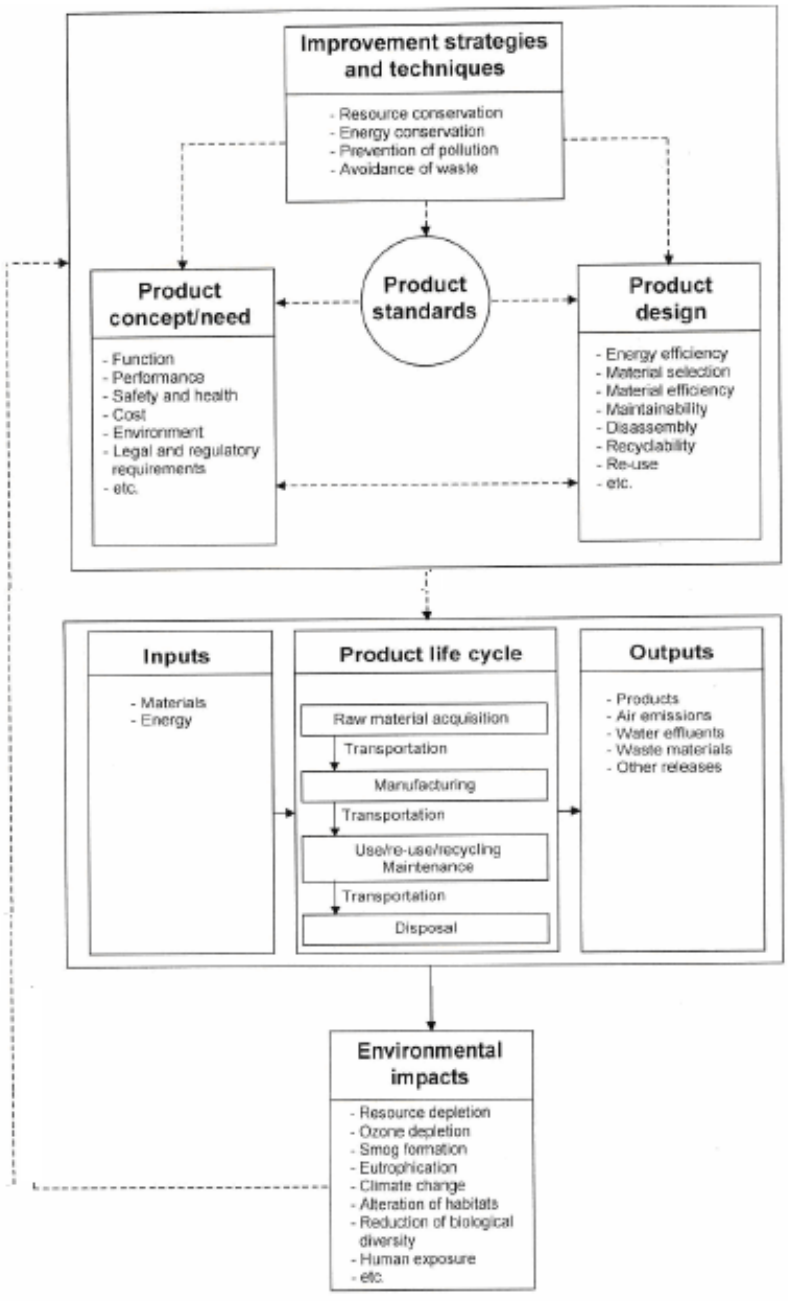

Figure 1. The product standards requirements and environmental impacts during the entire lifecycle of products.

Beyond being just a trend, the ecological design term denotes a mode of seeing

conception and manufacturing activities of a product in relation to its impact on the environment.

It was found, by documenting, that the ecological design has had an extensive development leading to the establishment of a large number of sophisticated ecological models and methodologies, assessment techniques, rules and guidelines design.

Ecological (environmental) issues are difficult to resolve by the fact that:

- environmental degradation progresses slowly, in a very long time period;
- environmental implications events and their effects are developing in large numbers and are evolving hardly over time;
- environmental policies must consider the business and market mechanisms, which hampers finding optimal solutions.

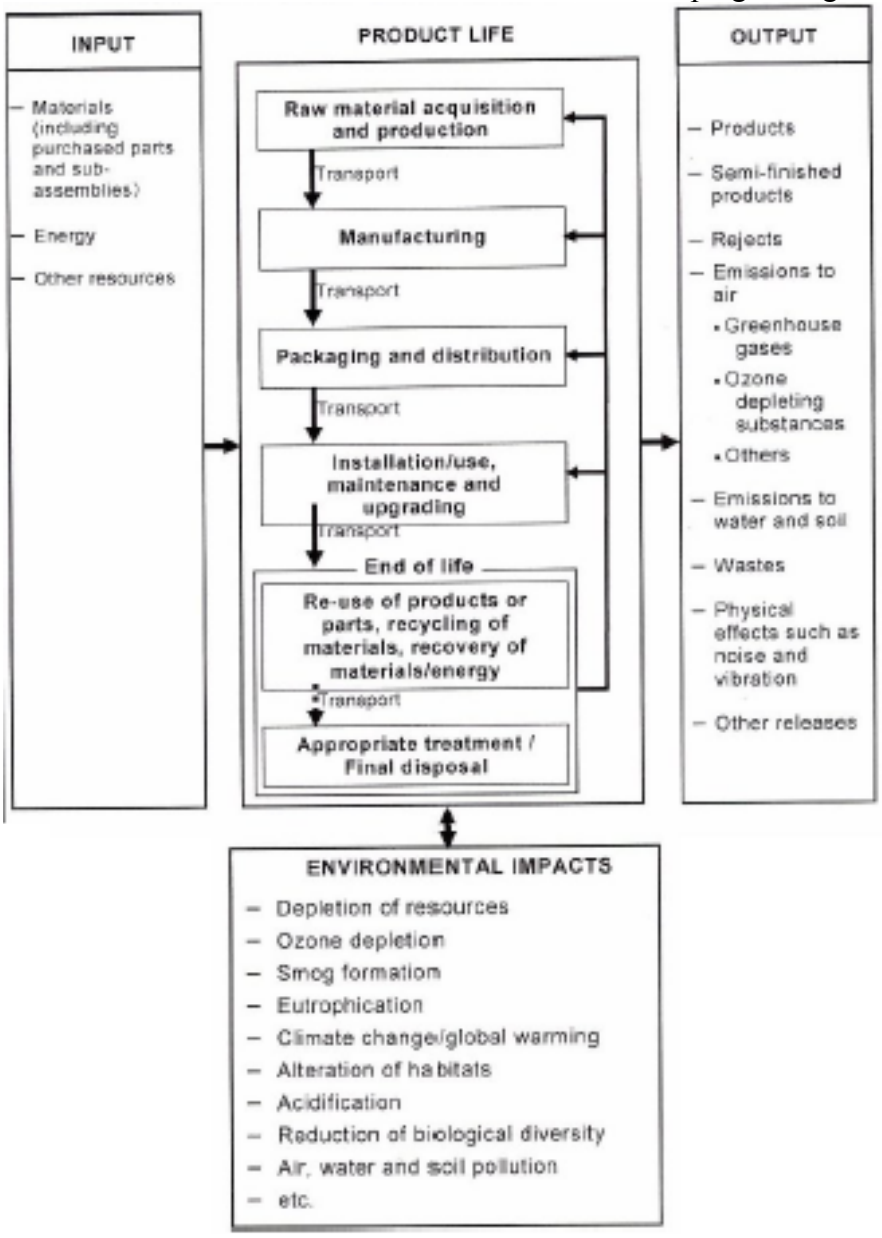

Figure 2. The main stages of the products lifecycle. Inputs, outputs and electronic products impacts on the environment

Taking in consideration that the current ecological instruments have a cvasigeneral character covering products or processes groups, the important issue of users (planners, designers, managers) is to identify the

appropriate instrument for the specific problem which is solved. For a proper optimal design, it is necessary to analyze the product design and compare with other materials, shapes and finishes.
The main activities, that contribute to the ecologic design of electronics products at various stages of development (product strategy, product profile, determining the requirements, product conception) and design (design fundamentals, design targets, detailed design, prototype testing) finished with the release manufacturing, are shown in Figure 3.

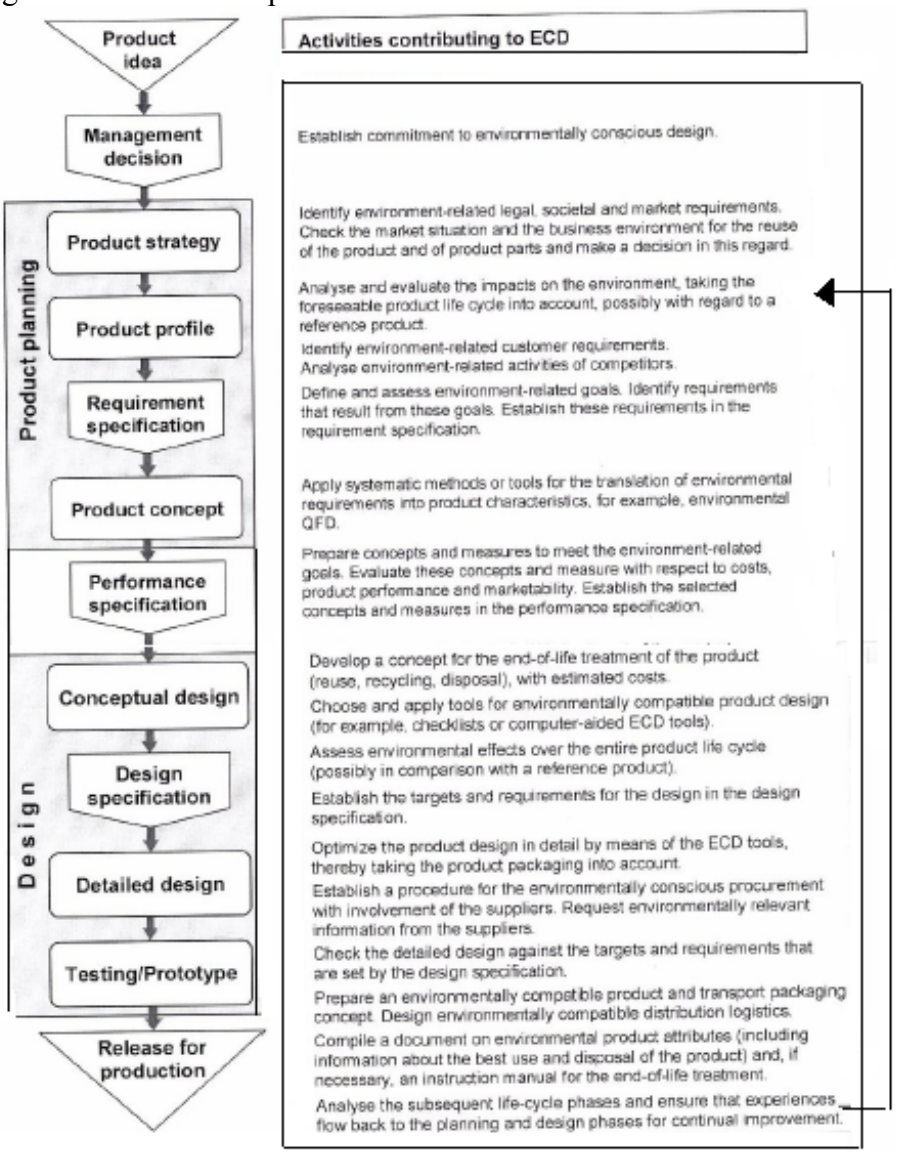

Figure 3. QFD-Quality Function Deployment. Integration of environmental aspects in the development and design of electronic products

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Based on documentation and case studies were established design rules, to mitigate environmental damages. These rules can be structured in different directions: corrections (reuse, reduction, recycling, disposal, replacement, redesign, rethink), consumption (weight, hazardous substances mass, energy, packaging weight), the lifecycle (design, processing, packaging, distribution, use, disposal), chemical-biological (contaminant, the solar effect, cyclical movement, safety, efficiency).
Seven directions were highlighted with the following meanings:
1. New concept development: dematerialization, widening use of the product areas, integration of functions, functional optimization of the product.
2. Selecting materials with low impact: purity, regeneration, low power processing, recyclability.
3. Reduction of used materials: weight reducing, volume reduction,
4. Manufacturing technologies optimization: alternative production techniques, reduced number of production processes, low energy consumption, waste reduction, technological materials (supplies) reduction.
5. Optimization of distribution system: reusable packages, efficient transportation, logistics efficiency;
6. Reducing environmental impact in use: low energy consume, renewable energy sources, small quantity of supplies, ecological supplies without waste and auxiliary energy consumption.
7. Initial lifecycle optimization , reliability, durability, easy maintenance and modular structure.

5. ENERGY EFFICIENCY

Energy efficiency improvement is the main objective of ecological design. Primarily, ecological design should take into account the operating consume modes of electrical energy devices.

6. LIFECYCLE OF GREEN ELECTRONIC PRODUCTS

When we buy new electronic products, we focus on what the newest technology offers us and try not to think about what it took to make that product. But if we scratch beneath the surface, we find that there are serious environmental and human health impacts. There are few other products for which the environmental impacts of mining, industrial refining, production, use and disposal are so extensive. These have had devastating impacts on electronics manufacturing and recycling workers, communities surrounding industrial facilities and areas around the world that have

become the dumping ground for toxic e-waste. We can present you a possible model of electronic products life cycle (figure 4).
Nokia strives to reduce the possible harmful environmental impact of its products,services and operations over the entire product life cycle.

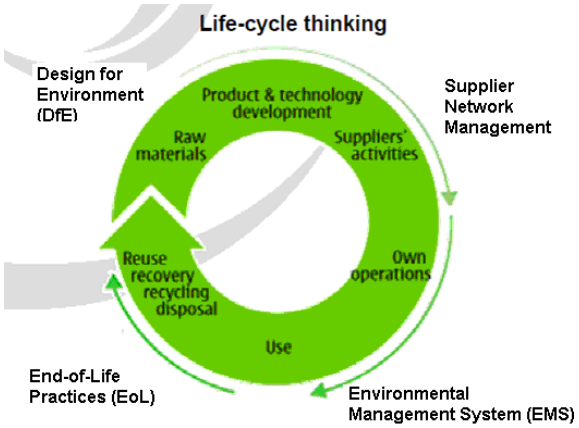

Figure 4. A possible model of electronic products life cycle

3. CONCLUSIONS

The product design must be adapted to environmental issues, seeking (in addition to the classic objective of low-cost and high performance) quantifiable eco-efficiency through reduced negative effects on the environment. Design involvement in the ecological projection has an important economic and educational impact over future generations.
To achieve competitive products, which are including ecological aspect, the designer will consider the necessary material and energy consumption throughout the product lifecycle.
From this point of view, the designer objectives will be: product miniaturization, information and data concentration, digitization, portability, functions integration (value added), energy saving equipment, production processes improvement through intelligent control and automation systems, cleaner production, high functionality with low money.
Materials consumption, energy and other resources used in making a product (Figure 2) can be reduced by optimal management of parameters: the product weight and volume, the recycled materials use, the energy consumption over the life cycle, the use of hazardous substances, quantity and nature of consumables needed for proper operation and maintenance, incorporation of used components.
The choice of materials used in eco-design will take into account the possible technologies to be used for their processing.
Healthy ecological technologies protect the environment, are less polluting, use resources in a sustainable manner, recycle a greater proportion of waste and sub-products they generate and convey the waste in a manner more acceptable to the environment than the technologies which them replace.

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THE ROLE OF VIRTUAL COLLABORATIVE ENGINEERING IN PRODUCT DEVELOPMENT

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Abstract: *In the context of network economy (net economy), the society based on information and knowledge products and collaborative work processes are changing their nature by turning through virtualization. The traditional work teams are transforming in virtual teams and are operating within workgroups from/at long distance of the main organizations headquarters. Collaborative Engineering is a virtual methodology that tends to bring to upstream knowledge professions involved in downstream design as preparation of manufacture, production and marketing. It involves effective participation of different professions specialists in the earliest stages of conception.*

Keywords: *collaborative engineering , virtual product,, computer-aided engineering*

1. INTRODUCTION

Virtual Collaborative Engineering (Integrated) is a methodology that tends to bring to upstream knowledge of the professions which are involved in downstream design (the manufacturing preparation, production and marketing). It involves effective participation of specialists from different professions starting with the earliest stages of conception. The highly dispersed and globalized nature of product development today has changed the way that product development teams come together on a design.

Tabelul 1. The components of a collaborative system

Material Component	Human Component	Energy Component	Information Component
Activity	People	Energy Resource	Procedures
Place			Flows
Material Resources			

Virtual meetings, emailed design data and lightweight design visualization have replaced white board sessions as product development departments become complex design chains dispersed across time zones, legal and regulatory boundaries, and languages.

2. THE COLLABORATIVE SYSTEMS

A collaborative system is defined by a large number of users or agents which are engaged in a shared activity, usually located in distant locations. As part of the distributed aplications, the collaborative systems represent a separate category, because the agents within the system are working together in order to achieve a common goal and having a great need to interact each other. Table 1 shows the components of a collaborative system:
Collaborative systems from consciousness society are ordered after collaborative systems from the knowledge and information society, beeing systems that include a uniform set of procedures which are governing relations between components. In the consciousness society, the human component plays a significant role over the conduct of any collaborative system. A collaborative system is one that works with people and other systems to get jobs done faster. Each person and each software program has various strengths and weaknesses. Working alone they can only accomplish so much. Working together, strength combines with strength to increase the likelihood of success [3]. The collaborative systems are an important subject of knowledge-based society and an important part of the human activities is involved in this field.

The collaborative systems in production are designed to increase production capacity and product qual-ity in different units producing goods and services;
Collaboration Engineering is an approach to the design of re-usable collaboration processes and technologies meant to engender predictable and success among practitioners of recurring mission-critical collaborative tasks .
Collaborative/ integrated engineering is defined as a methodology that allows integrated and simultaneous conception of products and production processes and associated maintenance. This ensures consideration, since the origin of all phases of product life cycle, starting with conception and ending with disposal, integrating quality problems, deadlines, demanding user costs, etc.

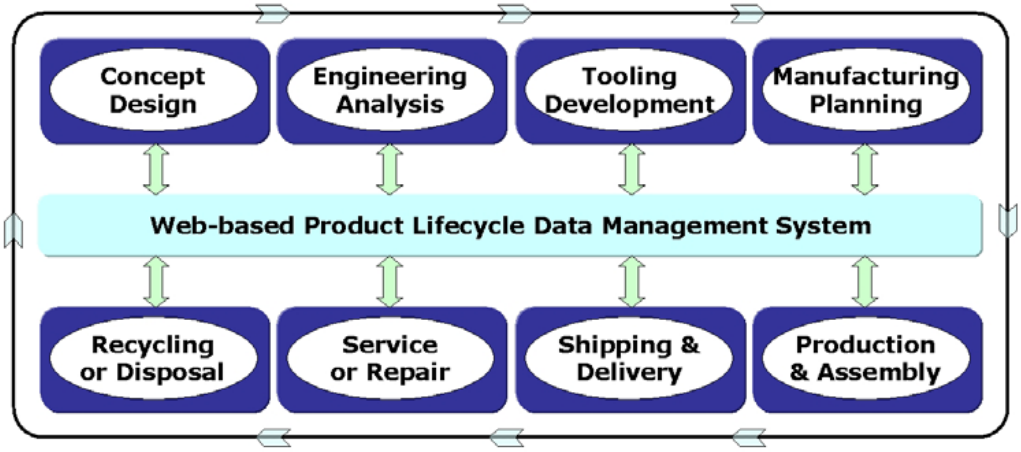

Figure 1. The web-based Product Lifecycle Data Management System

3. INFORMATION AND COMMUNICATION TECHNOLOGIES

Improved information and communication technologies (such as linked CAD tools, shared databases of engineering information, e-mail, and voice mail) can serve to break down common barriers to communication and to increase the capacity of an organization to transfer information [1], [2].
Whitney [4] points to many examples where innovative CAD tools are being successfully used to facilitate concurrent engineering in complex development projects. Though this approach may increase information transfer, it might not be sufficient for coordinating team activities since the transfer of the most

essential and difficult information is not assured. The web-based Product Lifecycle Data Management System is shown in the figure 1.

4. COMPUTER-AIDED PRODUCT DEVELOPMENT

The virtual product comprises a digital assembly of its part models. The parts are modelled in 3D using computer-aided design (CAD) programs and saved in standard formats (ex. IGES and STEP) for exchange between different programs. Computer-aided engineering (CAE) programs enable simulating the product mechanism and optimising the shape of each part under static/dynamic loads by simulating the internal stresses. The part models can be sent to a rapidprototyping (RP) system for automatic fabrication of a physical replica for form fit and function testing. The tooling models (moulds, dies, jigs and fixtures) can be quickly developed by modifying the corresponding part models. Computer-aided manufacturing (CAM) programs enable planning, simulation and optimisation of process parameters. Finally, computer-aided inspection systems enable automatic comparison of virtual and real parts for quality assurance.
The 3D model is the connecting link in various CAX programs (X=design, engineering, manufacture and inspection). The programs generate a huge amount of data, which includes the solid models of different iterations and previous versions of products, as well as tooling, materials, process plans and results of analysis. This necessitates a systematic approach to data storage, verification and retrieval, which is achieved by a product data management (PDM) system.

The Collaboration Engineering way working describes the steps that need to be taken to design collaboration processes. In other words, the way of working defines the design activities in the Collaboration Engineering approach. Overview of Collaboration Engineering Way of Working is shown in the figure 2.

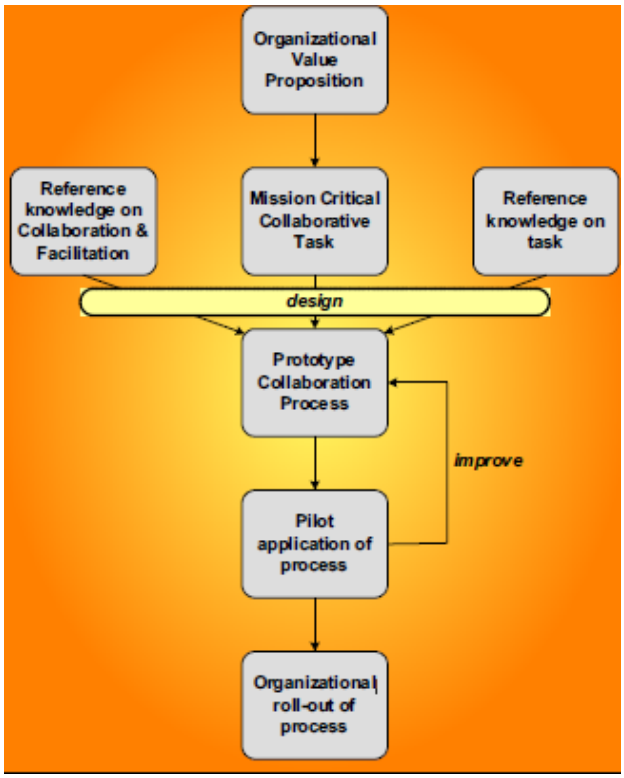

Figure 2: Overview of Collaboration Engineering Way of Working

There are a number of phases that can be distinguished when we are designing a collaboration process for a mission critical collaborative task that will deliver organizational value.

It is expected that these modeling tools, a.k.a. CACE (Computer Assisted Collaboration Engineering), can greatly increase design efficiency and effectiveness. Together these and other research challenges

constitute an exciting agenda for the coming years. The practical value of Collaboration Engineering has been demonstrated convincingly. The Collaboration Engineering research community has only recently begun to take up the academic challenge yet the results so far are promising and stimulating.

4. COMPUTER-ASSISTED COLLABORATIVE SYSTEMS

Computer-assisted collaborative systems present a immediate application and major advantages as follows:
1. creative activity in research, design and development of new products and applications in collaboration wit other authors areas such as:
- CAD / CAM (Computer Aided Design / Computer Aided Manufacturing);
- concurrent engineering ;
- CASE system.
2. administrative and economic processes such as:
- marketing, sales, purchasing and financial (management of orders and invoices, etc.). activities;
- transactions processing;
- workflow management ;
- staffing;
- office activities.

To use and develop computer-assisted collaborative systems we should consider the following key elements:
- group awareness;
- space, collections and types of shared information;
- methods and types of communication;
- knowledge of developing environmental facilities;
- multi-user interfaces;
- coordination within the group;
- support the heterogeneous and open environment that integrates single user applications.

4.1 Specific functional requirements for systems and collaborative engineering development platforms.

To be functional in a given organizational and economic framework, systems and collaborative development platforms must meet the following general requirements:
- possibility of integration with external sources - the information origin for cooperating community is "groupware" external environment (examples: tools for PCs, various collections of information from relational databases, etc.);
- platform independence - "groupware" applications often begin as departments implementations, further results can be extended on a much wider area; platform independence is a basic element to ensure extensive use and investment protection;
- Mobility - "groupware" infrastructure must be able to support many geographically dispersed locations, including a heterogeneous range of equipment;
- common coexistence of multiple drive applications - economic relations are linking economic partners as key actors in business processes automation, requiring the ability to easily extend the application page by successive additions.

4.2 Collaborative Product Development (CPD) . The challenge of keeping an engineering team working efficiently without getting in each other's way can be difficult to manage. Product development projects now involve people from multiple departments trying to collapse product introduction lead times. As if this was not complex enough, many companies are distributing these resources around the globe and forming virtual teams of people from different companies. Global design, a commonly cited alternative to the term of collaborative product design, has cost benefits that are very attractive to today's manufacturing, but adds new communication, control, and collaboration challenges and intensifies existing problem areas such as protecting intellectual property.
The essence of collaborative product design revolves around the need to involve the entire product development team – including the company’s personnel, customers and suppliers – during the development phase when a product’s most distinctive characteristics are defined. More participation by team members early in the process sharply reduces the need for changes later especially during tooling and

manufacturing, eliminating delays and potential cost increases.

Product design and development are in the midst of a revolution thanks to collaboration technologies. The tools used for product design, the process of gathering input and revising designs, and the roles of those in the extended enterprise are all changing. A new generation of online collaboration tools integrated with traditional CAD is transforming the product development phase .

Everyone in the product development process participates, sharing and building on one another's insights and ideas.

New technologies allow people from different companies with incompatible computing systems to meet virtually on Web environments. Instead of simply sending data from PC to PC, Web tools let people talk via their computers while looking at shared documents, carry on e-mail chats, and use electronic white boards where two or more people can draw pictures or charts, in real-time, as others watch and respond

The benefits of such collaboration are all encompassing. Using the collaborative platform to optimize communications, schedule and to resource usage, manufacturers can significantly reduce the cycle time to bring new products to market. They can implement solutions like DiFac for design and production tasks in order to reduce costs. By exploring design alternatives together, team members can leapfrog to truly innovative solutions. CPD is in demand because of its potential to cut product development cycle times.

Design collaboration entails all the issues associated with discrete manufactured products, as well as those that are engineered or configured to order. These products can have a long procurement cycle, a seasonal cycle, or a short production cycle, but the key similarity is that they all start with specification documents, e.g., line drawing, schematic diagram and engineering drawing. This type of collaboration requires the specification documents to be shareable and modifiable by both parties, with appropriate audit trails, particularly with respect to the effective bill of materials and process plan referencing the documents.

In this space, computer-aided design vendors such as CATIA can leverage their design products. Traditionally, in this first phase, one party sends the document to another for review and costing via e-mail or regular mail and then collaborates on the document via telephone, e-mail, or regular mail, creating significant delays and cost overhead. The next step in the product design cycle may be to send colour/material samples for approval/pricing, as in textiles which are the industrial sector of PPS. Collaboration tools that support this phase must manage the activities associated with it.

4.3 Product Development Teams.

Collaborative work can be successful if all members show goodwill and responsibility. Collabo-ration is necessary to deal with such large projects. The collaborative and essentially social character of work needs to be appreciated in un-dertaking interactive systems design. A collaborative system creates a environment where people can work better together, can share information without the constraints of time and space, being characterized by three fundamental aspects: joint activities, sharing environment and way of interaction. The solution lies in connecting the team members through a digital communications network and providing them appropriate software programs to create, analyse and modify a virtual model of the product. The model and results are stored in digital form in a central or distributed server and accessible to all team members over a

local area network or Internet. This approach to productdevelopment is referred to as Collaborative Product Lifecycle Engineering.

Product development teams are no longer constrained within the same four walls of the department. They are spread across different facilities, states, and increasingly across the globe. This has brought new challenges to product development, as designers must find new ways to share designs with collaborators who may never be in the same room. Companies are finding some measure of relief through a number of collaboration technologies that can help bring dispersed teams together. One solution that may often be overlooked but has a lot to bring to the collaboration table is video-conferencing .

5. THE CATIA INSTANT COLLABORATIVE DESIGN

The following scheme (Figure 3) aims at illustrating how the Instant Collaborative Design application works.

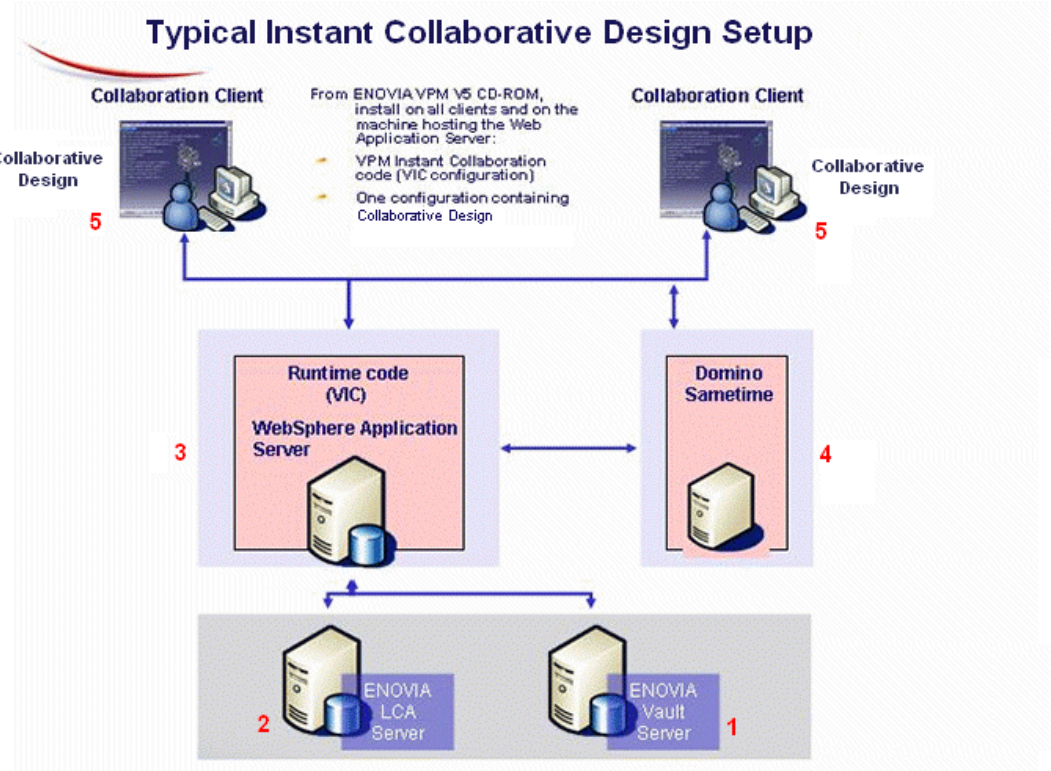

Figure 3. The CATIA Instant Collaborative Design application is based on a 3-layer system.

Storage layer: The first layer is made up of the ENOVIA Vault Server (1) and of the ENOVIA LCA Server (2). The physical data (briefcases created by the users) are stored in the ENOVIA vault (1). Sharing data (design collaboration data, and workspaces, data concerning which briefcase belongs to which workspace) are stored in the ENOVIA LCA database (2).

Communicating layer: The second layer made up of the WebSphere (3) and the Domino (4) servers, enables the ENOVIA Vault Server (1), and the ENOVIA LCA Server (2) to communicate with CATIA (5). Websphere is dedicated to the collaboration, whereas the Domino server is designed to the connectivity.

Design layer: The last layer made up of CATIA (5) enables the user to create Design.

5.1 ENOVIA SmarTeam PDM Solution.

ENOVIA SmarTeam® PDM, the core of PDM Solution, is the leading Windows-based, web-centric product data and workflow management solution for small to medium sized businesses and departments of large enterprises. ENOVIA SmarTeam® PDM leverages a company's knowledge base by enabling effective information collaboration

and improved data flow within an organization.

Now, ENOVIA SmarTeam® PDM broadens its PDM functionality into a robust, secure and web-based Collaborative Product Commerce solution. The shift from Product Data Management to Collaborative Product Commerce is as natural as was the shift from paper-based processes to electronic PDM systems. In addition to the benefits that PDM has brought to the product development process, CPC enables "real-times" product collaboration with business partners across the globe.

Rapidly implemented, scalable, customizable and uniquely cost-effective, ENOVIA SmarTeam® PDM provides best-in-class product lifecycle collaboration solutions for product teams in the extended enterprise and across the supply chain. ENOVIA SmarTeam® PDM Solutions address industry-specific business needs by managing all mechanical, electronic and software components in today's complex product development environment of the Fabrication and Assembly (F&A), Electrical and Electronic (E&E), Automotive and Aerospace, Life Sciences and Process industries.

ENOVIA SmarTeam® PDM V5 Solutions impact businesses' bottom-line profitability by managing and leveraging corporate product knowledge, and linking business processes together, enabling companies to improve innovation and product quality, reduce costs and times-to-market, and comply with industry standards.

Smarteam Best Practices Domain extends PLM solution benefits by optimizing product lifecycle processes. This platform use to empower their user communities, applying them in different modular combinations to tackle priority manufacturing & business needs.

Over the years, the concept of PDM has broadened considerably as the technology has evolved.

Once considered convenient way to manage CAD files, PDM buying vision consist of these five capabilities and they are as follows:

5.1.1. Document Management. Data vault and document management provides for storage and retrieval of product information. This discipline encompasses document registration, storage, access, approval and distribution.

5.1.2. Product Structure Management. Product structure handles Bill of Material, product configuration, and associated versions and design variations. It also handles the hierarchical organization of functions and systems or parts and assemblies.

5.1.3. CAD Management It provides seamlessly integrated PDM solutions to CAD mainstream and office applications in order to supply a common collaboration platform among engineering teams. This will in turn, create synergy between people, information, applications & business processes by providing an affordable easy-to-use data management solutions.

5.1.4.Workflow and Process Management Workflow and process management controls procedures for handling product data and provides a mechanism to drive a business with information. Change management is a form of Processes Management of formalizing and securing product definition data. Workflow - the method of assigning and executing work in a desired sequence.

5.1.5. Configuration Management The process of managing products, facilities, and processes by managing their requirements, including changes, and assuring conformance in each case. There are two basic related

concepts in Configuration Management. The first is effectively and this is defines when a change is effective, either as a range of dates or by ranges of product units, using serial numbers. The Second being its' Features, Variants and Options and the ability to add "fluid" configurations by allowing an item in an assembly to only apply to some of the final products. (ex: a car may have a feature called "roof" where the variants are "convertible" or "hardtop". One of the variants is required to build the product. The "pin striping" option may be added without affecting other items. Based on issues of concurrent engineering methods and tools , and current ITCs performances, collaborative design is increasingly integrated within in automotive and aeronautics industries in order to reduce costs and lead times, but also to improve product quality and value .

6. CONCLUSIONS

Collaboration Engineering is a design approach for recurring collaboration processes that can be transferred to groups that can be self sustaining in these processes using collaboration techniques & technology. The above sections have presented the different 'ways' of the Collaboration Engineering approach.

The collaborative conception or co-design of products and associated processes takes place in space, through meetings of experts of different professions and in time, by organizing parallel activities.

In this way now arises the new products development issue. The integrated approach is ensuring short terms for products conception and launch, increasing quality and reducing production costs.

The timely relevant and easily accessible obtained information is a key element in the operation of modern companies. In the company systemic approach, information system is linking the components of management and other systems at the micro level.

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STUDY OF PROPELLANT PRESERVATION USING A RE-LIQUEFIER SYSTEM

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Abstract: *For long time orbital and interplanetary missions, a fundamental problem is to preserve propellants in liquid state. The research works has shown that for missions longer than few months, a cooler and associated control, power and heat rejection systems results in a lower total systems weight. There are two alternatives active cooling systems to prevent boil off propellant. First is closed cycle coolers to balance the parasitic loads on the propellant and the second is re-liquefier. This paper presents an analysis of re-liquefier system, which uses the propellant vapor as working fluid.*

Keywords: *cryorefrigerator, re-liquefier, liquid propellant.*

1. INTRODUCTION

There are two possibilities to preserve propellant in liquid phase for long time orbital and interplanetary missions. To preserve the propellant a cooling system is necessary. This cooler can prevent the boil off of the propellant. One alternative is a closed cooling system to balance the parasitic heat loads. Like closed cooler we can consider Stirling, Brayton and Puls Tube cryocoolers. These coolers use a gas refrigerant that is not the same as the stored propellant. The second alternative is is to use the vapor from the storage tank as the refrigerant. This vapor is re-liquefied by the cooler and put back into the tank.

This may eliminate the need for a mixer in the propellant tank, may reduce the effect of leaks in the cooler and may allow a more graceful way to accommodate cooler failure. However, the re-liquefier is unlikely to be operating at its optimal operating point and will require some means of controlling contamination.

2. EMBEDDED COOLER WITH HEAT EXCHANGER

For better understanding of the problem, in figure 1 a conceptual Brayton closed cycle is presented. This cycle can be any recuperative cycle, because these kinds of coolers easy can become re-liquefiers.

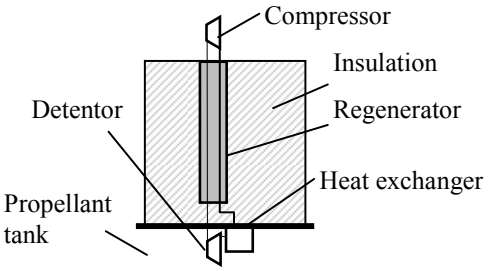

Fig.1. Closed cycle cryocooler

The cryocooler is sized to balance the tank heat load, so boil off is prevented.
The coefficient of performance of the cryocooler is:

$$COP = \eta\left(\frac{T_c}{T_h - T_c}\right) \quad (1)$$

where:
T_c - temperature of the cold expander;

T_h - temperature of the compressor;

$\left(\frac{T_c}{T_h - T_c}\right)$ - Carnot efficiency;

$\eta < 1$ - coefficient which contains all the losses.

If this cryocooler has been optimized, η has the maximum value. The cryocooler described in figure 1 will be considered a reference system. Any changes of the structure system will be reflected in η value.

In figure 2 a schematic drawing and T-s diagram for a reverse Brayton cycle are presented.

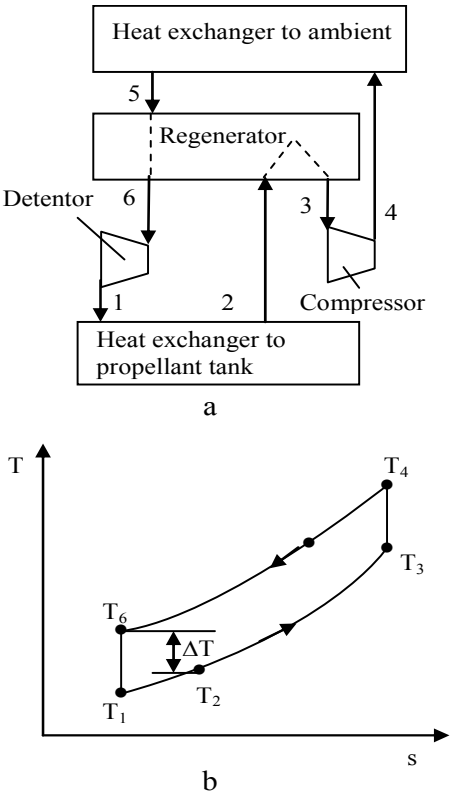

Fig. 2. Schematic layout (a) and T-s diagram (b) of Reverse Brayton Cycle

In real conditions, gradients temperature exist between the cryocooler and its load and between cryocooler and heat rejection system The cryocooler must operate over a bigger temperature range than given by nominal heat rejection and load temperatures. The hot end of the cryocooler will be ΔT_h above T_h and the cold end will be ΔT_c below T_c. These temperature gradients reduce the efficiency to

$$COP = \eta' \left(\frac{T_c}{T_h - T_c}\right) \tag{2}$$

where

$$\eta' \approx \eta \left[1 - \left(\Delta T_h + \Delta T_c \frac{T_h}{T_c}\right)\left(\frac{1}{T_h - T_c}\right)\right]$$

We assume that $\Delta T_h << T_h$, $\Delta T_c << T_c$ and η of the cryocooler is the same to first order. In practical situations, as the cryocooler is larger the efficiency is higher.

The temperature drop at the cold end of cryocooler has a larger effect on the efficiency than the same drop at the cold end.

3. EMBEDDED COOLER WITH PUMP MIXER

The cryocooler presented in figure 1 is connected to the propellant tank by a simple heat exchanger and it will work in good conditions for ground applications. The heat exchanger is placed in the ullage of the propellant tank and it can easily to re-liquefy the vapor. In space, stratification of the stagnant liquid and vapor in absence of buoyancy driven mixing can be significant. Stratification can be eliminated by using a pump, called pump mixer, to circulate the fluid. In figure 3 is presented a mixer that has integrated with the heat exchanger.

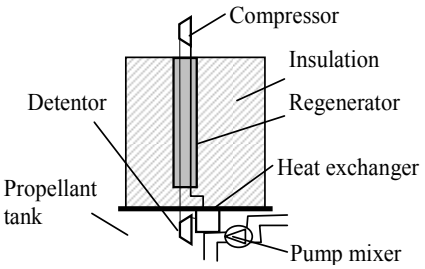

Fig. 3. Closed cycle cryocooler with a pump mixer integrated with the heat exchanger

A liquid acquisition device is needed to ensure that high quality liquid is fed to the pump mixer. Another device (such as a spray bar) is needed to ensure that flow mixes all of liquid in the tank.
In this situation, the coupled mixers with heat exchanger can maintain the tank temperature at constant value. The pump mixer dissipates power that must be removed by the cryocooler.

The heat flux that must be removed will be:

$$\Phi_c = \Phi_p + \Phi_m \quad (3)$$

where:

- Φ_c is total cooling power of the cryocooler;
- Φ_p is the heat flow leak;
- Φ_m is the power dissipated by the pump mixer

In that situation the cryocooler power is bigger by Φ_c / Φ_p.

We can consider the pump mixer and cryocooler as a single unit having an efficiency η''.

$$\eta'' = \eta \frac{\Phi_p}{\Phi_c} = \eta\left(1 - \frac{\Phi_m}{\Phi_c}\right) \quad (4)$$

is the efficiency compared to a cryocooler without pump mixer.

4. RE-LIQUEFIER USING PROPELLANT AS REFRIGERANT

Instead the use of pump mixer, there is the possibility to directly inject the cold refrigerant into the tank. The vapor propellant from the tank return to the cryocooler to be circulated and re-liquefied. In figure 4 a re-liquefier is presented. It requires the same working fluid as is stored in the tank.

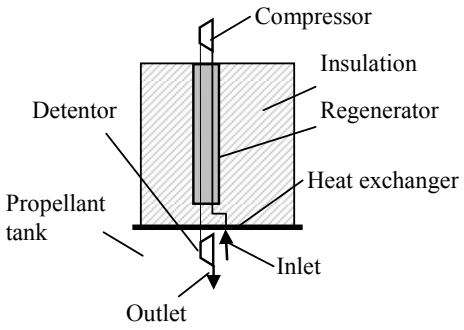

Fig.4. Open cycle cryocooler working as re-liquefier

This re-liquefier presents two important advantages:

- the pump mixer is eliminated. the mixing flow is supplied by the compressor.
- because low pressure in return circuit, this can be used as a vent line in case of compressor failure. In that situation the additional vent line is eliminated, reducing the heat leak on the tank. Using return line like an emergency vent line also intercept the parasitic heat leak that the nonfunctioning cryocooler components on the tank.

Both advantages reduce the heat that must be removed from the tank by cryocooler.
By eliminating the pump mixer, the efficiency of the liquefier is:

$$\eta''' \approx \eta\left(1 + \frac{\Phi_m}{\Phi_c}\right) \quad (5)$$

This relation can be generalized to show the effect of any reduction of heat flow, Φ_r, into the tank:

$$\eta''' \approx \eta\left(1 + \frac{\Phi_r}{\Phi_c}\right) \quad (6)$$

There are some disadvantages in case of use re-liquefier. The cryocooler must use vapor propellant as working fluid, with return pressure at tank pressure value and with two-phase fluid in the expander. An unbalanced enthalpy flow in the cryocooler heat exchanger

results because cold end two-phase regime operating conditions. This reduces the efficiency of the cryocooler:

$$\eta'' \approx \eta\left(1-\frac{\dot{m}\Delta h}{\Phi_c}\right) \quad (7)$$

where $\dot{m}$ is the mass flow through the cryocooler and Δh is the enthalpy change of the two phase flows. If the tank temperature and pressure change in time due to orbital conditions or tank operations, then the operating pressure of the cryocooler also changes. This is not an efficient operating condition.

Another disadvantage is the contamination of working fluid. Condensable gases and other solids in the propellant can block the flow passages in the cryocooler, damage the compressor and expander and reduce the effectiveness of heat exchangers. This contamination can be removed with extensive filtration, but in this situation a pressure drop will appear in filters. This pressure drop will lead to pressure ratio and power requirement of the compressor increase. If the pressure ratio of the compressor is increased from p to $p+\Delta p$ and the efficiency compressor is not changed, then:

$$\eta''' \approx \eta\left(1-\frac{\Delta p}{p}\right) \quad (8)$$

The mass flow rate in the cooler is expected to be significantly lower than mass flow rate from the pump mixer. This will reduces the effectiveness of the mixing

The design details must balances the cooling system efficiency against the risk of contamination causing system degradation or failure.

5. RE-LIQUEFIER USING PROPELLANT AS REFRIGERANT WITH THERMODYNAMIC VENT SYSTEM

This concept was introduced for liquid hydrogen applications. One problem with the re-liquefier with thermodynamic vent system, presented in figure 3, is ensuring that only vapor is returned to the cooler. Liquid flowing in the inlet line can cause flashing. This results in potentially damaging pressure spikes. On the ground, one can ensure there is vapor at the inlet by placing the inlet in ullage tank. In space, some device is the thermodynamic vent system TVS.

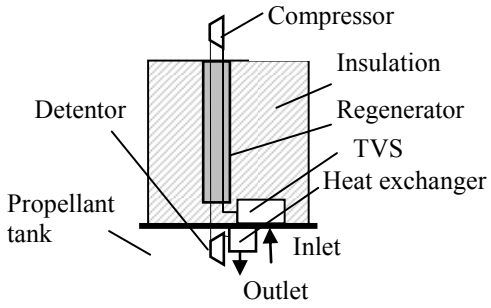

Fig. 5. Open cycle re-liquefier with thermodynamic vent system

This system, presented in figure 5, consist of a recirculation pump, a Joule-Thomson (J-T) expansion/shutoff valve, and a parallel flow concentric tube heat exchanger/spray-bar apparatus. The pump extracts liquid propellant from the tank and flows it through the heat exchanger. The fluid re-enters the tank through orifices in the spray bar that expel the fluid radially into the tank. This results in propellant destratification and ullage condensation through mixing. When pressure control within the tank cannot be maintained through mixing alone (bulk liquid is saturated at the ullage pressure), a small amount of fluid extracted from the recirculation flow is passed through the J-T valve where it is expanded to a lower pressure and temperature. The subcooled two-phase fluid mixture is then passed through the heat exchanger, which extracts heat from the recirculation flow, and subsequently is vented overboard.

6. CONCLUSIONS

To prevent boil off of the propellant two types cryocooler are presented. For a closed cryocooler, a different working fluid is used. If the system contains a pump mixer, this device circulates cooled propellant through the tank. This system presents the advantages in efficiency and the possibility to test the cooler before integration in propellant tank.

The second type is a re-liquefier , the propellant being the working fluid. In that situation, additional cooling is provided by a thermodynamic vent. This system is simplier to integrate and provide an emergency vent way that intercepts the parasitic heat of the cooler.

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CHARACTERISTICS CALCULATION OF THE WIND ELECTRIC WATER PUMPING SYSTEM

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Abstract: *One of the most attractive technologies for pumping using the renewable energy sources is wind electric water pumping. The purpose of this paper is characteristics calculation of the wind electric water pumping system over a period of one year, at different heights. Input data: Weibull frequency distribution of the wind speed for the selected site, power characteristic of wind turbine, technical characteristics of the permanent magnet generator, induction motor and centrifugal pump. The results were obtained by simulation in Matlab Simulink. Model of the system, the pumped water volume, wind generator rotational speed and frequency, induction motor rotational speed as a function of wind speed and pumping heights are presented. The maximum pumped water volume corresponds to wind speed between 6 and 7 m/s.*

Keywords: *Wind electric pumping, Simulink models, calculated characteristics*

1. INTRODUCTION

Over many centuries, on all continents, hundreds of thousands of windmills have been for pumping water for irrigation or drainage of land (the example of the Netherlands). Multi-blades turbines, called and „Farmer wheel" are currently used for pumping water or oil. The absolute majority of these systems are mechanical - wind energy is converted into mechanical energy which drives a piston or screw pump [1,2]. These systems are most effective for locations with annual average wind speeds equal or less than 4.0 m/s.

The disadvantages of these systems are the following:
1. Pumping system must be located very close to the water supply wells or even above. Often this requirement is sometimes impossible because the location is not good in terms of wind potential;
2. Piston pump requires permanent maintenance, the seals must be replaced every two years, in other words, it must demount the pipes and pump;
3. Multi-bladed wind turbines have a high solidity coefficient and at wind speeds exceeding that 6 m/s must be turned from wind direction to avoid mechanical stress.

Pumps Systems with electric pump connected directly to the turbine are an exceptional technology, which combines high reliability of the small wind turbines and centrifugal pumps with induction motors. These systems can operate for years without maintenance costs. The technology is based on the standard induction motor feature to operate at variable frequency and voltage and on the ideal compatibility between power required of

the centrifugal pump and power provided by wind turbine [3].

The purpose of this paper is to calculate the characteristics of the system in the steady-state conditions. It is assumed that in the turbine site is known the frequency distribution of the wind speed, which is approximated by Weibull function.

2. TECHNICAL ISSUES

The analysis system of this paper is presented in Figure 1. The components of the system are: wind turbine, generator with permanent magnet, induction motor driving a surface centrifugal or submersible pump.

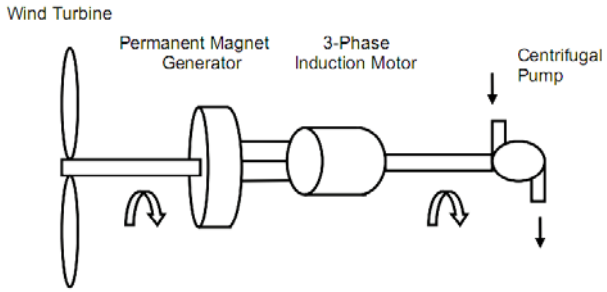

Figure 1. Main components of a wind –electric pump system

Permanent magnet low speed generator is directly coupled to wind turbine rotor. The turbine is equipped with a unit that controls the wind direction and provides protection against electrical and mechanical overload if the wind speed is higher than the admissible value. The electrical connection between the generator and motor is direct. Variability of wind speed leads to changes the turbine rotational speed, generator's frequency and voltage, the rotation speed of the pump and, in consequence, will varying the pump delivery and pumping height.

The pump is driven by an induction motor power of 7,5 kW, rated rotational speed, n = 2900 rev/min. Pump flow rate varies for different static heights: H_s = 10 m, Q_n = 60 m^3/h, H_s = 20 m, Q_n = 27 m^3/h, H_s = 30 m, Q_n = 16 m^3/h.

3. MATHEMATICAL MODEL

As input to the mathematical model is the wind speed - random size, which varies depending on weather conditions in the given site. The presentation of wind date makes use of the Weibull distribution as a tool to represent frequency distribution of wind speed in a compact form [4]:

$$F(V) = \frac{k}{A}\left(\frac{V}{A}\right)^{k-1} \exp\left(-\left(\frac{V}{A}\right)^{k}\right), \qquad (1)$$

where: $F(V)$ – is the frequency of occurrence of wind speed, A - scale parameter, m/s, k - shape parameter, and V - wind speed, m/s.

Specific power or wind power density per one square meter of surface is determined by the following relation:

$$p = 0,5 \cdot \rho \cdot V^3 \qquad (2)$$

where: ρ - air density equal to 1,225 kg/m^3, V - wind speed.

The power curve of the turbine is given by the manufacturer and shown in Figure 2.

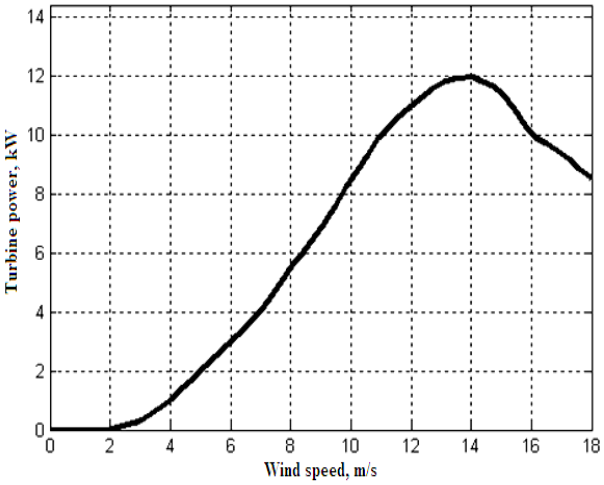

Figure 2. Power curve of a 10 kW wind turbine

The integral of the product of the frequency of occurrence of wind speed $F(V)$ and the power curve of the turbine $P(V)$ gives

the amount of electricity that can be produced by the turbine a preset time. If the duration of time is equal to one year the formula is:

$$E_E = 8760 \int_0^{\infty} \frac{k}{A}\left(\frac{V}{A}\right)^{k-1} \exp\left(-\left(\frac{V}{A}\right)^{k}\right) \cdot P(V)\, dV \qquad (3)$$

where: $P(V)$ is the turbine power curve.

The power produced by generator is determined by the relationship:

$$P_{el} = P_{mec} \cdot \eta \qquad (4)$$

where: P_{mec} - turbine mechanical power; η – generator efficiency.

Rotational speed of the generator driven directly by wind turbine:

$$n = \frac{30 \cdot Z}{\pi \cdot R} \cdot V \qquad (5)$$

where: R - radius of turbine rotor equal to 4 m; Z - turbine tip speed ratio equal to 6,1. The range of the wind speed variation in the selected site is 3 -18 m/s.

The rotation speed of generator determines the voltage frequency:

$$f = \frac{P_G \cdot n}{60} \qquad (6)$$

where: P_G = 20 - number of pairs pole.

Rotational speed of the motor and the pump is determined by the relationship:

$$n_M = \frac{60 \cdot f \cdot (1 - s)}{p}, \qquad (7)$$

where s- is slipping rotor; p - number of motor pairs pole.

Pump head-flow characteristic, H-Q is given by the manufacturer. For our case the rotation speed of motor varies, that will vary the flow and pump head.

H-Q characteristics family for the entire range of rotational speed variation is obtained using the formula below:

$$Q_i = Q \frac{n_i}{n}; \qquad (8)$$

where: Q - rate flow of the pump, n - rated rotational speed of the pump.

Pumping height:

$$H_i = H\left(\frac{n_i}{n}\right)^2 \qquad (9)$$

where: H-rated pumping height; Q_i, H_i - are the coordinates of points calculated for the rotation speed n_i.

The volume of water which can be pumped is determined by the formula:

$$V = 8760 K_d \sum_{V=3}^{18} F(V) \cdot Q_{PV}; \qquad (10)$$

where: $F(V)$ - is the frequency of occurrence of wind speed; Q_{PV} - flow developed by the pump to the wind speed V, K_d = 0.8 system availability factor (considering the possibility of lake or river freezing, the maintenance required time, electricity use for other purposes).

In figure 3 is presented Simulink model of the pumping system including system components described above.

4. MATLAB SIMULINK MODEL

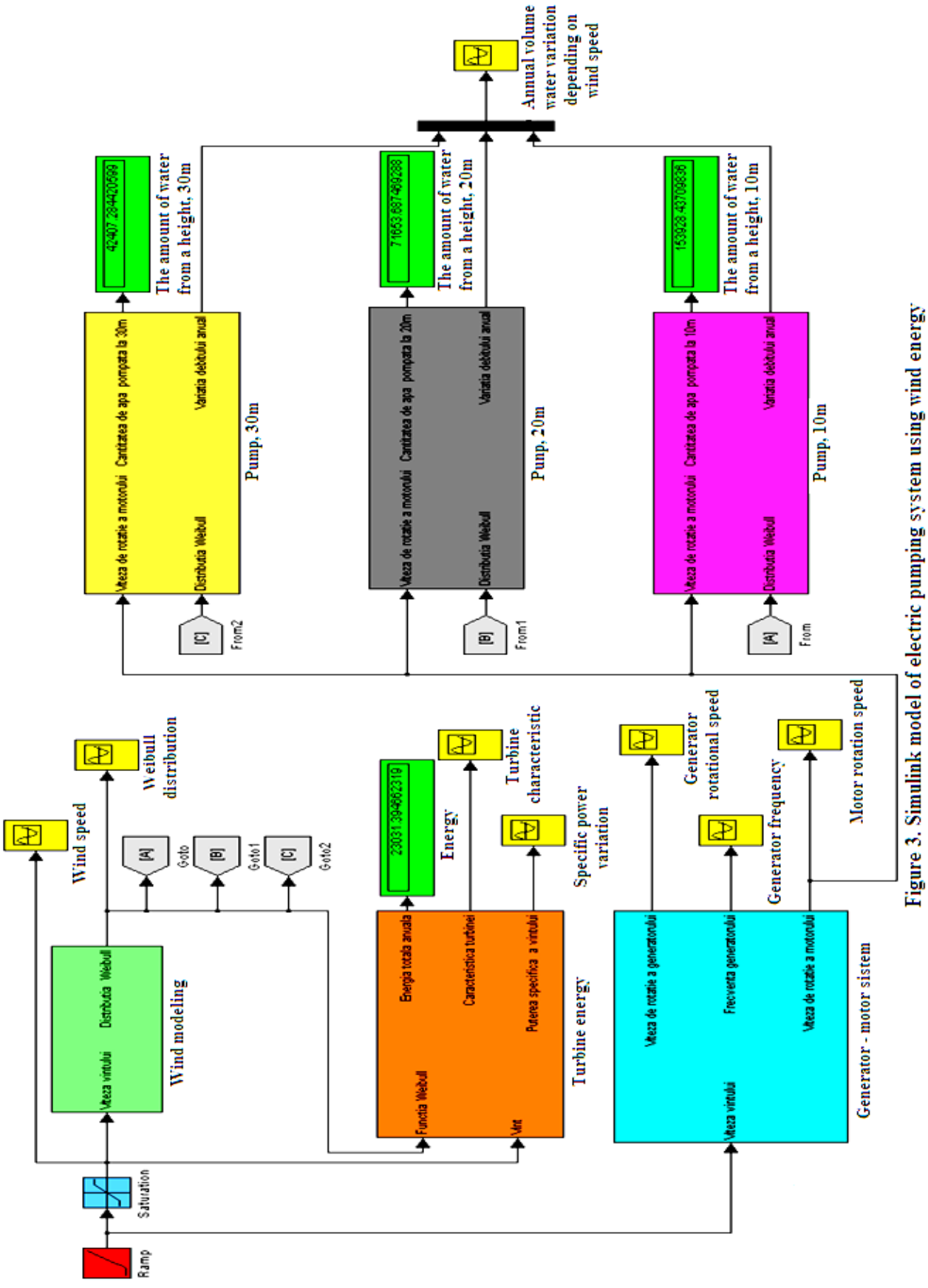

Figure 3. Simulink model of electric pumping system using wind energy

At the input of the system we have wind speed and at the output - the amount of water pumped at different static heights. Also we can calculate the annual variation of water volume as function of the wind speed. At the same time, the model allows to calculate the amount of electricity, which can be obtained from the turbine located in this site.

The proposed model allows one to calculate the characteristics of the pumping system at any point, it is only to change the coefficients for the Weibull approximation of the frequency of occurrence.

5. OBTAINED RESULTS

The amount of electricity which can be produced and the amount of water pumped to various heights for a year is presented by bloc called **Display**. Display graphics of all modeling results is performed using blocks **Osciloscop**. Furthermore, simulation results are presented in graphical form, Figure 4-10.

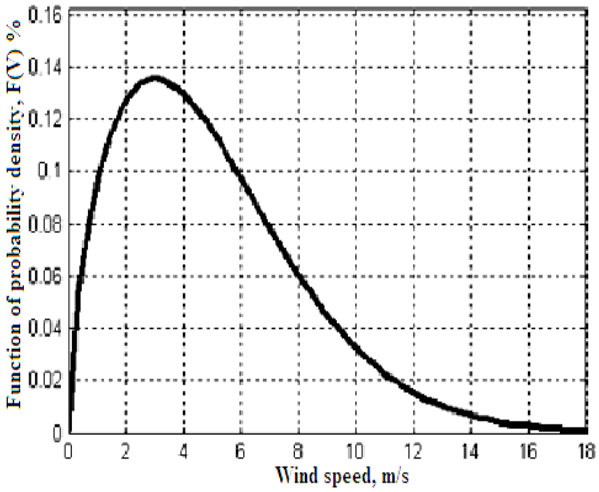

Figure 4. Weibull distribution of wind speed at Ghidighici site: parameters A = 5,6 m/s, k = 1.6

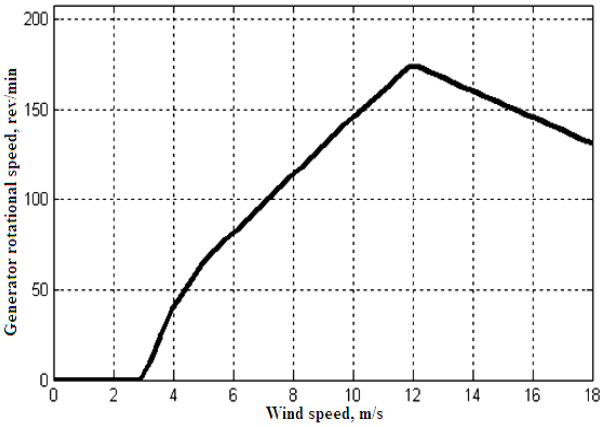

Figure 5. Generator rotational speed variation

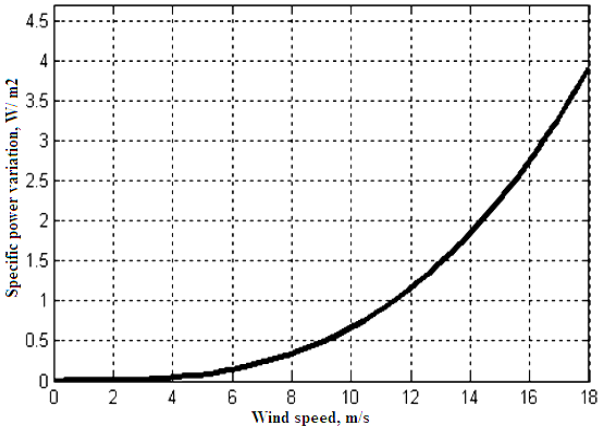

Figure 6. Wind power density variation

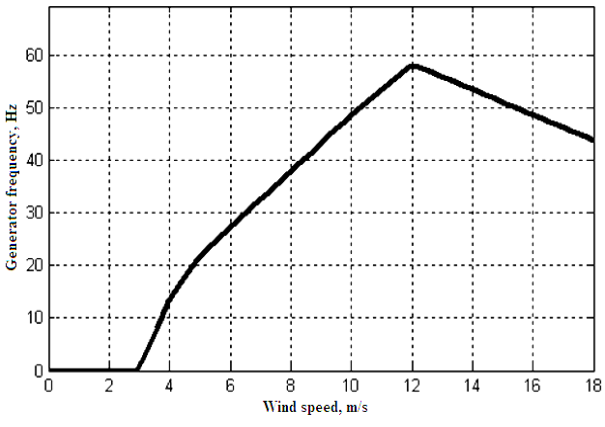

Figure 7. Generator frequency variation

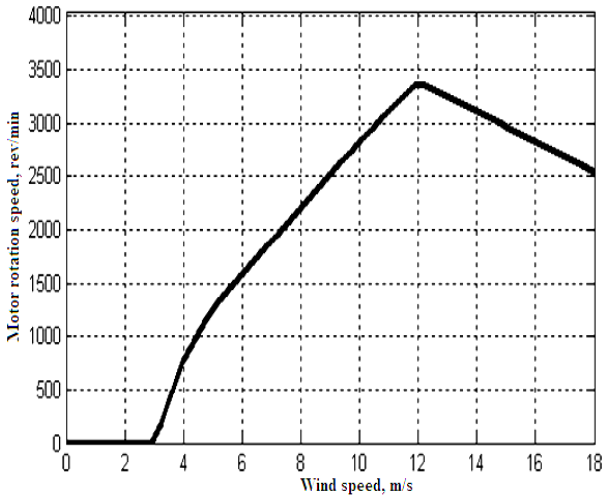

Figure 8. Motor rotation speed variation

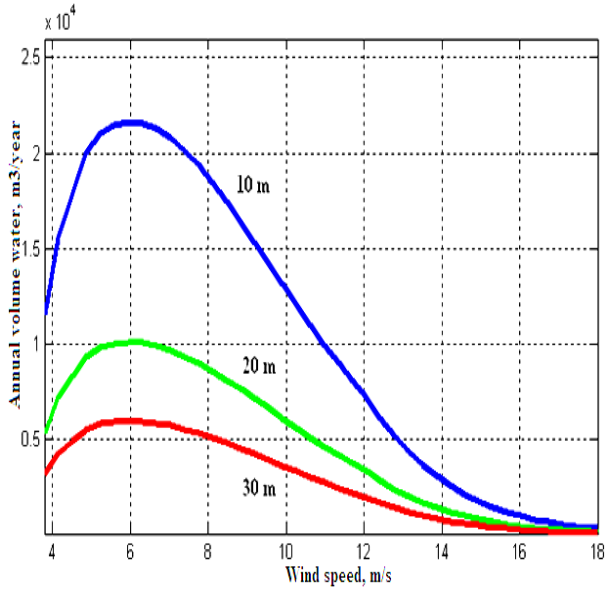

Figure 9. Annual volume water variation for different heights

6. CONCLUSIONS

Proposed Simulink model provides the calculation of steady state characteristics of a wind pumping system: the water volume, annual water volume variation depending on wind speed, the amount of electricity produced. As input data are used: frequency distribution of the wind speed for the selected site and technical characteristics of the system components - wind turbine, generator, induction motor and centrifugal pump.

For a site where annual average wind speed is equal to 5.0 m/s at the height of the turbine rotation axis, the system will pump: 154 000 m^3 to 10 m height, 72 000 m^3 to 20 m height and 42 000 m^3 to 30 m height.

7. ACKNOWLEDGEMENT

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MODIFIED CLAUS PROCESS APPLIED TO NATURAL GAS FOR SULFUR RECOVERY

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Abstract: *Approximately 25% of the natural gas being brought into production from new sources requires H_2S removal and disposal. Consequently, sulfur removal processes will play an increasingly larger role in future gas processing. As late as 1950, over half of the world sulfur supply came from "voluntary producers," that is, companies whose principal purpose was to produce elemental sulfur. Now, these producers furnish less than 5% of the world's supply and "involuntary producers," primarily petroleum refineries and natural gas plants, are the major source of the element. The most common method of converting H_2S into elemental sulfur, is the Claus process or one of its modifications. Unfortunately, the exit stream from Claus plants usually cannot meet environmental emission requirements, and, consequently, a tail gas cleanup unit (TGCU) is often employed to eliminate the last of the sulfur compounds. The most commonly used processes are Shell Claus off Gas Treating (SCOT), SUPERCLAUS, and cold-bed adsorption (CBA). This paper describes Claus and tail gas cleanup processes.*

Keywords: *sulfur recovery, gas processing, environmental protection , modified Claus process, tailgas cleanup processes.*

1. INTRODUCTION

Because approximately 25% of the natural gas being brought in to production from new sources requires H_2S removal and disposal, sulfur removal processes will play an increasingly larger role in future gas processing. Currently only two methods are available for dealing with large quantities of H_2S: disposal of the gas by injection into underground formations and conversion of the H_2S into a usable product, elemental sulfur.

However, more commonly, H_2S is converted into elemental sulfur, much of which goes into sulfuric acid production.

As late as 1950, over half of the world's sulfur supply came from "voluntary producers," that is, companies whose principal purpose was to produce elemental sulfur. Now, these producers furnish less than 5% of the world's supply and "involuntary producers," primarily petroleum refineries and natural gas plants, are the major source of the element.

The most common method of converting H_2S into elemental sulfur is the Claus process or one of its modifications. Two modified configurations are presented: straight-through and split flow:

- the straight-through process is the preferred and simplest. It can process feed streams that contain more than 55 mol% H_2S; with air or acid gas preheat, and can process 30 to 55 mol% H_2S in the feed;
- the split-flow configuration can process feeds that contain 5 to 30 mol% H_2S. The straight-through process provides the highest sulfur-recovery efficiency.

Unfortunately, the exit stream from Claus plants usually cannot meet environmental emission requirements, and, consequently, a tail gas cleanup unit (TGCU) is often employed to eliminate the last of the sulfur compounds.

The most commonly used processes are Shell Claus off Gas Treating (SCOT), SUPERCLAUS, and cold-bed adsorption (CBA).

2. PROPERTIES OF SULFUR

The thermo physical properties of sulfur are unusual. For a complete understanding of the Claus conversion process, a brief discussion of the relevant properties is necessary.

Sulfur vapor exists as S_x, where x can have values from 1 through 8. Figure 1 shows the distribution of sulfur-vapor species as a function of temperature.

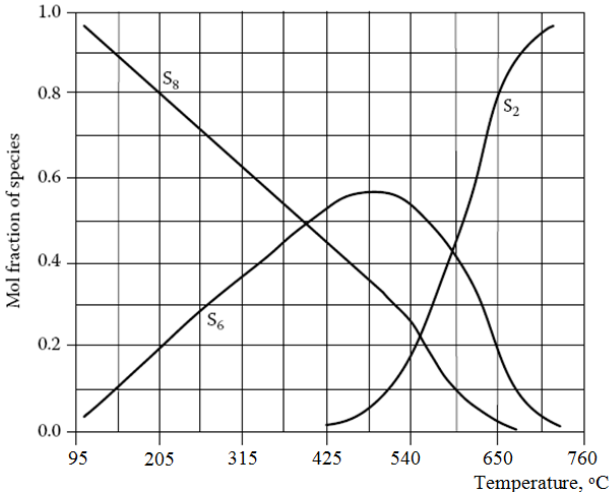

Fig.1. Sulfur-vapor species as a function of temperature.

Note that at lower temperatures, S_8 dominates, but as the temperature rises S_8 converts toS_6, and finally to S_2. The sequence is not unexpected, because increased temperature means increased energy for the molecules, which leads to the breakup of the clusters. The formation of sulfur clusters has a very pronounced effect on the physical properties that have a significant effect on processing operations, notably viscosity(fluid flow) and heat capacity (heat transfer).

3. CLAUS SULFUR RECOVERY PROCESS

All Claus units involve an initial combustion step in a furnace. The combustion products then pass through a series of catalytic converters, each of which produces elemental sulfur.

The Claus process consists of the vapor-phase oxidation of hydrogen sulfide to form water and elemental sulfur, according to the overall reaction:

$$3H_2S + \frac{3}{2}O_2 \rightarrow 3H_2O + \left(\frac{3}{x}\right)S_x \qquad (1)$$

The above overall reaction does not represent the reaction mechanism or show intermediate steps. In practice, the reaction is carried out in two steps:

$$H_2S + \frac{3}{2}O_2 \rightleftarrows H_2O + SO_2 \qquad (2)$$

$$2H_2S + SO_2 \rightleftarrows 2H_2O + \left(\frac{3}{x}\right)S_x \qquad (3)$$

The first reaction is a highly exothermic combustion reaction, whereas the second is a more weakly exothermic reaction promoted by a catalyst to reach equilibrium.

Figure 2 shows the equilibrium conversion obtained for H_2S into elemental sulfur by the Claus reaction. Kohl and Nielsen (1997) state that the unusual shape of the equilibrium curve is caused by the existence of different sulfur species at different reaction temperatures.

They point out that at a sulfur partial

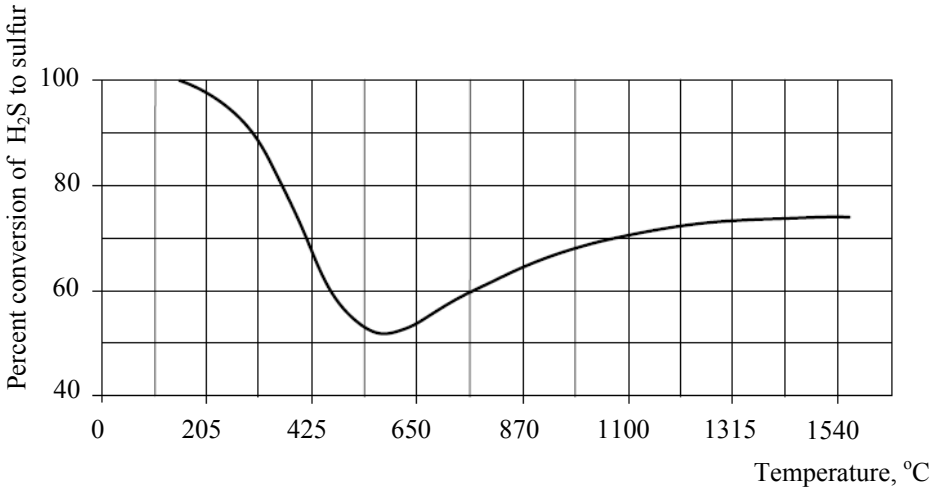

Fig.2. Equilibrium conversion of hydrogen sulfide to sulfur

pressure of 0.05 bar and temperatures below 370°C, the vapor is mostly S_6 and S_8, but at the same partial pressure and temperatures over approximately 540°C, S_2 predominates. This shift in species causes the equilibrium constant in the reaction to shift from a downward slope to an upward slope, as shown in Figure 2. This behavior has a significant effect on the operation of the Claus process. The melting point of amorphous sulfur is 120°C, and its normal boiling point is 445°C. Figure 2 shows that the maximum conversion to sulfur by reaction (1) is obtained at temperatures near the melting point of sulfur, but to maintain sulfur in the vapor state, relatively high temperatures are required. Consequently, if the catalytic converters are to operate under conditions in which the sulfur does not condense on the catalyst, they cannot operate at optimum equilibrium conversion. This is the reason for having a series of converters, with the sulfur product withdrawn from the reacting mixture between converters. Withdrawing the sulfur product causes the reaction (3) to shift to the right, which results in more sulfur product.

Figure 3 and Figure 4 show simplified flow diagrams for the two common configurations, straight through and split flow, respectively. In the straight-through configuration, the first reaction takes place in a combustion furnace operating near ambient pressure (0.2 to 0.6 bar). The air flow rate is adjusted to react with one third of the H_2S, along with any other combustibles, such as hydrocarbons and mercaptans. The H_2S reaction is exothermic (24.000 kJ/m^3, at 25°C at 1 atm) and is used to produce steam in a waste-heat boiler. Both reactions take place in the furnace - boiler combination, and the gases exit the waste-heat boiler in the range of 260 to 343°C, which is above the sulfur dew point, so no sulfur condenses in the boiler.

The combustion furnace-boiler is followed by several catalytic reactors in which only the second reaction takes place because all the O_2 has been consumed in the furnace. Each catalytic reactor is followed by a condenser to remove the sulfur formed. The gas is cooled to 149 to 204°C in the condenser to remove elemental sulfur. The condenser generally achieves cooling by heat exchange with water to produce low-pressure steam. Vapor that leaves the condenser is at the sulfur dew point, so the gas is reheated before passing to the next converter to prevent sulfur deposition on the catalyst. A combustion-furnace flame temperature of 927°C should be maintained because the flame is not stable below this value. The straight-through configuration cannot be used at H_2S concentrations below 55%, because the feed gas heating value is too low. Concentrations low as 40% are acceptable if the air or acid gas is preheated.

For H_2S concentrations in the range 25 to 40%, the split flow configuration Fig.4. can be utilized. In this scheme, the feed is split, and one third or more of the feed goes to the furnace and the remainder joins the furnace exit gas before entering the first catalytic converter. When two thirds of the feed is bypassed, the combustion air is adjusted to oxidize all the H_2S to SO_2, and, consequently, the necessary flame

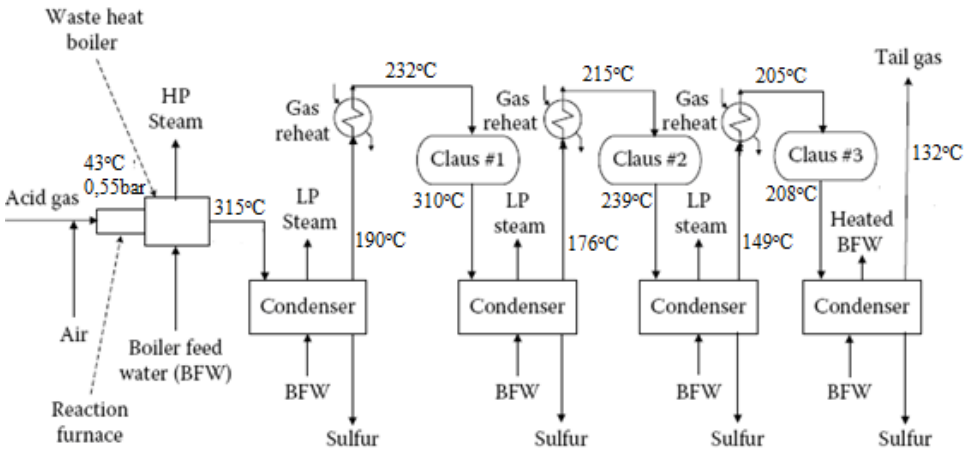

Fig.3. Straight-through Claus unit.

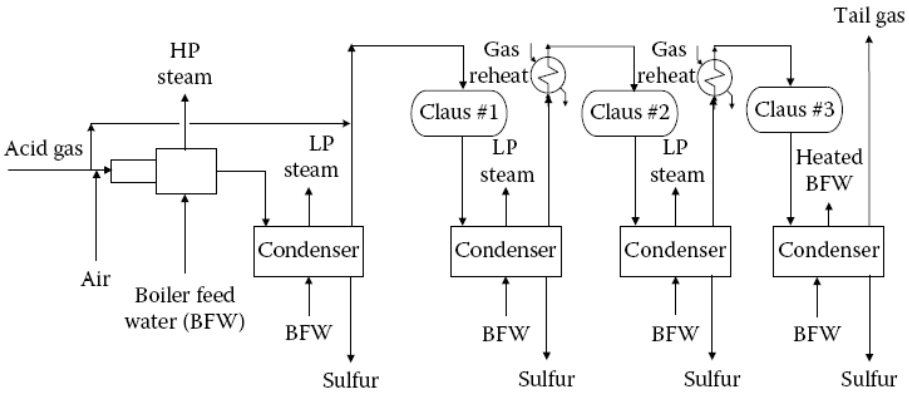

Fig.4. Split flow Claus unit. Typically two thirds of feed bypasses the reaction furnace.

temperature can be maintained.

The split-flow process has two constraints:

1. Sufficient gas must be bypassed so that the flame temperature is greater than approximately 927°C;
2. Maximum bypass is two thirds because one third of the H_2S must be reacted to form SO_2. If air preheating is used with the split-flow configuration, gases with as little as 7% H_2S can be processed. Generally, the sulfur recovery in the conventional plants discussed above varies from 90 to 96% for two catalytic converters. It increases to 95 to 98% for three catalytic converters.

4. CLAUS TAIL GAS CLEANUP

Until now, the off gas from the Claus unit was flared to convert the remaining H_2S to SO_2. Now, after sulfur emissions restrictions were imposed, environmental agencies demand higher sulfur recovery than can be achieved with a standard Claus unit, and additional treating of the Claus tail gas is needed. The tail gas cleanup entails either an add-on at the end of the Claus unit or a modification of the Claus unit it self.

The processes for this final sulfur removal are generally divided into three categories**:**

- direct oxidation of H_2S to sulfur;
- sub-dew point Claus processes;
- SO_2 reduction and recovery of H_2S.

4.1. Direct Oxidation of H_2S to Sulfur

SUPERCLAUS is an example of selective oxidation for final sulfur removal. The process as described involves a slightly modified two-stage Claus unit followed by a third-stage catalytic reactor to oxidize the remaining H_2S to elemental sulfur. Two reactors use the standard Claus catalyst, whereas the third reactor contains the selective oxidation catalyst. The Claus unit itself is operated with a deficiency of air so that the gas that exits the second reactor contains 0.8 to3 vol% H_2S. Sufficient air is added to this exit gas to keep the oxygen level in the 0.5 to 2 vol% range.

The mixture then goes to the third reactor, where the following catalytic reaction occurs:

$$2H_2S + O_2 \rightarrow 2S + 2H_2O \qquad (4)$$

The selective oxidation catalyst in the third reactor does not promote the reaction:

$$2H_2S + 3O_2 \rightleftarrows 2SO_2 + 2H_2O \qquad (5)$$

or the reverse reaction of sulfur with H_2O:

$$3S + 2H_2O \rightleftarrows 2H_2S + SO_2 \qquad (6)$$

and, consequently, a total recovery rate of 99% or higher can be reached.

4.2. Sub-Dew Point Claus Processes

From several processes of this category only the cold-bed adsorption (CBA) process is considered here because it is the most widely used. Figure.5 shows one of its many possible variations.

The front end of the unit is a Claus reactor, and the sub-dew point process takes place in the final two catalytic converters, CBA1 and CBA2.

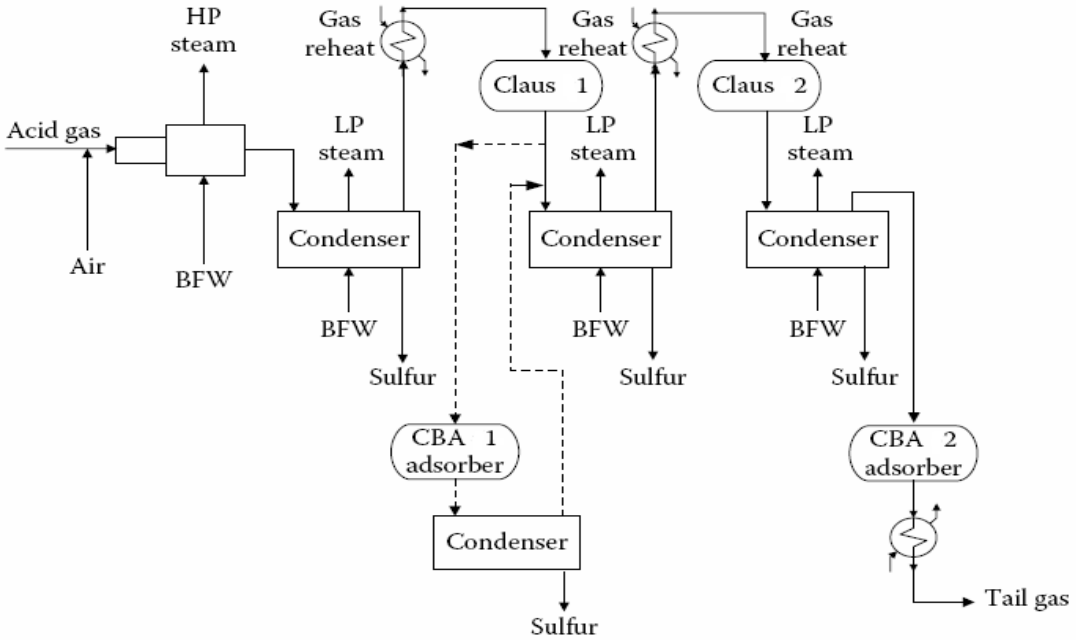

Fig.5. Cold-bed adsorption unit.
(dashed line denotes regeneration stream)

After the gas leaves the final condenser, it is not reheated but is sent to the third converter (CBA2), which is operated at a temperature well below the sulfur dew point. This flow results in a better equilibrium conversion but deposits sulfur on the catalyst and causes a gradual loss of activity. During the period that CBA2 is in service, CBA1 is being heated and regenerated with a slip stream from Claus 1. After regeneration is complete, the reactor can be cooled with a slipstream from the final condenser. When the catalyst in CBA2 is exhausted, valves are switched, and CBA1 becomes the adsorbing reactor while CBA2 is regenerated. With CBA processes greater than 99% total sulfur recoveries can be obtained.

4.3. Reduction of SO_2 and Recovery of H_2S

An example of the process that reduces the SO_2 in the Claus plant off gas back to H_2S is the SCOT process. It uses amine treating to remove the H_2S, which is recycled back to the Claus plant for conversion to elemental sulfur.

The process can produce an exit gas that contains 10 to 400 ppm of total sulfur, while increasing total sulfur recovery to 99.7% or higher. Figure 6 shows a simplified process flow diagram of the SCOT process. The feed, off gas from the Claus unit, is heated to 302°C in an inline burner, along with a reducing gas, H_2 or a CO and H_2 mixture. The reducing gas is supplied either from an outside source or generated by partial oxidation in an inline

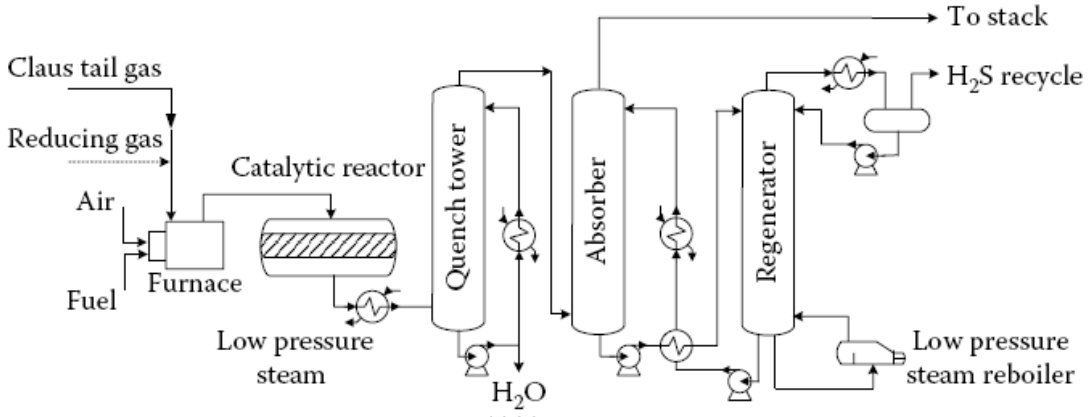

Fig.6. Shell Claus Off gas Treating (SCOT) unit

burner. The mixture then flows to the SCOT catalytic reactor (cobalt-molybdenum on alumina), where the sulfur compounds, including SO_2, CS_2, and COS are reduced to H_2S and water. The gas that leaves the reactor goes to a waste-heat exchanger, where it is cooled to about 160°C and produces low-pressure steam. The gas from the waste-heat exchanger then flows through a quench tower; where it is cooled to approximately 38°C by externally cooled recycle water in countercurrent flow. The water from the tower is condensed, and the excess water is sent to a sour water stripper. Gas from the quench tower then contacts an aqueous amine solution in the absorption column.

The amine is generally methyldiethanolamine (MDEA) or diisopropylamine (DIPA) to absorb H_2S while slipping CO_2. The gas that exits the top of the absorber contains very little H_2S (10 to 400 ppm) and is sent to an incinerator. The rich amine that leaves the bottom of the absorber flows to the regenerator, where heat is applied to strip the H_2S from the amine solution.

The overhead from the regenerator is cooled to condense the water, and the H_2S is recycled to the Claus unit. Lean amine is cooled and returned to the absorber.

5. CONCLUSIONS

In order to meet SO_x emission limits set by the Clean Air Act, refinery "sour gas" (also sometimes called "refinery gas," "still gas," "acid gas," or "process off-gas" resulting from fractionation, cracking, coking, hydrotreating, and hydroprocessing) must be treated to remove sulfur, which can also be sold.

First, the hydrogen sulfide (H_2S) is removed from the sour gas with a chemical solvent. Second, the gas is returned for use as fuel in refinery processes, and elemental sulfur is removed from the hydrogen sulfide using (primarily) the "Claus Process," which utilizes heat and a catalyst. The sulfur recovery apparatus is commonly called the "Claus Unit," "Sulfur Recovery Unit" ("SRU"), or "Sulfur Recovery Plant" ("SRP"). The gas from the SRU is referred to as "tail gas."

The exit stream from Claus plants usually cannot meet environmental emission requirements, and, consequently, a tail gas cleanup unit (TGCU) is often employed to eliminate the last of the sulfur compounds. Some refineries use incinerators for treating such tail gas, others use the Shell Claus Offgas Treatment ("SCOT") system, and still others use a solution tank treatment known as a Stretford process.

The most commonly used processes are Shell Claus off Gas Treating (SCOT), SUPERCLAUS, and cold-bed adsorption (CBA).

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THE THERMAL MANAGEMENT OF BUILDING SECTOR ENERGY SAVINGS USING ELECTRICAL DEVICES FOR HEAT TRANSFER

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Abstract: The article relates to methods and apparatus for promoting heat transfer management. More particularly, the article relates to methods and apparatus for promoting an increase of convection heat transfer in systems employing electronic components. A few methods and/or apparatus are commonly employed for providing such thermal management.

Some of those include: heat conduction, where through a material, such as copper, heat flows from a warmer temperature to a cooler temperature; natural convection, which relies on airflow for cooling without any external forces applied to the air; The present electric heater provides a novel method and apparatus to increase convection heat transfer in an electrical system. The increase in convection heat transfer is achieved by introducing a heat source in the vicinity of an element to be cooled, thereby increasing convection heat transfer, i.e. increasing the amount of airflow across the element.

Keywords: *heat transfer, convection, Coanda effect, best board heating*

1. INTRODUCTION

Recent increased interest in the development of high-performance buildings is strongly related to the *world-wide* efforts to reduce greenhouse gas emissions and to increase fissile and fossil energy savings facing fissile and fossil resources depletion. The building sector constitutes one of the most significant energy consumers, and energy reductions combined with diversification of energy production through renewable energy will have a major impact on energy savings and by reducing greenhouse gas emissions could limit actual fast climatic change (see figure 1).

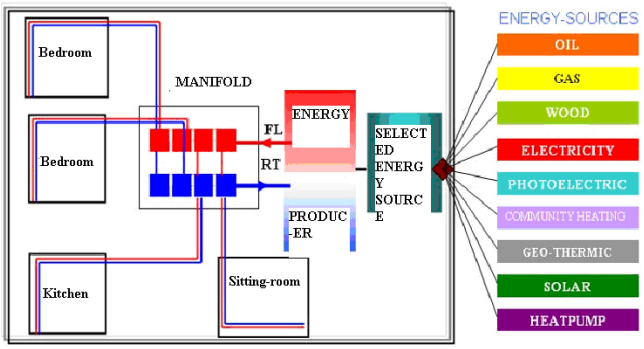

Figure 1. Alternative energy sources

Electricity is an alternative energy source [3]. The present electric heaters will become more fully understood from the detailed description given herein below and the accompanying

drawings which are given by way of illustration only and thus are not limitative of the present electric heaters.
The use of a specific heat conducting material is useful to maximize a high efficiency thermal interface between the electrical device and the environment.
The heat source may be a heating device that converts electric current to heat by means of resistors that emit radiant energy. Resistors may be composed of metal-alloy wire, nonmetallic carbon compounds, or printed circuits. Heating elements may have exposed resistor coils mounted on insulators, metallic resistors embedded in refractory insulation and encased in protective metal, or a printed circuit encased in glass.

2. CONVECTIVE HEAT TRANSFER AS THERMAL MANAGEMENT

2.1 Convective heat transfer. Convective heat transfer is one way of addressing thermal management. Convective heat transfer is the heat transfer process that is executed by the flow of a fluid over a surface of a medium. Convective heat transfer includes advective heat transfer, which is based on the velocity of the fluid flow compared to the medium, and conductive heat transfer, which is based on static fluid adjacent to the medium. In convective heat transfer, the fluid acts as a carrier for the energy that it draws from (or delivers to) the surface of the medium.

There are many ways to specify the types of convection. The flow over the surface can be specified as internal, e.g., with pipes or ducts, or external, e.g., with fins. The motive force behind the bulk fluid motion can be forced, e.g., by a fan or pump, or natural, e.g., driven by buoyancy forces caused by fluid density changes with temperature. The flow can be further classified as single-phase, wherein the fluid does not change phase or multi-phase, e.g., boiling or condensation.

There are many specific characteristics of the flow of a fluid that greatly affect the heat transfer rate from/to the medium's surface, but the two categories that govern the effectiveness of single-phase forced convective heat transfer are:
1) the rate of conduction of energy (heat) to/from the medium surface; and
2) the rate of conveyance of energy toward/away from the surface with the mass flow of the bulk fluid.

The rate of conduction is dictated by both the thermal conductivity of the fluid and the temperature of the fluid in the boundary layer. The thermal conductivity of the fluid is a temperature dependent physical property of the fluid that is being used in the convection process. The temperature of the fluid in the boundary layer is influenced by the amount of heat transferred, the specific heat of the fluid and the flow characteristics in the boundary layer. Poor flow characteristics will not allow the fluid in the boundary layer to be replaced by the bulk fluid. The major factors that determine the rate of energy conveyance are the mass flow rate of the bulk fluid and the specific heat capacity of the fluid.

2.2 The Coanda effect. The Coanda effect [1] consists of the attachment of the flow on the wall, when it has a particular shape, known as volet, or Coanda surface (figure 2). This is a cause for the presence of a force between the wall and the jet. Considering the actuator (torque motor, proportional electro-magnet, piezo-dynamic, magneto-stricter or electro-chemical actuator) make the displacement of the piston, it is very important that the resistance forces on it to be as small as possible.

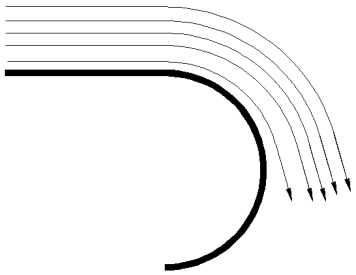

Figure 2. The Coanda effect

The name *Coanda effect* is properly applied to any situation where a thin, high-speed jet of fluid meets a solid surface and follows the surface around a curve. Depending on the situation, one or more of several

different physical processes might be involved in making the jet follow the surface.

2.3 **Sensible heat from electric equipment.** Heat transferred from electrical equipment [4] can be calculated as:

$$\mathbf{H_{eq} = P_{eq}\ K_1\ K_2} \qquad (1)$$

where

$\mathbf{H_{eq}}$ = heat transferred from electrical equipment (W)

$\boldsymbol{P_{eq}}$ = electrical power consumption (W)

$\boldsymbol{K_1}$ = load coefficient

$\boldsymbol{K_2}$ = running time coefficient

Energy efficiency is a prime consideration these days when trying to determine the best solution for temperature control in homes. Everyone wants to conserve power, save money and be kind to the environment but there is an invisible line beyond which it's not possible to save.

Table 1.
Parameters and Variables used in convective heat transfer

A_i	Area of heated panel i (m2)
F_{ij}	Gray interchange factor between panels i and j (m2)
h_i	Convective heat transfer coefficient for panel i (W/(m2/°C))
q_{i-s}	q_{i-s} = net rate of radiation heat transfer from panel *i* to all other surfaces in enclosure (W/m2)
q_{i-conv}	Rate of convective heat transfer from panel i (W/m2)
q_{i-pwr}	Rate of electrical resistance heat transfer to panel i (W/m2)
q_{i-hl}	Rate of heat transfer from panel i to guard space (W/m2)
R_t	Thermal resistance of wall (m^2 °C/W)
σ	Stefan-Boltzmann constant (W/(m2/K4))
T_{ref}	Reference temperature (°C)
$T_i \cdot T_j$	Average surface temperature of panels *i* and *j* (°C)
T_{gs}	Guard space temperature (°C)
V_i	Line voltage on panel *i* heater (volts)

For a heated surface, assuming no participation of the enclosure air in the radiant exchange, the energy balance is:

$$q_{i-conv} = q_{i-pwr} - q_{i-s} - q_{i-hl} \qquad (2)$$

where:

q_{i-pwr} is the rate of heat transfer to the panel from the electrical resistance heaters,

q_{i-s} represents the radiant exchange between room surfaces, and

q_{i-hl} is the "back loss" to the guard space.

The electrical power input to each panel was calculated from the measured voltage, the measured resistance of the heated panel, and the measured area of the panel:

$$q_{pwr} = \frac{V^2}{R \cdot A_i}\left(W/m^2\right) \qquad (3)$$

The net radiant heat transfer from the *ith* room surface to all the other surfaces in the enclosure is given by Hottel and Sarofim (1967) as

$$q_{i-s} = \frac{1}{A_i}\sum_{j=1}^{56}\left[F_{ij}\cdot\sigma\cdot\left(T_i^4 - T_j^4\right)\right]\left(W/m^2\right) \qquad (4)$$

Finally, the rate of heat transfer from the inside surface to the guard space (the "back loss"), q_{hl} , is calculated from the measured surface temperatures and the thermal resistance of the surfaces:

$$q_{i-hl} = \left(\frac{T_i - T_{gs}}{R_t}\right)\left(W/m^2\right) \qquad (5)$$

Thus, the convective flux was explicitly calculated from experimental measurements for each surface in the room. Since the guard space was controlled to the inside surface temperature, for the isothermal room configuration the only significant term on the right-hand side of the equation is q_{i-pwr}.

The convective heat transfer coefficient was calculated from the rate of convective heat transfer and the temperature difference between the surface and an arbitrarily selected reference temperature.

$$h_i = \frac{q_{i-conv}}{(T_i - T_{ref})} \qquad (6)$$

The selection of the reference temperature was arbitrary in the sense that for enclosure heat transfer, a clear and obvious choice for a temperature reference does not exist. An important part of the investigation was to examine the impact of various reference temperatures on the proposed correlations and on the experimental uncertainty associated with the heat transfer coefficients. The room inlet temperature, the room outlet temperature, and spatially averaged planar and bulk air temperatures were examined as possible references.

2. THE BASEBOARD HEATING SYSTEM BY A PLINTH

Heating system by a plinth is elegant and efficient way to heat any space being oriented to the future in terms of new trends in the construction effective.

Best Board heating technique offers the highest quality and is different in ease and speed of automatic regulation in each room, thus obtaining a significant saving of energy." Due to the possibility of self-regulation in each room, to obtain a significant saving of energy, both with a high optimum comfort. Ascent phase, the heat distributed dry exterior walls, thus eliminating the heat and humidity and heat in the irradiant inside.

The baseboard heater is now the only way to create interior climate economically and without a big investment. The part of the wall heated surface, becomes the source of radiant heat transmitted into the room. The walls are heated to a temperature of 40 ° C, 10 cm above the baseboard heater, and up to 20 ° C below the ceiling (see fig. 3)

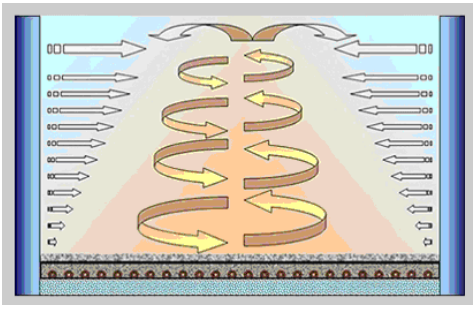

Fig.3 The wall heated surfaces

The curtain of warm air leaving the baseboard heaters (thermal veil) is issued against the wall, up and book gradually while its heat content to the inner surface of the outer wall.

The thermal veil acts as a barrier against cold, giving to the room a comfortable fit (see fig. 4).

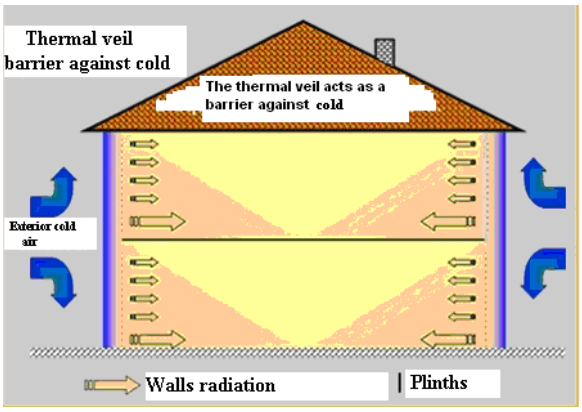

Fig. 4 The thermal veil acts as a barrier against cold

The heat content of the veil is no heat when it has cooled and has reached room temperature. Generally, this happens before the curtain air reaches the ceiling. That is why it does not accumulate any hot air under the ceiling (no cushion of surplus heat) which would be warmer that the air located in the lower layers (see fig. 5). Thus, we found only a homogeneous temperature in rooms heated by electric baseboards. It is just as hot over the floor and below ceiling. Baseboards absorb a small amount of air they spread upwards, their air movement production is barely perceptible above the floor, just before the intake of air. This very low air flow prevents dispersion of dust. The dust content in the air remains very low.

The humidity rate of ambient air is also ideal. It is always between 50 at 60%. The physics of these baseboard heaters has long remained hidden.

Their operation is very simple. The hot water heating spreads in copper or aluminium pipes (and back) battery heater and flows inside the baseboard heater. The air heats up between the fins (consisting of a bonding antistatic. No accumulation of dust), undergoes a load-bearing and passes through the top slot of the plinth. The aluminium coating emits in lowlands ideal warmth that will act against the cold down.

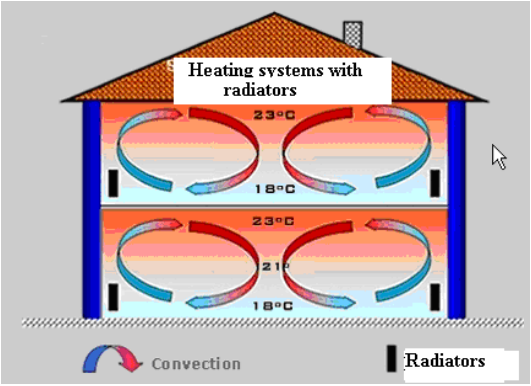

Fig. 5. The homogeneous temperature in rooms heated by electric baseboards

Thus, no cold air can circulate in the room. The rising hot air heats the wall surface on which the baseboard heater is installed (see fig. 6).

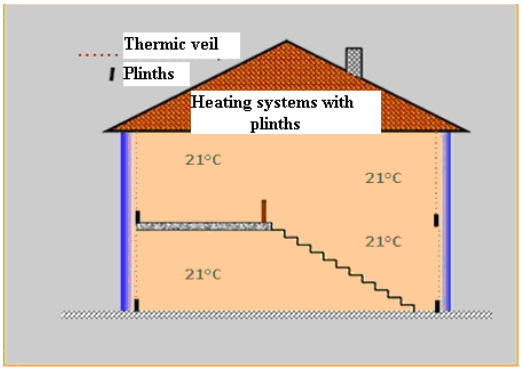

Fig. 6 The rising hot air heats the wall surface on which the baseboard heater is installed

2.1 Electrical and water plinths characteristics [5].

Table 2. Technical characteristics of electrical plinths (230 V)

Length of resistors	mm	2500	1500	1000	700
Power	W	500	300	200	140

Table 3. Cable fireproof silicone 300°C in parallel

Thermostat dimensions BB -75	mm .	width x height x depth	75 x 77 x 26
Transformer dimensions	mm	width x height x depth	107 x 125 x 161
Plinth dimension	mm	width x length	137 x 28

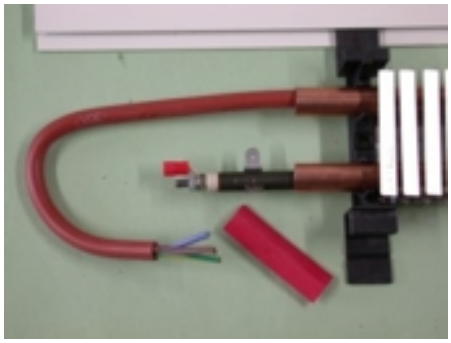

Fig. 7 Electrical plinth mounting in a house

Fig. 8 Water plinths mounting in a house

Fig.9 Water plinths mounting in a house corner

Table 4 temperature of the plinth in °C and Power [6]

Departure temperature of the plinth in °C	40	45	50	55	60	65	70	75	80	85
Power parameter in Watt	88	105	132	149	178	197	226	246	277	294

Table 5. The recommended temperature for sizing installations

Temperature difference between departure / return	5	°C
Quantity of water per meter of skirting departure / return	0.34	m
Maximum length of a circuit (ref. WH)	12.5	m
Exterior diameter of Reflon feeding pipe	13	mm
Inside diameter of Reflon feeding pipe	10	mm
Diameter of protective sheath	20	mm
Reflon tube resistance against temperature	-50°V/+130	°C

Table 6 Dimensions Thermostat,transformer/plinth for installations

Thermostat dimensions BB -75	mm .	width x height x depth	75 x 77 x 26
Transformer dimensions	mm	width x height x depth	107 x 125 x 161
Plinth dimension	mm	width x length	137 x 28

3. CONCLUSIONS

The plinth is a space heater (group) connected to a distributor (VT). The flexible pipes from the distributor to the plinth heating is up to 30 mtr. long. In some cases the distributor must be placed an additional pump. It depends on the size of that house and desired temperatures. It is also possible the plinth heater in the wall integration. It is possible to arrange a room temperature. This is the appropriate group (s) of the distributor drive an electric top. This is controlled by the thermostat in the room. It is thus possible to switch the boiler directly. The Best Board plinth electric heater is also used. This is the bottom tube of the heat-resistance element a rod pushed. This is with or without a thermostat connected to 230 volts. The bar maintains a constant temperature of 60 °C and then delivers the same performance as with water of 60° C.

The best convective heat transfer occurs when the fluid properties and flow conditions are optimized. The optimal fluid properties are high thermal conductivity and high specific heat capacity. The flow conditions that favour optimal convective heat transfer include high local fluid velocity at the medium's surface. Unfortunately, it is difficult to optimize both the thermal conductivity and specific heat capacity of a fluid, and the naturally occurring boundary layer limits the flow near the medium's surface.

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ELECTROPHYSICAL TREATMENT OF THE SECONDARY MILK PRODUCTS

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Abstract.*The analyses of the secondary milk products thermal and electric parameters during the treatment by electrophysical method are presented. The arguments are adduced that it is necessary to control temperature and its effect on the final product quality. Energy consumption and optimal time for protein extraction are presented. The results could be used at the designing and elaboration of membrane electrolyzers and thermostabilizing systems, utilized in technological processes.*

Keywords*: electrophysical technology, protein extraction, secondary milk products, membrane electrolyyers, quality*

1. INTRODUCTION

As it was noted in the documents of the International Dairy Federation, a complete and wasteless milk processing is one of the important problems of dairy industry [1]. Its importance has increased during the last 10-15 years owing to the expension of production volume of dairy products [2]. Whey contains such valuable milk components as proteins, carbohydrates, vitamins, mineral substances and virtually does not contain fats. Its biological value is very high, since the most valuable protein fraction of milk (soluble whey proteins) and almost all lactosa (71.7%) remain in whey; the energy value of whey (in calories) is minimal.

Various methods of whey processing are known allowing to produce protein concentrates used as various biologically active food additives. A special emphasis was placed in recent years to the development of various infant food formulations on the basis of whey protein concentrates [4]. A number of food and feeding stuffs are produced from demineralized whey. Since whey proteins possess high emulsifying properties, their use in confectionary industry allowed to develop new products including various pastes [5]. The methods of whey processing, which are developed and improved, possess both definite advantages and disadvantages compared one to another [6]. The thermal methods lead to denaturation at temparatures exceeding 55-60 ^{o}C; chemical methods introduce reagents in proteins; this lowers the biological value of the products and narrows the field of their application [7]. Using highly efficient, though expensive, diaphragm methods (ultrafiltration) allows to recover the maximal protein quantity. However, the less are the pore dimensions, the more expensive is application of such diaphragms. Moreover, these are methods of periodical action; this leads to decreasing in the efficiency of treatment [8]. The ion-exchange resins allow fractionation of whey proteins, though they refer to expensive materials, and long-lasting treatments for recovery of ion-exchange agents are needed [9]. When electrodialysis is used fro whey processing, a

regular regeneration of diaphragms and high energy expenditures are necessary [10].

Analysis of the state-of-the art in this field allows to conclude that the most effective methods for whey processing provide such technologies where combined methods are jointly used. The aim of the performed research was to optimize one of the electrophysical methods of whey treatment based on the electroactivation of liquid media, directed for a wasteless treatment of whey yielding high-quality products [11].

2. EXPERIMENTAL RESULTS

Electrophysical and biochemical data give evidence, that using these methods allows to recover about 60% of proteins of their total content in the initial whey (IW) in the form of protein-mineral concentrate (PMC) and to obtain a deproteinized whey (DW). It contains a major part of aminoacids, a rather high percentage of lactulose inverted from lactose during the processing as well as a residual lactose. To optimize the process, the current density, the flow rate of the liquid, the temperature, the type and the state of the diaphragm were varied.

While investigating the thermal and electrophysical parameters of the method we have found that the content of the recovered protein increased from 30 to 60% with the increase in the current density from 0.013 to 0.021 A/cm^2 , Figure 1.

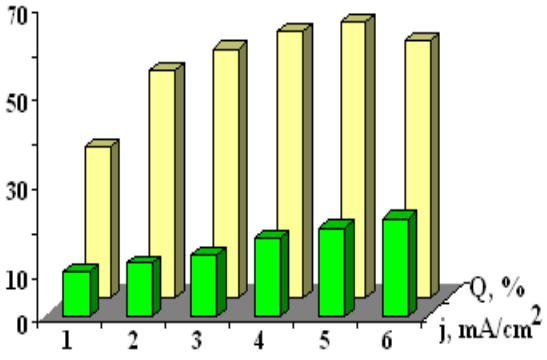


Fig. 1. Protein extraction characteristic. Protein recovery in PMC at the different values of the current density: 1 – 8; 2 – 10; 3 – 14; 4 – 18; 5 – 20; 6 – 22 mA/cm2.

The increase in the current density is accompanied by an intensive heating of the treated whey in the cathode camera, Fig. 2. The end temperature in the camera amounts to 42 ^{o}C for j = 0.021 A/cm^2; for j = 0.023 A/cm^2 the temperature increases to 60 ^{o}C and reaches the denaturation limit for protein macromolecules. Therefore, it is not possible to optimize the process over the current density only.

To optimize the method, an additional selective supply with calcium ions is appropriate not only to increase the percentage of the recovered protein in the PMC, but also

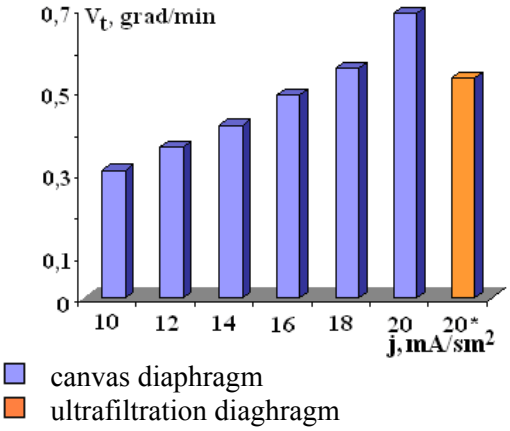


Fig. 2. Increase in the whey temparature versus the current density

to decrease the voltage and the energy expenditures, respectively Fig. 3.

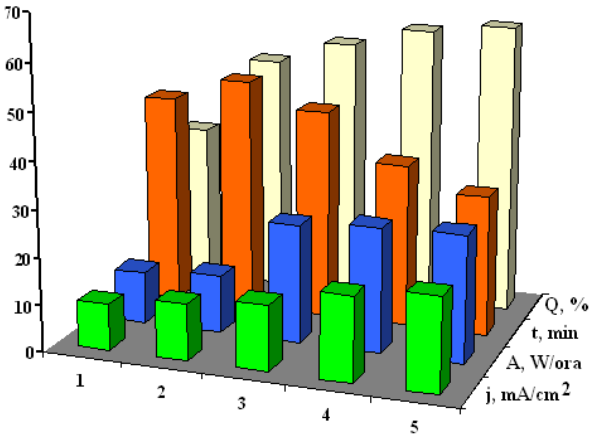
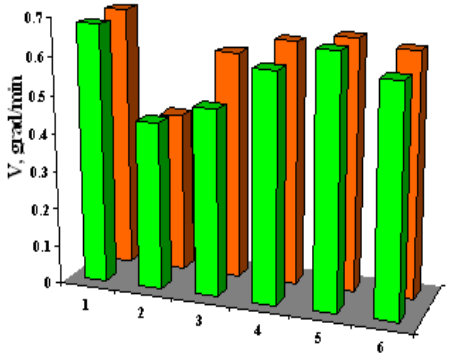


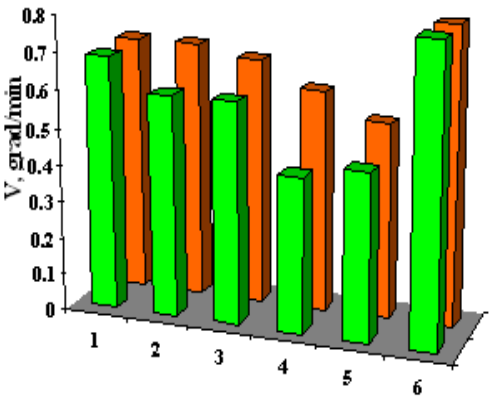
Figure 3. Qualitative dependence of the j, A, t, Q parameters from maximum values of the proteins extraction. j – current density (1 – 8; 2 – 10; 3 – 14,4 – 18; 5 – 20), mA/cm2,A– energy consumption, W/h;t – time, min;Q – recovered protein quantity, maximum value, %.

The temperature characteristics independent of the composition of the anode liquid and the diaphragm type do not influence the protein yield, Figure 4, 5. However, a preliminary continuous cooling of the IW is necessary during the treatment to avoid approaching the denaturation limit. Therefore, the treatment temperature did not exceed 55-60 ^{o}C in all the experiments.



- over the total period of treatment;
- during 45 min of treatment

Fig. 4. Temperature increasing for various solutions of the anode liquid and treatment duration, canvas diaphragm: (1) initial whey, (2) 10% $CaCl_2$ solution in the DW, (3) 5% $CaCl_2$ solution in the IW, (4) 1% $CaCl_2$ solution in distilled water, (5) 1% $CaCl_2$ solution in the DW,(6) 1% $CaCl_2$ solution in the DW

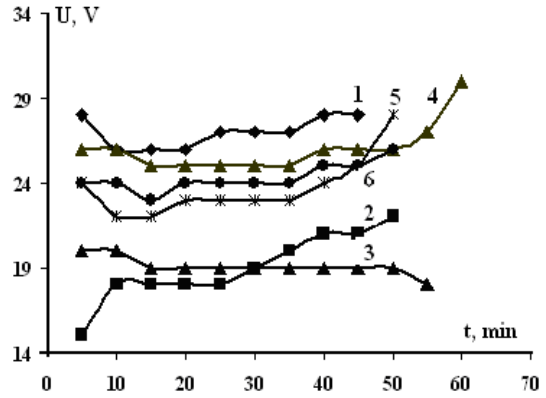


- over the total period of treatment;
- during 40 min of treatment

Fig. 5. Temperature increasing for various diaphragms, solutions of the anode liquid and treatment duration: (1) initial whey, canvas diaphragm, (2) 1% $CaCl_2$ solution in distilled water, canvas diaphragm; (3) 1% $CaCl_2$ solution in the DW, canvas

The optimization was performed according to two directions: by variation of the composition of the anode liquid with the aim to increase the protein yield and conserve the DPW to be suitable for further processing, as well as by variation in the diaphragm type to decrease the energy expenditures and to perform the process purposefully.

In the case of a canvas diaphragm and various compositions of the anode liquid, particularly when $CaCl_2$ solution in distilled water was used, a protein deposition on the diaphragm surface was not observed. The process was accompanied with an intensive foaming. Evidently, an intensive migration of calcium ions through the diaphragm facilitates the PMC formation. When an ion-exchange diaphragm MK-40 is used, a considerable voltage lowering, Figure 6, 7 and the increase



Fig, 6. Voltage variation for various composition of the anode liquid; canvas diaphragm: (1) initial whey, (2) 10% $CaCl_2$ solution in the DPW, (3) 5% $CaCl_2$ solution in the IW, (4) 1% $CaCl_2$ solution in distilled water, (5) 1% $CaCl_2$ solution in the DW,

(6) 1% $CaCl_2$ solution in the DW

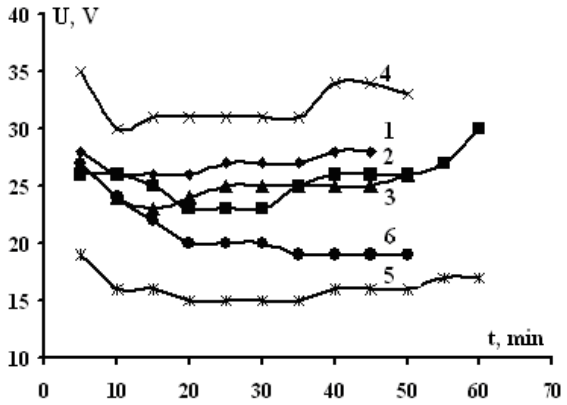


Fig. 7. Voltage variation for various diaphragms and compositions of the anode liquid: (1) initial whey, canvas diaphragm, (2) 1% $CaCl_2$ solution in distilled water; canvas diaphragm, (3) 1% $CaCl_2$ solution in the DW; canvas diaphragm, (4) IW, ultrafiltration diaphragm, (5) 2% $CaCl_2$ in distilled water; diaphragm MK-40, (6) 2% $CaCl_2$ solution in distilled water, diaphragm MK-40; (1) – (5) through regime is 5 ml/min; (6) stationary regime

in the protein percentage in the PMC (to 70% of the IW) were observed, Figure 8.

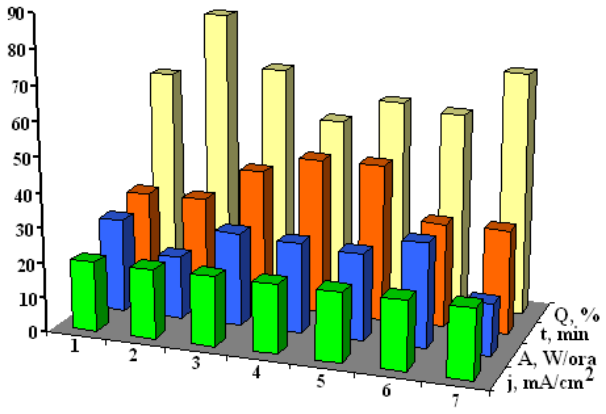


Fig. 8. Application of The Different Membranes And Liquid Anodic Solutions In Dependence of the Recovered Protein Maximum Quantity:1 - Iw, Prelate Membrane (Pm); 2.– 10% Sol. $Cacl_2$ In Dw, Pm; 3.- 5% Sol. $Cacl_2$ In Iw, Pm; 4. –1% Sol. $CaCl_2$ in Water (distilled), industry,PM; 5. –1% sol. $CaCl_2$ in Water (distilled), PM; 6. – IW, ultra filtration membrane; 7. - 2% sol. $CaCl_2$, ion selective membrane MK-40.

3. CONCLUSION

The study of thermal and electrophysical parameters of whey processing allows to analyze and substantiate the effective regimes for the recovery of valuable components, to optimize the combination of various parameters and treatment conditions with the aim to produce an ecologiclaly pure and of high quality protein-mineral concentrate and lactose-lactulose product to be used in the food and pharmaceutical

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INTEGRATED SYSTEM FOR AIR TRANSPORT OF DANGEROUS GOODS

Eugene BUSA
FPC IFPTR ARAD

"One machine can do the job of fifteen ordinary men.
No machine can do the job of one extraordinary man "
- Elbert Hubbard.

1.STADIUL REVIEW OF TRANSPORT OF DANGEROUS GOODS

In the present period there was a sharp acceleration of the deployment of processes and phenomena that surround us, natural or artificial. And the need for transport is growing larger, so that aircraft are required dynamic performance and traffic safety increasingly higher. However, they still require a set of ecological conditions on harm reduction, lower operating costs and improving maintainability thus leading, as in modern aircraft to be fitted intelligent devices to control the operation and provide information useful to diagnose the technical state.

As a result of global economic development and technical progress in the last century, increased the transport of dangerous goods. Air transport of dangerous goods have a particular importance in the overall transportation system in our country because they are an active factor in ensuring the production process between businesses and particularly in the sphere of material dangerous goods.For smooth movement of dangerous goods transport business operating personnel of companies must have specific tasks to work on that to know in detail and implement them fully.

Unification of Europe into a single unitary structure - the European Union and the transition to the European single currency, the Euro has led to changes in legislation implicitly European. Union countries are trying to achieve a light transport standard to allow for transport of dangerous goods high quality and security while taking into account environmental protection.

Security in transport of dangerous goods covers a multitude of factors that may directly or indirectly influence of business conditions in this domeniu.Astfel, staff qualifications and professionalism of the transport of dangerous goods, education of all road traffic participants, the technical condition and amenities aircraft carrying dangerous goods, quality of infrastructure are factors contributing to the smooth conduct of transport security and safety.

Completing the integration and harmonization of legislation to complete the European Union in particular regarding

market access and professionalism as well as measures to improve safety through education and training at European Union level, providing and developing information systems for the aviation network, provide air transport in Romania can compete on equal terms with the worldwide air transport.

In order to protect the unwanted events that could occur have been developed at the UN level, a series of stringent measures, technical and legal nature, which apply domestic and international traffic of dangerous goods. Compliance with these measures make possible the safe transport of dangerous goods in rail traffic, road, water, air, multimodal and handling of goods. The measures relate to packing, loading and transport using some modern technology (containment, pallets and packing). As a result of the need to harmonize legislation with European legislation regarding the carriage of dangerous goods in order to facilitate economic exchanges with countries in Europe, Romania has joined the Technical Instructions for the safe transport of dangerous goods by general air.Principal governing the international transport of dangerous goods by air are contained in Annex 18 to the Convention on International Civil Aviation. Detailed technical instructions contain all the instructions necessary for safe international transport of dangerous goods by air. Dangerous goods can be transported safely to the air whether the principles that have been adopted as technical instruction. They are designed to facilitate transport while providing a high level of safety, so that dangerous goods can be transported safely to the aircraft or its occupants and providing all the conditions of an incident if it is not an accident can lead.

Man-aircraft-environment relationship in terms of dangerous goods is complex and involves at least three distinct sub-components:

- SUBSYSTEM-TO REFER TO HUMAN CONSCIOUSNESS AND HUMAN FACTOR REQUIRED EXPERTISE HANDLING AND TRANSPORT OF DANGEROUS GOODS-awareness of the dangers of dangerous goods, learning and continuous training to raise the level of training of personnel involved in the transport process.

- ENVIRONMENT SUBSYSTEM-TO RELATE TO PHYSICAL AND CHEMICAL PROPERTIES OF DANGEROUS GOODS AND THEIR IMPACT MEDIOAMBIENTAL-characteristics of hazardous substances, mainly present danger and environmental impact.

- AIRCRAFT SUBSYSTEM-TO RELATE TO THE TECHNICAL ASPECTS OF CONSTRUCTION OF AIRCRAFT CARRYING DANGEROUS GOODS-constructive-functional characteristics of means of transport for dangerous goods.

CONCLUSIONS ON THE INTEGRATED AIR TRANSPORT OF DANGEROUS GOODS

Development, modernization and improvement of air transport is possible by completing and harmonizing legislation in the countries of the European Union road, improving road safety and raising the level of staff training that is involved in transport.

In terms of human subsystem: Worldwide, European and national

efforts are made to prevent any major accidents resulting in property damage, casualties or environmental pollution, because the human factor plays a decisive role in carrying out transport operations.

In this context through the transport of dangerous goods is appropriate to make the following proposal:

- All persons involved in shipping, transportation or professional intervention should be formed to meet the requirements of their activities and the responsibility imposed by working with these dangerous substances.În these conditions will possess expert knowledge on the characteristics of hazardous substances and articles can be transported, their hazards, emergency equipment required, and recommendations on how to proceed and act when there are losses (spills, leaks) or events (fires, explosions, contamination) that poun endangered human life or health, jeopardize the integrity of the material assets (buildings, machinery, facilities), or affect environmental quality.

In terms of the environment subsystem:

Use of chemicals has resulted in the need of solving problems of humanity, but without knowing the consequences or the price to be paid later to reduce environmental degradation or health. Today, clearly it is known that many synthetic chemicals are suspected to generate environmental and health damage, it being found in many products that we consume daily, or being present in our environment.

Source of concern is the scarcity of knowledge about the impact of many chemicals on human health and the environment. EU chemicals policy must ensure a high level of protection of human health and the environment, both for existing generation and future generations, while the effective functioning of the internal market and competitiveness of the chemical industry. To achieve these objectives, the precautionary principle is fundamental. Another important objective is to encourage the substitution of hazardous substances with less hazardous substances where suitable alternatives are available.

In this context through the mitigation of dangerous goods on the environment is appropriate:

To prevent accidents or incidents, all actors in the transport of dangerous goods here include: shipper, carrier, receiver, charger, charger tanks, packer, the operator of tanks or containers, have set responsibilities of a non-exclusive manner, which is interwoven so that error is virtually eliminated. Participants in the transport of dangerous goods must be trained to meet the requirements of their activities and the responsibility imposed in the exercise of their activities. In those circumstances will possess expert knowledge on the characteristics of hazardous substances and objects that can be transported, their hazards, emergency equipment required, and recommendations on how to proceed and act when there are losses (spills, leaks) or events (fires, explosions, contamination) that endanger human life or health, jeopardize the integrity of materials (buildings, machinery, facilities), or affect environmental quality.

Awareness of the dangers presented by dangerous goods transported must concern not only the sender, carrier and consignee of dangerous goods ***but recommend that crucial first step of creating specialized teams to intervene promptly and professionally with the***

highest incidents, accidents involving dangerous goods .This own body, well defined tasks structured field of dangerous goods in the future could prevent major accidents resulting in increased property damage, casualties and increasing environmental pollution accentuată.These teams to be effective there must be in Each county can operate promptly and be composed of professionals who know in detail the properties currently periculoase.The fire men goods are overwhelmed with the problems of dangerous goods demonstrating countless times (see Mihăileşti accident, etc..) their inability manage this area.

Proposals on measures proposed to prevent the aggression of dangerous goods on the environment are:

- Designation for each ***(company or office), shipper or carrier of one or more safety advisors for dangerous goods***;
- Continuous training of personnel functions which contribute to the safety of dangerous goods
- Procedures for implementing emergency measures and, where appropriate, drafting of the report, in case of accidents, incidents or serious infringements recorded during transportation, loading or unloading of dangerous goods
- Verification procedures for equipment used in the transportation, loading or unloading of dangerous goods;
- Implement necessary measures to prevent recurrence of accidents, incidents or serious misconduct during transportation, loading or unloading of dangerous goods

- Check that the personnel involved in the transport, loading or unloading of dangerous goods have detailed procedures and work instructions;

- Take measures to raise the risk inherent in transport, loading or unloading of dangerous goods.

In terms of aircraft subsystem:

Aircraft carrying dangerous goods must have as many safety systems to carry dangerous goods in a safe maximum.

As a result of global economic development and technical progress in the last century, increased the transport of dangerous goods. International carriage of dangerous goods is regulated by international agreements. In order to protect the unwanted events that could occur have been developed at the UN level, a series of stringent measures, technical and legal nature, which apply domestic and international traffic. The measures relate to packaging, cargo handling, loading and transport using some modern technology (containment, pallets and packing) and that these measures make possible the safe transport of dangerous goods in rail traffic, road, water, air, multimodal . These rules are approved by international organizations and are updated periodically to take account of technical progress and improve safety. The Maastricht Treaty established the European Community's competence to deal with transport safety.

Mode of transport of dangerous goods must be chosen according to the risk that it involves their transport. The main objective risk assessment of the goods / hazardous substances is to provide a reliable

database to decide safeguards / security measures (risk management) based on specific uses.

Risk assessment provides an estimate of the situation in which if a substance used as specified by the scenario of exposure could cause adverse effects. This includes a description of the nature and effects a calculation of probability that they happen, and to assess the development or magnitude.

Proposals for the aircraft carrying dangerous goods and means of transport of dangerous goods are:

- To increase safety in the transport of certain hazardous substances aircraft carrying dangerous goods must be equipped with advanced safety systems and authorized to carry certain categories of dangerous substances according to the danger posed by them.
- Type of aircraft used to transport dangerous goods must be chosen according to the risk that it involves transportation. The main objective risk assessment of dangerous goods and substances is to provide a database for groups of substances to decide safeguards / security measures (risk management) for transportation.
- Provide aircraft carrying dangerous goods by high-performance security systems to reduce the risk of incidents / accidents while increasing the safety of these shipments.
- Sharing of dangerous substances according to the state of aggregation of these risk factors present in the class of risk and appropriate identification of each type of transport aircraft (cargo or people).

The issue of dangerous goods is one of the most acute problems of modern trade, the implications of this problem affecting both broad economic structures, and public administration, social security, etc.. The implications of cross-border issues of dangerous goods, as evidenced by the consistency of interventions specialized agencies of the UN, EU and national regulations note the contents of the common area.

Romania's interest in order to bring safety concerns in the field and give these products becomes evident logistics realism and modernity, thus providing reliable trading partners and potential partners in Romania. However, this involvement requires extending the approach to the problem of dangerous goods and formative structures, which provide the relevant powers.

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PHYSICAL PARAMETERS INFLUENCE IN FRIED POTATOES PROCESSING

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Abstract: *Paper presents reducing of Acrylamide content forming by process steps optimization of fried potatoes. It is presented the impact of fried potatoes slices humidity, inlet and outlet process temperature in Acrylamide forming. There is also presented Acrylamide potential measured with different laboratory equipment.*

Keywords: *frying, temperature, moisture, Acrylamide.*

1. INTRODUCTION

Acrylamide is a „potential human carcinogen" substance and therefore poses a serious HAZARD to human health. The magnitude of the real risk cannot be evaluated and a non effect level has not been established so far. In this respect the ‚ALARA Principle'(As Low As Reasonably Achievable) is applied by snacks producer in order to minimize the Acrilamide content as result of food processing. Potato Snacks and are at the top of the list of amounts of Acrylamide found per kg of final product. The issue is known since 2002. Mitigation in different European countries is not done with the same emphasis and priority.

Potatoes tubers are washed, pilled and cut in slices. Raw, washed and partially dried slices go through the deep fryer to be steadily deep-fried in hot edible oil. The process of deep frying is divided into three phases which vary depending upon the aid of the physical processes on and in the product characteristic features resulting from it.

The first phase of the crisp building is called vaporization. This phase is characterized by the uninhibited vaporization of the freely contained water and unbound water in the cell membranes and cell walls. This phase is executed in the deep fryer, generally in the area of the turn wheels.

Under the dipping belt or pressure belt many product features are already created. Here the drying of the product takes place. Essentially the vaporization occurs to macromolecules (starch, proteins, pectin) of bounded water. The usual boiling temperature does not manage to convert this water directly into steam. The last phase is called cooling and is typical for the process on the discharging transporting belt. [4]

The driving factor for the vaporization is the oil temperature. The higher temperature, the more intensely and the shorter is the deep frying process.

The edible oil circulation system is an open system without pressure and exists on the deep fryer basin with entering and outlet canals, a fine material separation, a main pump, a temperature regulation system, a heat exchanger as well as one or more edible oil buffer tanks with the suitable pumps and conduit systems for the filling and refilling. In addition, a heat exchanger is necessary for the edible oil cooling, to cool the edible oil quickly after equipment shutdowns or while shutting down the equipment. [2]

A very important driving factor in Acrylamide reducing is represented by the frying temperature. A low frying temperature can reduce the impact of Acrylamide forming.

The stabilization of the product moisture occurs through the duration of the slices in the deep fryer. In the zone of the finished baking, that means the point in the deep fryer where the intense steam development has already decreased and the slices only release a little water, the greatest possible control is necessary in the product guidance. This is managed by the so called pressure belt (preferably the under diving belt, submerging belt) under which the slices are piled up at the outlet from the last paddle. [3]

The final humidity content in finished goods is also very important as a potential in Acrylamide forming. The humidity should be as high as acceptable from technological process point of view. [5]

2. MATERIALS AND METHOD

Moisture content of fried potatoes slices was measured with a thermo hygrometer. Is an instrument used for measuring the moisture content in the environmental air, or humidity. Humidity is difficult to measure accurately. Most measurement devices usually rely on measurements of some other quantity such as temperature, pressure, mass or a mechanical or electrical change in a substance as moisture is absorbed. From The classic laboratory method of measuring high level moisture in solid or semi-solid materials is loss on drying (LOD). In this technique a sample of material is weighed, heated in an oven for an appropriate period, cooled in the dry atmosphere of desiccators, and then reweighed. If the volatile content of the solid is primarily water, the LOD technique gives a good measure of moisture content. Because the manual laboratory method is relatively slow, automated moisture analyzers have been developed that can reduce the time necessary for a test from a couple hours to just a few minutes. These analyzers incorporate an electronic balance with a sample tray and surrounding heating element. Under microprocessor control the sample can be heated rapidly and a result computed prior to the completion of the process, based on the moisture loss rate, known as drying curve. [1]

Inlet end outlet temperature of oil inside frying equipment was read on equipment electric panel. Temperature values are read thanks to two sensors which are installed at the entrance and at the exit of frying equipment.

3. RESULTS AND DISCUSSIONS

By definition, the entering temperature is between 180 ºC and 185 ºC. This temperature range may be left only to produce special crisps with a higher fat content. The temperature must be stabilized by using a regulator and may vary in the stable maximum of an area from +/- 0.5 % ºC around the set nominal value of oil. (Table 1)

Deep fried is basically up to the moisture defined in the process specification, normally within 1-2%. If the moisture sinks less than 1%bundesirable effects appear like excessive fatness, darker coloring, burnt taste and a high Acrylamide value.

Deep fryers are to be designed with a temperature difference of 15-20K. Therefore the outlet temperature is normally between 160 to 170 ºC. In case of special requirement, like the reduction of undesirable conducted substances which can originate during the deep-frying, the outlet temperature can lowered to 150 ºC. Deep-frying less than 150 ºC outlet temperature is to be avoided.

Figure 1 – Moisture content in fried potatoes

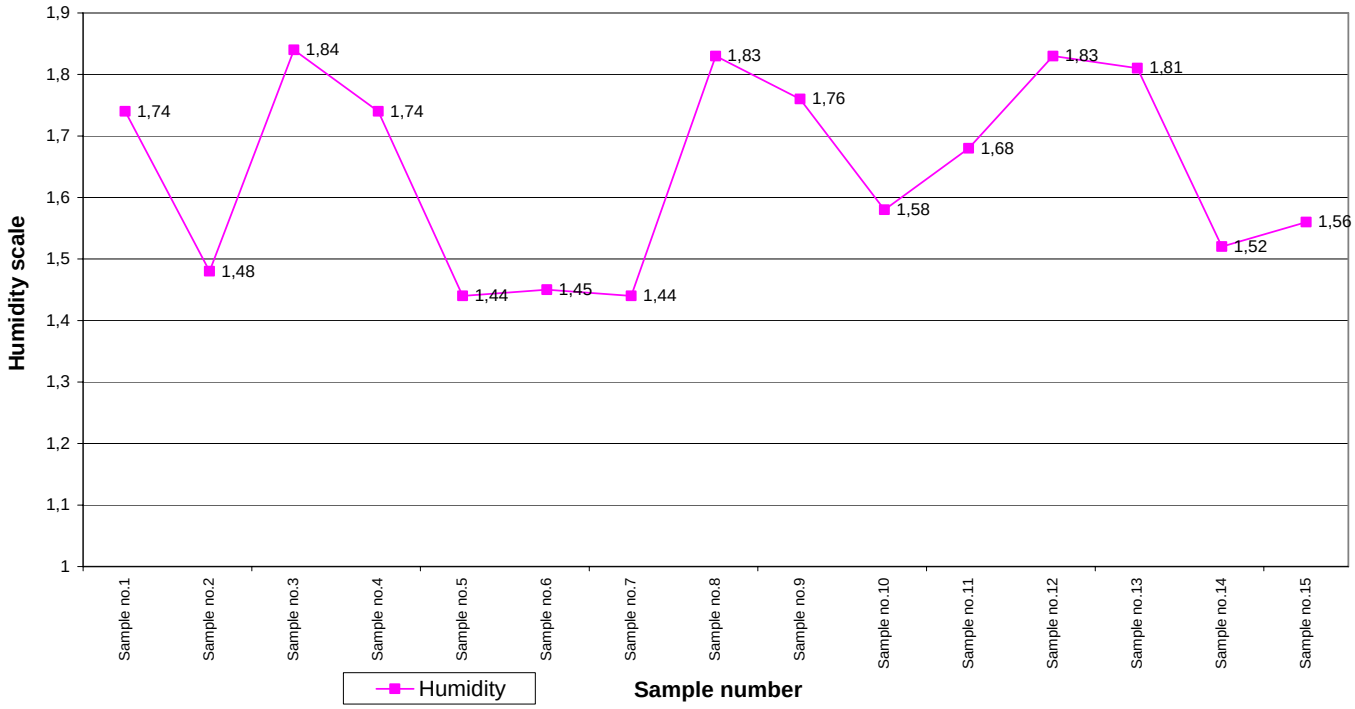
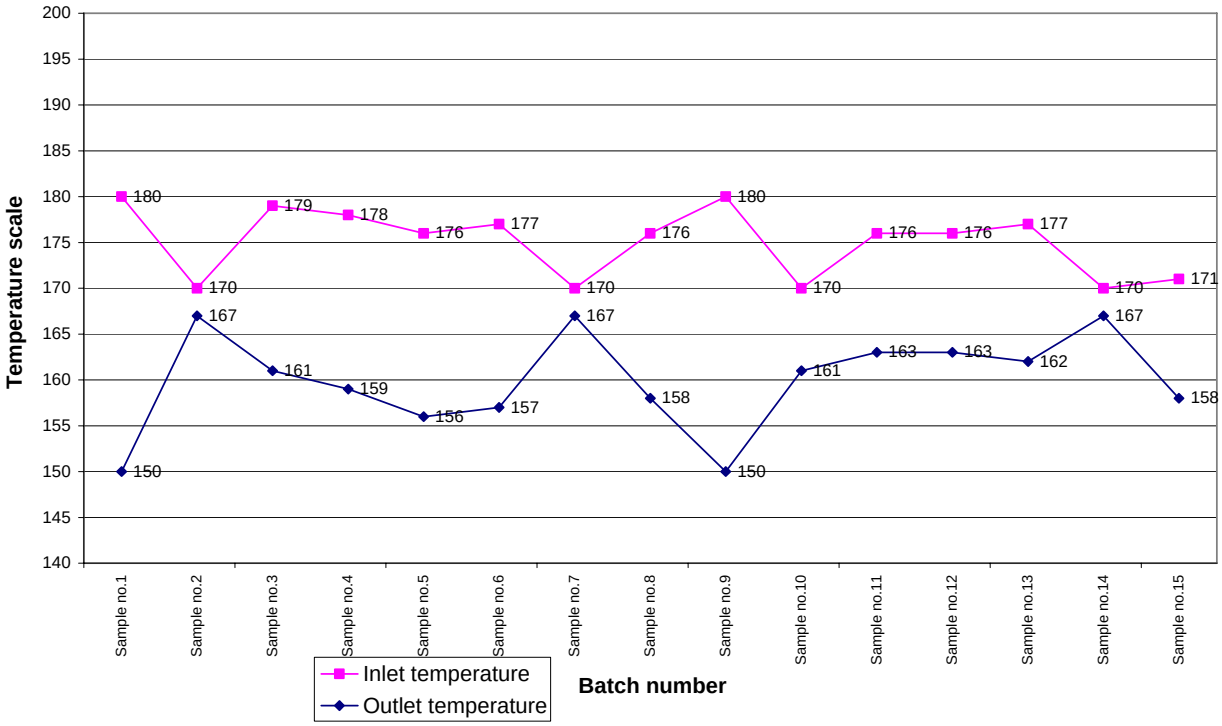


Table 1

Crt.no.	Date	Frying temperature in, °C	Frying temperature out, °C	Moisture, %	Sample number
1	03.01.2011	180	150	1,74	Sample no.1
2	03.01.2011	170	167	1,48	Sample no.2
3	11.01.2011	179	161	1,84	Sample no.3
4	11.01.2011	178	159	1,74	Sample no.4
5	17.01.2011	176	156	1,44	Sample no.5
6	17.01.2011	177	157	1,45	Sample no.6
7	25.01.2011	170	167	1,44	Sample no.7
8	02.02.2011	176	158	1,83	Sample no.8
9	02.02.2011	180	150	1,76	Sample no.9
10	10.02.2011	170	161	1,58	Sample no.10
11	10.02.2011	176	163	1,68	Sample no.11
12	14.02.2011	176	163	1,83	Sample no.12
13	14.02.2011	177	162	1,81	Sample no.13
14	22.02.2011	170	167	1,52	Sample no.14
15	22.02.2011	171	158	1,56	Sample no.15

Figure 2 – Inlet and outlet oil temperatures inside fryer



Oil temperature must be continuously documented to guarantee a well organized production procedure. Also moisture percentage is to be constantly monitored. This is the best achieved by the use of on-line controls which allow an immediate reaction in the process. In order to control the moisture percentage, an on-line measuring sensor in the discharger of the deep fryer must be installed at the point after which the crisps have already left the oil bath for 25-30 seconds. (Fig. 1) Ideally, for any given defined oil temperature, the dwell-time should be the same for the crisp with the same slice thickness.

To reduce the number of variables in production line the once temperature is set, based on the kind of potato and lot, the differences from one deep fryer to another deep fryer should be kept or be changed as little as possible. (Fig. 2)

3. CONCLUSIONS & ACKNOWLEDGMENT

Basically, zoned deep-fryers with at least three oil entering and three oil outlets are very important to obtain a good product from quality point of view. Furthermore the zoned deep-fryer guarantees a higher flexibility with the setting of the temperature profile. Finished goods has a natural-yellow color, so a natural aspect, and has also characteristic crispiness of fried potatoes slices. Moisture variations must be controlled / monitored in order to avoid dark potatoes slices, because dark potatoes slices mean high Acrylamide content. The frying time per slice must be uniform with a right temperature profile for reducing Acrylamide.

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POTATOES CRISPS QUALITY FROM FIELD TO FINISHED PRODUCT

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Abstract: *The following descriptions provide a listing of the critical specifications for the raw materials which are used in potatoes crisps production. An unacceptable number of quality deviations must be detected during the process in order to isolate the reasons for these deviations. There are also presented measures during of crisps production in order to avoid process fluctuations.*

Keywords: *potatoes, starch, processing, chips*

1. INTRODUCTION

The quality of the raw materials has a significant influence on every step in the manufacturing process. As a consequence, if the raw material already is under standard at the beginning or it gets worse during the storage in the plant, the finished product specification cannot be met.

2. TECHNICAL REQUIREMENTS

2.1 Potatoes. Conducting harvest in a timely manner is critical in the production of high quality potatoes that are in demand by the market. A timely harvest will not improve the quality of the potatoes, but a crop can be lost if harvest is not timed appropriately.

All irrigators strive to eliminate soil moisture deficits to produce a high yield of good quality potatoes. Irrigators must understand both soil-water and crop characteristics, in order to determine when and how much to irrigate.

A wide range of insect, disease and weed pests can attack potatoes. The key to successful production of potatoes without the use or synthetic pest control products is prevention and plant nutritional health. Potato fields that have been planted properly will produce complete stands of uniform plants. With adequate mid-season management, they will produce high yielding, top quality, and profitable crops. (Fig.1)

Plant misses result from seed decay, planter skips or blind seed pieces. A plant adjacent to a "miss" produces higher than average yield. However, the increase is not sufficient to compensate for the zero yield of the missing plant.

Plants adjacent to misses generally produce oversize tubers that bruise more easily and are more subject to hollow heart, knobs and deformities.

Production costs for a field with a poor stand of variable plants are the same as those for a field with a high stand of productive plants. (Fig. 2)

Figure 1 - Good plant stand

Figure 2 - Poor plant stand

Planting into soil of the proper temperature is important to ensure a healthy stand of potatoes, especially when planting fresh cut seed. Wound healing of fresh cut seed takes place when soil temperatures are between 55-60°F (13-16°C). This temperature also encourages quick emergence without promoting the growth of seed piece decay organisms. Planting unhealed seed pieces in cold soils delays emergence and increases the risk of seed piece decay resulting in a poor plant stand. [4]

Before every converting process, the workplace and the equipment must be checked to assure that they are clean and free from all raw, products, product remains or articles not required for the planned operations.

The raw product potato has the greatest influence on the quality of the finished product. With potatoes for potato crisps the quality will be influenced by such factors as: kind, cultivation, handling of the raw material including storage.

Very important factor in potatoes processing is starch content in tubers. A high content of starch means good productivity (slices are more heavy). (Fig. 3)

The dimension of the potatoes for the production of potato crisps can be adjusted to the packet dimension (35-70 mm). For this the potatoes must be calibrated accordingly. For small bags small nodules are desired, while bigger nodules are preferred for bigger bags. The form of the nodules is very important for the production because it has an influence on the peeling losses.

Regarding potato storage emphasis is placed on receiving the nodules in the best processing state during the storage period. With ideal storage no germ formation occurs. Additionally, no formation of sugaring or other substances should occur by which the potato crisps would take on a dark color.

The storage units for the potatoes are controlled for light, temperature and moisture in such a way as to allow for a sufficient quantity of qualitatively flawless potatoes to be available for a longer period of time.

The transport of potatoes in boxes or containers and their filling must occur in such a way that damage, wear, cutting and the formation of pressure points is kept to minimum. Regular samples, for example weekly, must be taken from the storage to determine if any defects to the potatoes have occurred in the interim.

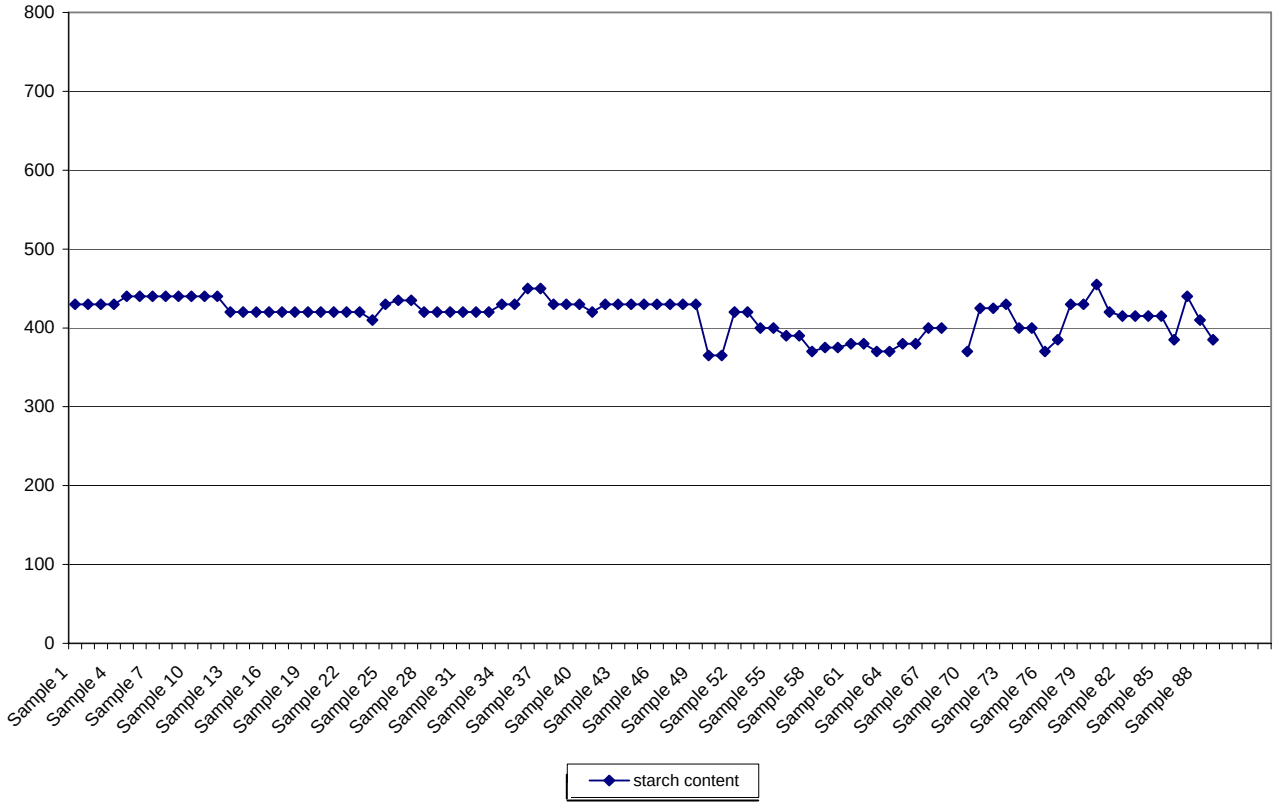
The nodule aeration must adhere to during the storage. Appropriately positioned fans help to hold the temperature and aerial humidity within these areas.

Insufficient airings result in the quick formation of carbon dioxide in the surroundings and moist parts of the potatoes.

The potatoes contain, as a rule, approximately 85% water. The potatoes will begin to shrivel if the relative humidity moisture falls below 80% during the storage. The yield of the potatoes is thereby lowered. Therefore, moisture from > 90 % for the whole storage period should be maintained.

The storage has to be patrolled regularly and problems handled accordingly (during storage period) and disinfected (if storage is empty) to minimize the contamination by insects and rodents.

Figure 3 - Variation of starch in potatoes



2.2 Frying oil in general. Fat is (in chemical terms) a combination of the 3-valued alcohol glycerin with 3 fatty acid residues which are tied together around a so-called Esterbindung. The fatty acids are differentiated based upon their reaction properties into "saturated" and "unsaturated" ones.

Due to health controversy surrounding the trans fatty acids is recommended to be used only fat that contains small quantities of trans-fatty acids and lies in the melting points so low that sensorial properties have been maintained. This is achieved by the fractionating of oils. For this process different oils are suited, as for example sun flower oil (High Oleic Sunflower) as well as Palm Oil (Palm oil fractionated). To protect sensitive oils against oxidation, manufactures often add tiny amounts of antioxidation mediums, as for example Butyliertes Hidroxianisol (BHA), Tocopherole (vitamin E) or Ascorbylpalmitate. The optimum storage temperature is 10 ºC above the melting point of the oil. [3]

2.3 Flavors. Spice aroma mixtures provide the taste of potatoes crisps. They are made up primarily of the following ingredients: salt, sugar, taste amplifier, yeast powder, yeast essences, seasonings, herbs, vegetables, fruits, cheese powder, acids, aromas, view particle/herbs, colorings.

Storage has an essential influence on the sensorial stability of aromas (flavors). On this front, it is subject to such factors as: temperature, aerial moist, light, time and kind of packaging.

These are the most important factors which can influence the durability and therefore the sensorial stability of the crisps made from it.

Storage terms are as followings: cool (maximum: 20 ºC, minimum 12 ºC), dry (relative moisture 50%, maximum 70 % at times), dark (well packed in closed containers).

2.4 Crisps production. In this step of the process a raw potato, either from the potato storage or directly from the supplier, is processed into a white potato.

While destining all stones and foreign bodies which are heavier than potatoes, must be removed.

Next step is potatoes washing. The washing is a wet cleaning process. The target of the washing is to create sandy free, sterile potatoes free of organic matter. The fresh water application may not fall below 0,5 m^3 per tone of potatoes. The water interchange rate should be 0,3 x per hour. The conductivity of the cold water in the washing apparatus is to be collected at regular intervals (1 x shift). It may not exceed 600 µ p./cm about the base value of the fresh water. So that microbiological process is halted, the cold washing water may not be warmer than 20 ºC.

The washed potatoes are than peeled. For this process an abrasive peeler is used; it is controlled by the following parameters: peel time, filling degree, batch amount, water application, transport of the peeled potatoes.

Before potatoes cutting it is necessary a potatoes examination by one or two persons. Strict inspection must be carried out and defects must be manual removed by cutting the defect area, or if it necessary, by removing the whole potato.

The dosing potatoes dosing before cutting determines the flow rate of the whole line. The measured potato amount must be steady. Achieving a high exactness the application of a gravimetric dosage is recommended.

Potatoes slice cutting is a very important step of the process. The slice thickness is a major parameter which has a basic influence on the different quality criterions of the finished product. A constant thickness means an uniform humidity, an uniform fried slices, no bubbles and no greasy aspect. To achieve these parameters it is also important to change knifes periodically, at every maximum 2 hours. During cutting step fresh water is added. To prevent the build-up of starch and small parts, a steady fresh water flow must be guaranteed in the cutter. Immediately after cutting of the slices, an intensive cleaning must be done. The main cleaning process can be connected by conveying the slices. All other washing steps are to be performed and operated so that an excessive washing-out is avoided. A technical measurement of the water quality is to be continuously collected in the washing apparatus. The conductivity in the cold washing water of the first cleaning step may not exceed 1500 µ p/ cm above the base value of the fresh water. The water exchange rate for every cleaning step in the washing system should be at least 1 x hour.

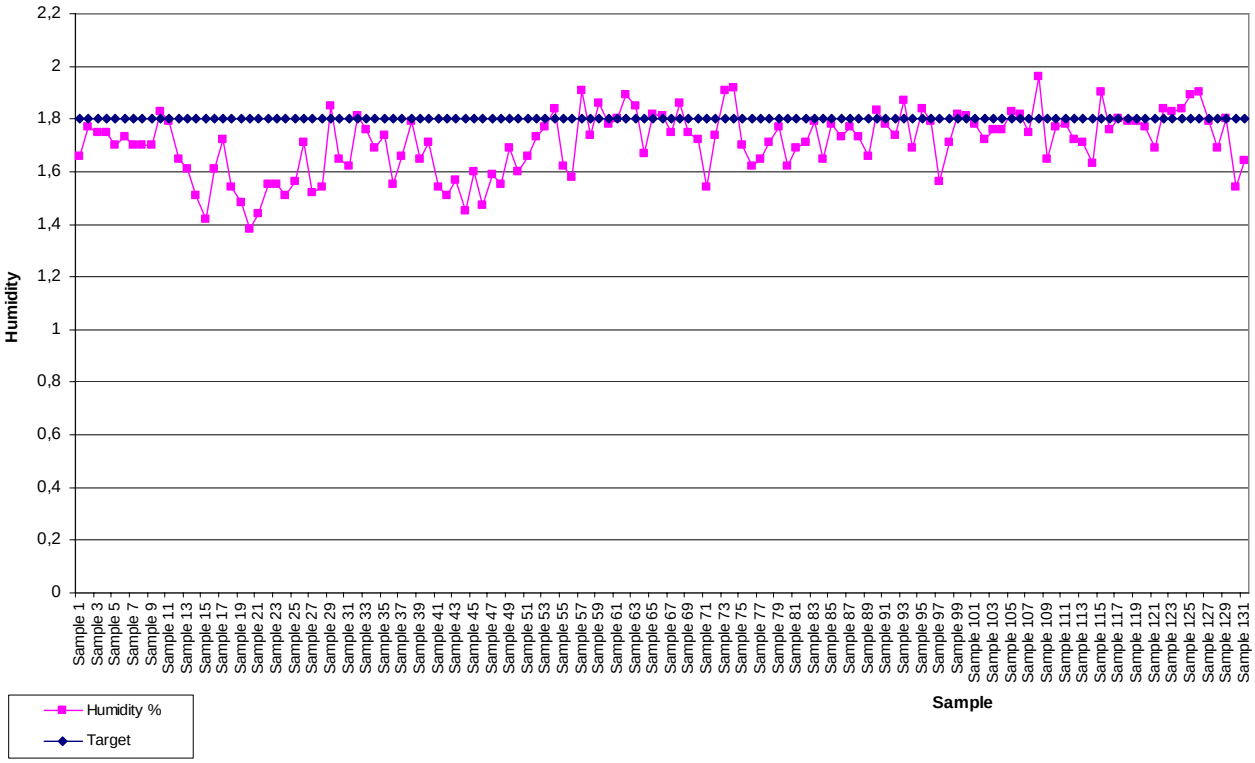
Due to the fact that potatoes have a high percentage of unwanted sugaring and free amino acids in particular, at the end of storage period, measures must be taken to decrease the content of sugaring in the potatoes slices. The method recommended for removing the undesirable sugar is blanching with hot water. The blanching temperature (water temperature), measured in the product outlet of the blancher must be at least 83 ºC, so that the slice temperature can reach 80 ºC. The blanching time is between 2 and 3 minutes, depending of the slice thickness.

To compensate partly the sensorial defects which appear by blanching the slices, the retexturing must be integrated after blanching as a texture-establishing procedure into the process completion. Retexturation is made usually with Calciumlactats.

Slice separation is made with spread water. To much adhesive water in the frying oil require unnecessary high energy expenditure. Compressed air by air nozzles blows from ventilating fans the adhesive water off the surface of the slices.

Washed slices, partially dried go through the deep fryer to be steadily deep-fried in hot edible oil. The process of deep frying is divided into three phases which vary depending upon the aid of the physical processes: vaporization, drying and cooling. The driving factor for the vaporization is the

Figure 4 – Humidity level in fried potatoes slices



oil temperature. The higher the temperature, the more intensely and the shorter is the deep frying process. The entering temperature is between 180 ºC. This temperature range may be left only to produce special crisps with a higher fat content. The temperature must be stabilized by using a regulator and may vary in the stabile state maximum of an area from +/- 0.5 ºC around the set nominal value. [1]

Deep fried is basically up to the moisture defined in the specification, normally within 1-2%. If the moisture sinks less than 1% undesirable effects appear like excessive fatness, darker coloring, burnt taste and a high Acrylamide value. (Fig. 4)

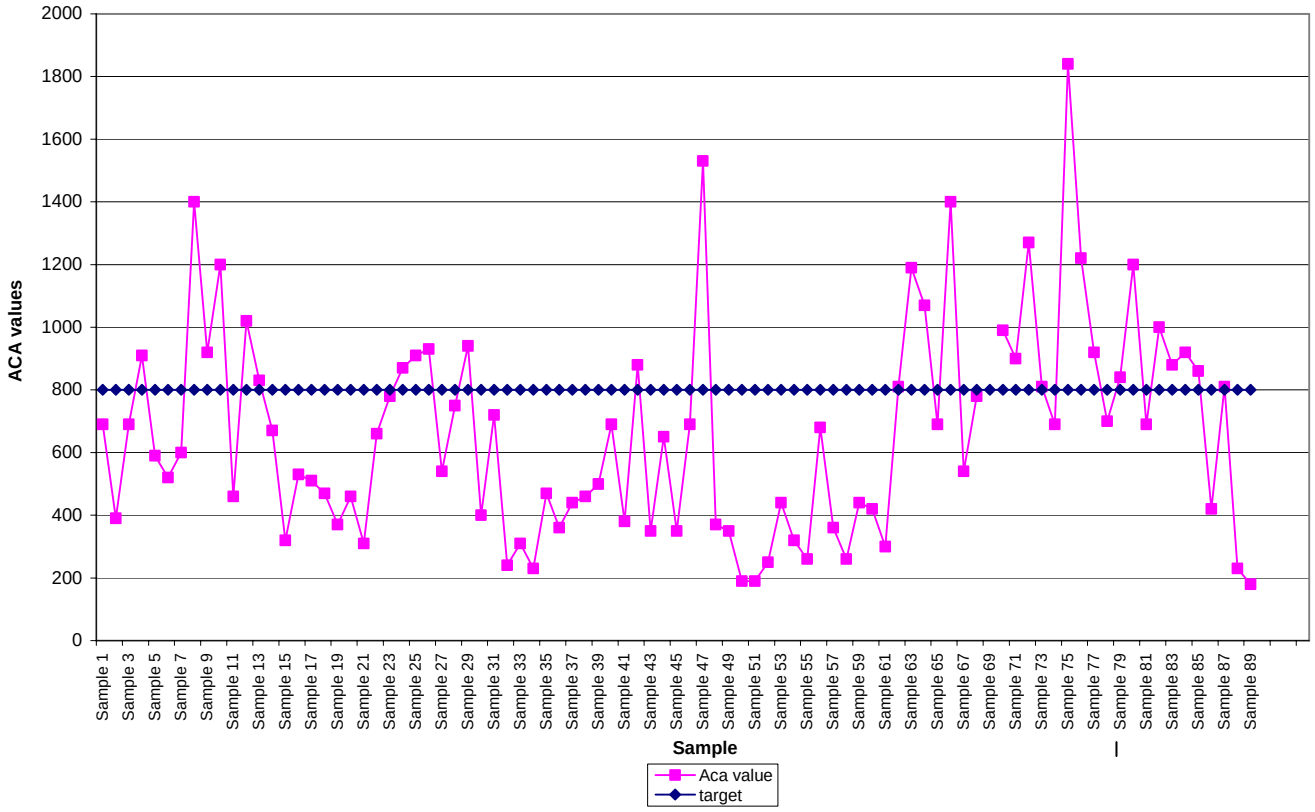
Deep fryers are to be designed with a temperature difference of 15-20 K. Therefore the outlet temperature is normally between 160 – 170 ºC. In case of special requirements, like the reduction of undesirable conducted substances which can originate during the deep- frying, the outlet temperature can be lowered to 150 ºC. Deep-frying less than 150 ºC outlet temperature is to be avoided. [2]

At this point the transport of crisps into the deep fryer is carried out by special conveyor facilities which also allows for dwell time regulation. Wheels or flap belts convey the slices through the fryer trough in the form of a stopper current (plug-flow).

In order to control the moisture percentage, an on-line measuring sensor in the discharger of the deep fryer must be installed. The controlling station is to be installed at the point after which the crisps have already left the oil batch for 25-30 seconds.

Taste is developed primarily in the last phase of the deep-frying process.

Figure 5 – Acrylamide content in chips



Fried slices with defects (black spots, green parts, too dark color) are removed in the nest two steps of the process: optical sorting and manual sorting. Optical sorting is made before flavoring and the manual sorting is made after slices flavoring. Before seasoning, the crisps must be cooled by the outlet temperature of the deep fryer (120 ºC) to achieve the optimum temperature for seasoning. A too law seasoning temperature (< 60 ºC) as well as too high temperature (> 80ºC) is to be absolutely avoided. Flavoring is made in a seasoning drum, where the spice aroma mixture is steadily dispersed on the crisps in a rotary mixing drum.

The potato crisps are bunkered after manufacturing. Then they are conveyed from the bunker over a transport distance and into the packaging area.

Packaging machines weighing automatically the product and the half finished product is packed into bags and they are put in boxes.

3. CONCLUSIONS & ACKNOWLEDGMENT

All aspects of the manufacturing process must be focused on the careful treatment of the potatoes, slices and crisps. The individual manufacturing process must be done in compliance with the provided instructions, procedure descriptions and in accordance to production good manufacturing practices. Adequate and sufficient means must be available for the realization of these control measures.

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AERONAUTICAL ACTIVITY UNDER THE CONDITIONS OF THE FLEXIBLE USE OF AIRSPACE

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Abstract: *The present paper lays emphasis upon the importance of the flexible use of airspace. This work highlights a wide range of aspects regarding the human activity in the airspace, including the necessary infrastructure from the ground and airspace, the specific industry in this domain and the capacity of developing human activities in, from and through the airspace. What is also underlined here is the fact that the flexible use of the airspace remains the only way to bring together civil and military requirements and this implies extended civil and military cooperation when dealing with the use of the available airspace. Moreover, all the activities linked to the planning and implementation of airspace structures evolve in a coordinated way, at the international level, through cooperation actions between the civil and military authorities. This paper also brings into the spotlight the fact that working together is the only solution for both civilian and enlisted men to manage in solving all the problems regarding the togetherness of the two air traffic management systems and the creation of an integrated system which should permit the use of the existent airspace at maximum.*

Keywords: *aeronautical, airspace, civil, military, use, aircraft, management*

1. INTRODUCTION

Concerning the aeronautic activity, the necessary condition is to take into consideration both human activity in the airspace – the flight – and all the other connected activities, starting with the manufacture of different types of aircrafts and ending with the creation of the infrastructure which is specific to aeronautics and to air navigation actions. Of course, the dominant environment, in which the aeronautic activity takes place, is represented by the airspace.

Furthermore, two very important characteristics of aeronautics must be highlighted: its very small *`age`* (in spite of their thousands of years of existence, humans have not begun the exploration of the air space till the beginning of the last century); its amazing development rhythm (if at the beginning, flights were only experiments at distances and altitudes measured in meters, nowadays humans can practically explore the entire airspace.

The spectacular evolution of aeronautic activities has caused not only conceptual changes and reconsiderations regarding the airspace, but also major contradictions which require certain solutions. The main challenge

arises from the exponential growth of air traffic while the airspace remains the same.

The amplification of the number of aircrafts which fly simultaneously, their characteristics and performances and those of the equipment on the ground have lead to the concept of *flexible use of airspace* (FUA).

2. HUMAN ACTIVITY IN THE AIRSPACE

The term of *airspace* generally represents the shell from around the Earth, the air column from above the terrestrial territory and the area covered with water. It cannot be exactly delimited in height because of the physical proprieties of the gas from which it is composed.

At the beginning, in the specialized literature, the main thesis stated that the airspace was unlimited. The development of aeronautics requires its legal regulation. Thus, there are two types of airspace: *the airspace pertaining to states* (as a component element of their territory) and the *international airspace* (which is not submitted to the sovereignty of any state, as it is for example the airspace above a free sea). Through the *Paris Convention*, which took place on the 13th of October, 1919, the sovereignty of the subjacent states over the national airspace was assigned and regulated. Even if problems regarding the superior delimitation of airspace are still under debate, the idea that this frontier should be established, taking into consideration more or less conventional criteria, has been propelled. Moreover, in this context, what is crucial for a state is to exercise its sovereignty in its own airspace.

The sovereignty of a state upon its airspace includes the regulation of the legal system of that space, the development of activity within that space, the permission of transit and traffic of foreign aircrafts, the limitation of flight, the ban of the foreign aircrafts' entrance, the execution of the jurisdiction upon the foreign aircrafts in the airspace and the right to claim remuneration in case of damages caused by foreign aircrafts.

Besides the regulations regarding the legal status of their airspace, the states have issued a series of documents, called *freedoms of the air* [5], regarding international air navigation. Thus, there are five *freedoms of the air*: the right of a foreign aircraft to go through the airspace of a particular country, without landing; the liberty of a foreign aircraft to land with noncommercial purposes on the territory of a state (the right to make technical stopover); a foreign aircraft has the right to disembark, on the territory of a state, passengers and goods which came from the country that owns the aircraft; the right of a foreign aircraft to embark passengers and goods for transport from a state to the country which owns the aircraft; the right of an aircraft to make transports from the state which allows them to third states.

It has been noticed that not all states recognize the five *freedoms of the air*, the last being complex having international implications. For example, in 1965, our country has adhered and to the *Airspace and Aeronautics Law* and its dispositions are applied in the Romanian airspace to all the civil/military aeronautic activities and to all the natural/ legal persons and to the international aeronautic activities which are developed in the Romanian airspace on air routes and the established areas for these activities.

The national airspace is defined as the space which is encountered above the sovereign territory of Romania [4]. Both the airspace from above the international area of the Black Sea, allotted to Romania through the regional agreements of air navigation and the extraterritorial airspace in which Romania was delegated, permanently or temporarily, to provide services of air navigation are also assimilated from the point of view of the navigation systems.

The evolution of human activities in the airspace is characterized by the intensification/ growth of human presence, which is more and more visible every day – all kinds of aircrafts in transit and other objects of human origin coming into being, but, in the context of congestion they cannot be eluded: different types of projectiles with air trajectories, different types of missiles flying in the cosmic space or coming back to Earth

and remaining pieces of meteorites which fall. Furthermore, in the present-day airspace, a multitude of man-built objects evolve simultaneously.

Firstly, some criteria are required in order to make a nonconventional classification of the issues regarding human activity in the airspace, aircrafts and all man-made objects in the airspace.

The first criterion refers to the *transparency of the activity*, by which we understand the completeness and correctness of the information regarding the already mentioned activity/ aircraft and the opportunity of the dissemination towards all the participants in the activity. According to this criterion, there are: *known activities*, when the one who initiates, plans and develops the activity transmits all the data of common interest to those involved with the purpose of correlation, coordination and assurance of flight security, e.g. the flight of an aircraft pertaining to a certain flight company from airport A to airport B; secret *activities*, when the one who initiates, plans and develops the activity does not deliberately transmit the data regarding its own flight activity or transmits false data to some of those who develop aeronautic activities in the same volume of airspace, e.g. the flight of a combat aircraft in the area where military operations take place.

Moreover, this criterion allows us to determine to which extent the activity is sustained and supported in order to have a successful and secure outcome. Whereas in the former case, all the participants contribute to this goal, in the latter, they might appear hostile participants ceasing the activity, also by knocking down the involved aircraft.

A second criterion refers to *the control upon the activity* regarding the evolution of the aircraft or object which can be controlled or not in real time. From this perspective, there can be encountered several types of activities, such as: *controllable activities,* when man can intervene upon the aircraft/object through the modification of flight parameters e.g. trajectory, speed; *uncontrollable activities,* when man cannot intervene upon the evolution modification. Thus, the aircraft/object should fly according to a predictable trajectory (for example, a cannon projectile has a ballistic trajectory), or to an unpredictable trajectory (for example an aircraft which exploded in the air).

Furthermore, regarding control, there has to be determined by which extent the other activities developed simultaneously in the same volume of airspace are or can be affected.

The analysis of the aeronautic activities, through the two criteria mentioned above, permits drawing conclusions and acting in order to optimize air traffic and flight security, respectively. Usually, in official documents or documents with normative character on aviation or, more generally, on aeronautic activity, two domains are taken into account - *civil and military* – with distinct peculiarities highlighted by specific regulations.

The complexity of actions in the airspace and their advantages represent the motivation of the permanent concern of the states, including armies, for the improvement of technologies and activities developed in, from and through air.

Concerning the equipment specific to aviation and human activities in the airspace, there is the necessity for military – nonmilitary compatibility for at least two reasons: nowadays, on the one hand, the production industry in this domain can no longer belong to one state only, thus a transfer of technology with obvious military and civil connotations is required and on the other hand, the aeronautic

activity needs large airspaces, high fly speeds and togetherness in the activities of the states. An aircraft takes off from an airport situated on the territory of one state to operate on airports situated in other states, geographically disposed at a distance of hundreds and thousands of kilometers. This fact has determined the development of relationships among states, the creation of a complex of systems regarding air navigation and facility systems which are compatible as well as the creation of a law system relating to the specific activities in this domain.

Obviously, these problems gain new meanings when speaking about military activities. In the case of activities with nonmilitary character, there is the supposition that cooperation and mutual support are involved. By contrast, when military aspects appear, lots of problems with secret character will emerge. These problems go beyond the confidentiality framework, which is specific to the economic organisms. Thus, there is a shift from the status of competitors to that of combatant adversaries.

This work has covered several aspects concerning the human activity in the airspace, including the necessary infrastructure from the ground and airspace, the specific industry (aircraft factories, equipment factories, etc.) and the capacity of developing human activities in/ from/ through the airspace. As a consequence to these realities, there have been identified two development directions of cooperation in the domain: military cooperation and civil cooperation.

The first aspect implies leading military actions in/ from/ through airspace and supposes the realization of the conditions of leading the states' own military forces in safety conditions and the annihilation of the adversary's actions, especially those directed to the states' own forces. Thus, there are structures and organisms, specific to the military system, both at national level and at the collective structures of security level.

Furthermore, the interoperability of equipments and procedures applied in Romania must be in accordance with those of the other member states of NATO – NATO Integrated Extended Air Defense System – NATINEADS [6].

The second aspect implies all aeronautic activity and supposes the realization of flight conditions and the connected activities development under safety conditions. Moreover, the place and role of national organisms in the management of the national airspace and their relationship with the European organism – EUROCONTROL – assures the compatibility of aeronautic activities management. Romania has signed the documents for adherence in 1997, and confirmed the signature in 1999 [2].

Civil/ military cooperation is a key factor in the management of civil air traffic under the most propitious conditions of security and efficiency and in the fulfillment without restraints of the Air Force missions.

Because of the fact that the airspace is a limited resource and the requirements of its use are higher and higher, as a result of the spectacular rise of both civil air traffic and the military necessities to assure national sovereignty and the involvement in international military activities, the only solution is to provide a good management of airspace and the necessary technical resources.

3. THE FLEXIBLE USE OF THE AIRSPACE

The implementation of the concept of the flexible use of the airspace (FUA), as a solution for the above mentioned contradictions, has generated many controversies between the civilian and military representatives of the air traffic services.

The implementation of the concept of the flexible use of the airspace, based on the creation of certain temporarily reserved areas to perform certain training flights with military combat aircraft, has turned into a necessity for the safety of air traffic. It is worth to mention the efforts of the European Organization for the Safety of Air Navigation - EUROCONTROL – and of the European Union Council in this field.

In the European airspace, there are registered about 26,000 flights per day at present and the forecasts indicate the doubling

of the figure in the next 10 years [8]. The existence of several States, with their own airspace management systems, determines increased spending (about 2-3 billion euros per year) in comparison with other similar systems all over the world. By its innitiative – 'A Single European Sky' – the high-level group of the European Commission aims at examining the reform of the European air traffic management system, at supporting and strengthening the role of EUROCONTROL optimizing the European airspace organization and implementing FUA.

The aim of this approach is to satisfy the air traffic demand and to assure the maximum use of the available airspace capacity in the context of a uniform European Air Traffic Management System (EATMS) that will be achieved by the European Air Traffic Management Programme (EATMP). In this field, the main objectives of the European Commission innitiatives are [7]: developing certain requirements harmonized for the safety of the ATM systems; restrengthening the cooperation between the civilian and military authorities; creating a strong regulating organism; drawing up certain regulations appliable and consistent all over Europe; creating an integrated airspace management system; increasing the interoperability and standardizing the ATM systems; getting a uniform staff training in the ATM field and developing a programme for the air traffic safety.

Providing specific activities at safety and quality levels in accordance with the European standards, under the conditions of the increasing civil air traffic forecast for the beginning of the third millenium, is conditioned by a very close civilian/ military cooperation for solving the aspects of flight coordination in a mutually beneficial way to both parts, assuring the secure, efficient and economic operability of civil aircrafts and the fulfillment of training tasks of the military aviation. This cooperation must have as a starting point the rephrasing of the actual conception regarding the assurance of coordination of Air Force flights with the civil traffic. This involves giving up the procedural coordination system that is currently used applying a dynamic coordination system based on directing operational air traffic. These directions are given by the air traffic organs from ACC/APP during the flight.

The application of the FUA concept is based on the creation of some temporary reserved areas for the flights of Air Force aircrafts which cannot be coordinated with the civil air traffic in real time. It is worth to mention this procedure of temporary segregation of the airspace which implies both the declaration of some air routes as being conditioned and the definition of some alternative routes in order to engage civil flights when the temporary reserved areas are activated.

The coordination of airspace use implies taking decisions and developing specific activities in the three phases corresponding to the competence level: strategic, pre-tactic and tactic. According to the fundamental principles, which represent the basis of the activities enclosed in the three phases, the use of airspace must have characteristics, such as: an on-going character; the airspace allocation which must equally satisfy the needs of all users.

In order to optimize the use of the available airspace, the existence of a civil/military system is needed to assure: the collection and evaluation of all airspace use requirements; the planning and allocation of airspace, including that of the segregated

areas; the activation and deactivation of segregated areas in real time in order to minimize the unavailability periods of some airspace structures; the distribution of detailed information regarding the use of airspace in real time to all the interested users.

If these functions are fulfilled, the system will assure both the coordination of activities for the allocation with priority of some areas in the airspace for some users, civilian or enlisted men, and the development of air traffic under safety conditions and efficiency. Thus, the airspace will be allocated for the use in real time and the civil-military coordination will also be made.

All the activities linked to the planning and implementation of airspace structures will evolve in a coordinated way, at an international level, through cooperation actions between the civil and military authorities.

The airspace management unfolds on various levels, having different responsibilities. Thus, at the first level, the national one, the main task consists of defining and revising the national policies regarding airspace, taking into consideration the users' requirements and the international organizations' recommendations. In order to assure the coordination in this phase, which is considered to be a strategic one, civil and military aeronautic authorities have different tasks, such as: establishing the use policy of airspace; periodically reassessing the airspace structure; defining negotiation procedures, national principles and priorities of airspace allocation; coordinating the important military exercises which impose the temporary closure of a route; periodically revising the specific procedures and operations to next levels.

In the next level there are established, according to the predicted air traffic figures, the flight coordination procedures by making a preliminary coordination at the flight planning level. In this phase, the activities which are assured are: receiving airspace temporary reservation requests from the military units, air traffic organs and other authorized aeronautic agents; allocation of the available airspace according to priority procedures and regulations established at the first level; elaboration of the Airspace Used Plan (AUP) and the Updated Used Plan (UUP).

During the last phase, the tactical one, the civil air traffic organs coordinate, in real time, the flights of the Air Force aircrafts. The real time coordination of the flight activity in a space and a unit of time are made possible by the permanent exchange of information between the two systems: civil and military.

Management, at this third level, consists of the use of airspace in real time with the goal of concrete, secure, economically efficient operations of air traffic. It is divided into civil and military units of traffic assurance services i.e. civil and military air traffic controllers by activating, deactivating and reallocating, in real time, the airspace allotted at a superior level in order to solve concrete problems.

The real time access to the flight data, including the intentions of the air traffic controllers, optimizes airspace use and reduces the necessity of airspace reservation. Thus, airspace use becomes flexible, efficient and secure. At the third level, certain airspace areas are activated/ deactivated or reallocated and this is the solution for concrete coordination in dynamics.

4. CONCLUSIONS

The basis of the activities which take place in the three phases is represented by the concept of flexible use of the airspace. In its turn, this concept is based on the fundamental principle according to which the use of airspace must have a continuous character and by its implementation, an obvious rise of the coordinating capacity of the airspace systems is assured.

It is worth to highlight the fact that air traffic management activities are closely linked to the existence of three subsystems: that of the on-board equipment, that of the ground equipment and that of human resources. Referring to the aviation equipment

and those specific to human activities in the airspace, the conclusion is that it is necessary to establish a compatibility between them due to two reasons: at present, the production industry in the domain can no longer belong to one state and this imposes a technology transfer; the aeronautic activity requires large airspaces, high flight speeds and togetherness between the states while developing activities [1]. The three previously mentioned subsystems interact in order to achieve the goals of the air traffic management and, unfortunately, the system's capacity is limited by the capacity of the weakest loop chain which defines it. For this reason, working together is the only solution for both civilian and enlisted men to manage in solving all the problems regarding the togetherness of the two air traffic management systems and the creation of an integrated system which should permit the maximum use of the existent airspace by all the categories of users.

All in all, the flexible use of the airspace remains the only way to bring together civil and military requirements. This fact implies extended civil-military cooperation, it assures the possibility of executing all civil and military flights and optimizes both technical and airspace resources and airspace security.

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SOME ASPECTS REGARDING THE ARHITECTURE AND BASIC REQUESTS FOR AN AIR DEFENCE BATTALION COMMAND POST

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Abstract: *The operational heart of an air defence battalion, or for a Ground Based Air Defence (GBAD) system, is represented by the Command Post (CP) structure. In order to assure the surveillance function, a CP must integrate and control also a sensor subsystem. The paper presents some relevant aspects regarding the architecture and the main characteristics of such command and control structure.*

Keywords: *air defence, Battalion Command Post (BCP), command and control, GBAD, SHORAD, weapon system.*

1. INTRODUCTION

An mobile Air Defence Battalion is equipped with a self-propelled system–of–systems, comprised of: a Battalion Command Post, a few (4÷6) Battery Command Posts and the Weapon subsystem (guns and missiles) with/without dedicated sensors.

The Battalion Command Post (BCP) is the command and control (C2) structure of an air defence battalion and integrates weapons (with/without dedicated sensors) and sensors.

The BCP site consists of a Radar, a Command and Control Shelter and a Vehicle. The BCP control a number of BtCP's (Battery Command Posts) which are connected in a Battalion radio net. The BtCP site consists of a Command and Control Shelter and a Vehicle.

State-of-the-art military advanced sensors have unprecedented requirements regarding the vast amount of environmental data to be measured and processed. Therefore, a basic functional element which must be assured at the level of a *Ground Based Air Defence* (GBAD) system is the *surveillance*, which consists of two main aspects:

- air picture production;
- asset management.

A BCP can control multiple sensors; it will provide air space data exchange with Higher Echelon Unit (HEU) through Tactical Data Links (TDLs). Also, a BCP interfaces with subordinate and/or adjacent Air Defence units. It will have the capability to combine RAP (Recognized Air Picture) and LAP (Local Air Picture) in a Single Integrated Air Picture (SIAP).

All relevant information from the RAP will be filtered at the battalion level and forwarded to the battery level as required, similarly all GBAD information unique to the LAP should be extracted at the battalion level and made available for use by other systems (e.g. for subsequent incorporation into the

RAP). A generic Command and Control architecture is shown in the diagram below (***Figure 1***).

The BtCP controls a number of WTs (weapon terminals) which are connected in Radio net. The WT receives commands and target information from the Battery radio net and integrates the weapons and sensors on the weapon platforms.

The system described in the diagram performs the following functions:

- Command and Control Posts (CN1) above the netted Battalion Fire Units should serve to support the Battalion by: improving the tactical battlefield situational awareness, improving the information basis for engagement decisions, improving the engagement scheduling through coordination, optimizing friend protection, optimizing the general use of sensor and weapon resources;

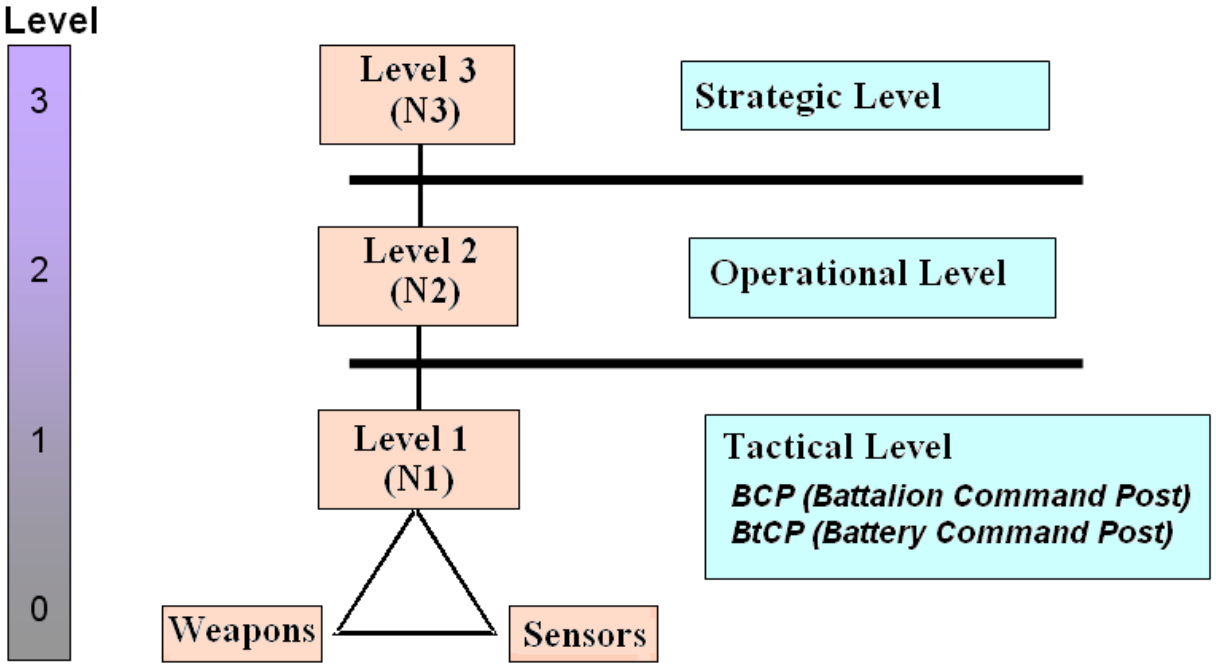

Figure 1: -A generic weapon system C2 arhitecture

- At the same time these CNs should continue too have the capability to manually intervene or directly control the Battalion engagements;
- The main CN functions are:

- establish a Local Air Picture (LAP) including ID and classification (All-sensor integration);
- transform received orders and information into a form directly useful for the Battalion Fire Units;
- generate formatted information showing own and enemy capacities and limitations;
- perform high level engage ability assessments for all subordinate weapon systems and allocate weapon systems to targets (engagement coordination).

The main tasks which are performed by a Battalion Command Post (BCP) are: data link management, sensor control, air picture production, track identification and classification, friendly protection, threat ordering, weapon system allocation.

2. AIR PICTURE PRODUCTION AND MANAGEMENT. REAL TIME AWARENESS PICTURE

The LAP (Local Air Picture) is generated on the base of information which is extracted from dedicated sensor, such as: radar and/or EO (Electro Optical sensor). The BtCP (Battery Command Post) collects a Local Air Picture based on input from Radars (or/and EO) on the weapons.

In the same time, BCP receive RAP from Higher Echelon Unit (HEU) through Tactical Data Links (TDLs).

Air Picture Management is a basic function in the Command Post and makes shared awareness throughout the GBAD force possible.

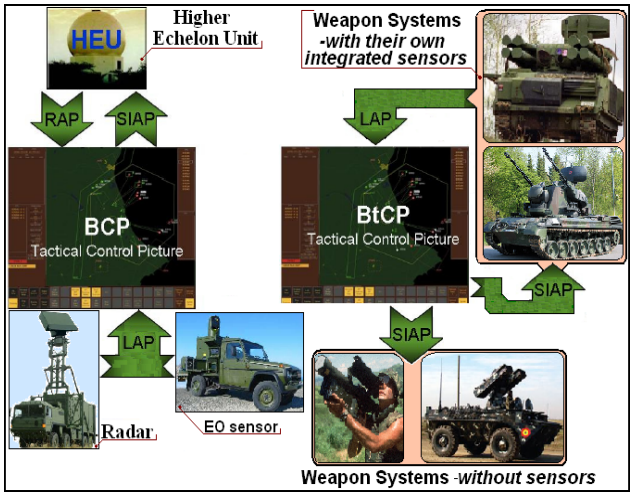

Figure 2: -Single Integrated Air Picture (SIAP) based on multiple correlated inputs

The air picture management subsidiary functions are: Track Correlation, Identification handling, Friendly Protection and Airspace Control Orders visualization. The geographical area which is in full colour displays lots of information such as: target data, Airspace Control Order, position of Defended Assets, position of Air Defence systems.

The quantity and quality of the information which represents the aerial situation is strongly influenced by the main characteristics of the sensors.

Thus, image quality which reveals the airborne threats depends on the following sensor characteristics: range and elevation coverage, accuracy (in azimuth, in range and elevation), data renewal rate, resolution, detection capability against future threats (UAVs, stealthy targets, cruise missiles), radar track capacity, the signal processing, dedicated to reject the noise and, to eliminate the effect of ECM measures.

A Battalion Command Post will have the capability to combine the RAP and LAP.

2.1. The Cueing Systems

An innovative system, named Cueing Systems (CS), has the role to improve the capabilities and mission profiles of the weapon systems. This system (CS), which is supposed to close the capability gap of connecting weapon teams to a real time situational awareness picture, comprises a Cueing Device, the Communication/ Cueing Processor Unit (CCPU) and a Weapon Terminal (WT).

The computer is configured to display and handle real time surveillance data as well as airspace control means. Within the Weapon Terminal all required orders and commands like fire control and target data can be transmitted. Pursuant to the reports and information about status and position of weapon teams, the Weapon Terminal (WT) provides cueing information to the gunner.
This information is displayed by the Cueing Device that visually guides the gunner to cue the weapon system to the assigned target.

Therefore, the basic function of the WT is to assure the *engagement management*, which consists of three phases: *target designation and search* (WT displays in real time the target designation data from BtCP), *target identification*, and *firing and kill assessment* (Weapon Terminal informs the operator when the target is inside the firing range).

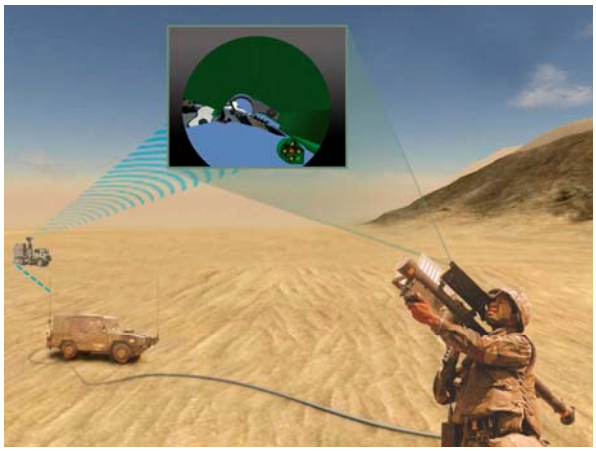

Figure 3: -A "MANPAD" cueing system example

3. A BCP TYPICAL ARHITECTURE. BASIC REQUESTS

The BCP site consists of a sensor subsystem, a command and control shelter and a vehicle.

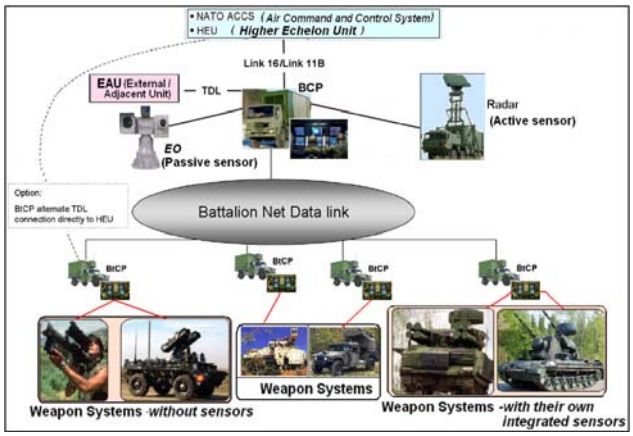

Fig.4 - A typical configuration for an air defence battalion

The BCP controls a number of Battery Command Posts (BtCP's) which are connected in a Battalion radio net. A Battery Command Post, whose site consists of a command and control shelter and a vehicle, controls a number of weapon terminals (WTs) which are connected in Radio net.

Therefore, the Battalion Command Posts represent the command and control (C2) structure of that battalion.

This structure integrates weapons (with/without dedicated sensors) and the sensor subsystem.

The basic requests for a Battalion Command Post are the following:

- BCP comprises 3 main subsystems: the BMC4I (Command and Control) subsystem, the sensor subsystem and the vehicle subsystem;
- the system has an open physical, functional and data architecture;
- is able to command and control more than 4 BtCPs;
- the Command and Control structure provides the following functions: system and network management, LAP generation, Threat Evaluation and Weapon Assignment (the TEWA function), Force planning and operations:
- the sensor subsystem (SS) includes active and passive sensor, which can acquire the following air threats: fixed and rotary wing air vehicles (aircrafts and helicopters), UAVs, missiles, Large caliber rockets, artillery and mortar ammunition;
- The sensor subsystem is capable of operate in a countermeasure environment (ECM/IRCM) without significant reduction in effectiveness;
- The vehicle subsystem assure IED (improvised explosive devices) protection and has fording capability;
- All subsystems are integrated and interoperable with NATO ACCS and C4I systems.

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THE CONCEPT OF FLEXIBLE USE OF AIRSPACE

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Abstract: *Papers Identified as a judicious use need of European airspace by the European Civil Aviation Conference, since 1990 several versions of this concept have been stated, such as En-Route Strategy which had as implementing term 1998. January 2000 marks another stage included in the 2000+ Strategy, which names a version of this concept "One Airspace".*
Romania legitimates and implements this concept beginning with 2003. Thus, in order to define FUA concept the following form is accepted "the total of the activities undertaken in order to have a proper usage of air space by all users categories (military and civil operators), avoiding the permanent segregation of air space".
Organized in three action directions (Level one – Strategic, Level two – Pre-tactic, Level three – Tactic), the application of this concept can ensure:
- the simultaneously perform of military and civil flights in total security
- decrease of flight duration
- cost cut for military and civil operators
The FUA concept – through out specialized institutions and specific application methods – can ensure an optimal flux of safe, organized, fast and efficient European airborne traffic.

Keywords: *airspace, concept, flexible, management.*

1. INTRODUCTION

The introduction of the FUA Concept is based on the fundamental principle that airspace is one continuum to be allocated for use on a day-to-day basis to accommodate user requirements.

2. FLEXIBLE USE OF AIRSPACE CONCEPT

2.1 Definition. The basis for the Flexible Use of Airspace Concept is that airspace is no longer designated as either "military" or "civil" airspace but is considered as one continuum and used flexibly on a day-to-day basis. Consequently, any necessary airspace segregation is only of a temporary nature.

2.2 History. Identified as a judicious use need of European airspace by the European Civil Aviation Conference, since 1990 several versions of this concept have been stated, such as En-Route Strategy which had as implementing term 1998. January 2000 marks another stage included in the 2000+ Strategy, which names a version of this concept "One Airspace".

Despite the disappearance of land frontiers, airspace frontiers nevertheless still exist. For this reason, the European Commission adopted, on 10 October 2001, a package of

measures on air traffic management with a view to establishing the single European sky by the end of 2004. The objective is to put an end to the fragmentation of European Union (EU) airspace and to create an efficient and safe airspace without frontiers.

2.3 Evolution. The necessary evolution of the FUA Concept is described in the "EUROCONTROL Airspace Strategy for the ECAC States" under the Enhancement of European Airspace Management initiative:

2005: Extend Fexible Use of Airspace (FUA) application to the Lower Airspace, where beneficial;

2005: Expand Airspace Planning with Neighbouring States for Cross-Border Operations;

2006: Extend FUA with Dynamic Airspace Allocation to respond to short-term changes;

2006: Harmonise Operational Air Traffic/General Air Traffic (OAT/GAT) Handling to the maximum possible extent across Europe;

2008: Introduce Collaborative European Airspace Planning in line with the 'Single European Sky';

2015: Move towards a more demand-responsive and integrated function to support the ECAC States' collective responsibility for European airspace planning and management.

2.4 Objectives. The introduction of the Flexible Use of Airspace Concept is based on the fundamental principle that airspace is one continuum to be allocated for use on a day-to-day basis to accommodate user requirements.

The FUA Concept will allow the maximum joint use of airspace by appropriate civil/military co-ordination to achieve the required separation between civil and military flights, hence reducing airspace segregation needs.

2.5 Concept. The FUA Concept increases the flexibility of airspace use and provides Air Traffic Management (ATM) with the potential to increase the capacity of the air traffic system. The FUA Concept allows the maximum joint use of airspace. The FUA Concept also ensures, through the daily allocation of flexible airspace structures, that any necessary segregation of airspace is based on real usage within a specific time period. Effective application of the FUA Concept requires the establishment in each of the European Civil Aviation Conference (ECAC) States of a national High-Level Airspace Policy Body. This body is tasked with the re-assessment of national airspace, the progressive establishment of new flexible airspace structures and the introduction of procedures for the allocation of these airspace structures on a day-by-day basis.

The practical application of the FUA Concept relies on national Airspace Management Cells (AMCs) for the daily allocation and promulgation of flexible airspace structures in the Airspace Use Plan (AUP), and on the Centralised Airspace Data Function (CADF) for the dissemination to aircraft operators of the daily availability of non-permanent Air Traffic Services (ATS) routes by the Conditional Route Availability Message (CRAM). The States should also establish real-time civil/military co-ordination facilities and procedures to fully exploit the FUA Concept.

2.6 Flexible airspace structures. The Flexible Use of Airspace Concept is based on the potential offered by adaptable airspace structures and procedures that are especially suited to temporary allocation and utilisation:

2.6.1 Conditional Route (CDR). A non-permanent Air Traffic Services (ATS) route or portion thereof which can be planned and used under specified conditions. According to their foreseen availability, flight planning possibilities and the expected level of activity of the possible associated Temporary Segregated Areas (TSA), Conditional Route (CDRs) can be divided into the following categories:

- Category One : Permanently Plannable CDR,
- Category Two : Non-Permanently Plannable CDR,
- Category Three : Not Plannable CDR.

2.6.2 Temporary reserved area (TRA).

Airspace temporarily reserved and allocated for the specific use of a particular user during a determined period of time and through which other traffic may be allowed to transit under Air Traffic Control (ATC) clearance.

2.6.3 Temporary segregated area (TSA).

Airspace temporarily segregated and allocated for the exclusive use of a particular user during a determined period of time and through which other traffic will not be allowed to transit.

2.6.4 Cross-border areas (CBA).

Temporary Reseverd Airspace (TRA) or Temporary Segregeted Airspace (TSA) established over international boundaries.

2.6.5 Reduced co-ordination airspace (RCA). A specified portion of airspace implemented when Operational Air Traffic (OAT) is light or has ceased and within which General Air Traffic (GAT) is permitted to operate outside the ATS route structure without requiring General Air Traffic (GAT) controllers to initiate co-ordination with Operational Air Traffic (OAT) controllers.

2.6.6 Prior co-ordination airspace (PCA). A given block of controlled airspace within which military activities can take place on an ad-hoc basis with individual General Air Traffic (GAT) transit allowed under rules specified in Letter of Agreements between civil and military Air Traffic Services (ATS) units concerned.

2.7 The three airspace management levels. The 3 main levels of Airspace Management (ASM) correspond to civil/military co-ordination tasks in a distinct and close relationship. Each level has an impact on the others.

2.7.1 ASM Level 1.

Establishment of pre-determined airspace structures

STRATEGIC LEVEL

Is the high level definition and review of the national airspace policy, taking into account national and international airspace users and Air Traffic Services (ATS) providers requirements.

Related tasks include the establishment of the airspace organisation, the planning and the creation of permanent and temporary airspace structures, and the agreement of airspace use priorities and negotiation procedures.

2.7.2 ASM Level 2.

Day-to-day alocation of airspace acoording to user requirements

PRE-TACTICAL LEVEL

Is the conduct of operational airspace management within the framework of the structures and procedures defined at Level 1. Pre-Tactical tasks include the day-to-day allocation of airspace and the communication of airspace allocation data to all the parties concerned.

2.7.3 ASM Level 3.

Real-time use of airspace allowing a safe OAT/GAT separation

TACTICAL LEVEL

Consists of the activation, de-activation or real-time reallocation of the airspace allocated at Level 2, and the resolution of specific airspace problems and/or individual traffic situations between Operational Air Traffic (OAT) and General Air Traffic (GAT).Related tasks include the prompt exchange of data with or without system support between the relevant civil and military ATS units to permit the safe and expeditious conduct of both Operational Air Traffic (OAT) and General Air Traffic (GAT) flights.

3. CONCLUSIONS & ACKNOWLEDGMENT

-FUA ensures the simultaneous civil and military flights safely

-cost cut for military and civil operators

-promoting harmonization of navigation equipment

-favors the development of joint civil-military structures

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KAIZEN - NEW INSTRUMENT FOR PROCESSES OF MAINTENANCE IN AIR FORCE

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Abstract: *Article is orientated to the cost decreasing during process of maintenance by Kaizen method. It provides information about process of system Kaizen installment and about results that it had achieved after installing of such access. Article provides in certain measure also guidance for managers how to process during implementation of Kaizen access. In air force are processes of maintenance very important and very financial demanding and Kaizen is one of instruments, that it allow to decrease costs in maintenance. This instrument bring technical, economical and personal gains for maintenance in air force and for each firm.*

Key words*: Kaizen, cost, maintenance, wastage, permanent improving*

1. INTRODUCTION

Reason for solving of cost decreasing is their broadly using, since firm's costs create quantitative index of economical efficiency and they are determinant for cost management. Cost is rising in every branch of national economy and necessity to decrease them is reflecting not only at the macro but also at the micro level that means in the firms. Prof. Kassay in his book „World class firm" defines three basic factors for world class firm success. **Cost, quality and time** belong to such factors. And Massaki Imai in his book „Gemba Kaizen" defines improving through **QCD** access, that means orientation to the **quality, cost and supplies** in sense of client's needs satisfying. [6] Due to these facts we can state that basic assumption for building of world class firm is already cost decreasing.

2. KAIZEN METHODOLOGY

Whole level of cost in the firm influences financial situation in the sense of two accesses mainly efficiency and profitability. These indexes are reflected in cost saving and in the effectiveness of production factors using in the sense of production volume maximization and efficiency by profit maximization. Both elements are directly intervening to the cost management. Various methods are using for cost decreasing that bring certain contributions in the sense of cost decreasing. Kaizen method is one of the accesses that is used in the practice and that achieved considerate success mainly in Japan.

Best known method of permanent improving is based on the creative thinking of employees and it is naturalized in Japanese firms and it starts to be applied and used also in the world.

Whole process Access of this methodology results from PDCA cycle (plan, do, control,

and act). Every activity that is used during Kaizen method for removing of wastage must be integrated in PDCA cycle. [6] At the same time every activity must lead to the permanent improving. Total effectiveness of such access is reflecting in productivity increasing, in wastage removing, in increasing of employees' performance and finally in creation of value added.

Philosophy Kaizen is based on the using of various tools that lead to the wastage decreasing. Basic tool of Kaizen access is so called *„Five S"(5S)*. 5S je control list of good economy with aim of achieving of better order, effectiveness and discipline at the working post. It is directed from Japanese words seiri, seiton, seiso, seiketsu and shituke that are translated as to sort, to arrange, to clear, to systemize and to standardize. [6]

Through (5S) we can remove *„Three M – (3M) "*, that is muda, mura and muri. Goal of this method is to remove shortages, that Japan managers marks as **„3U".** It is interpretation of three Japan words that symbolize such activities, that firm must unconditionally remove, when it wants to achieve better solution and higher effectiveness during the problem solving. Their importance is as follows:

„3MU":

MURI – excesses, overloading;
MUDA – losses, wastages;
MURA – inequality, deviations.

Wastage in the firm can be over production, product mistakes, lost times and waiting, excess stocks, excess work, excess movement in the production process, excess transport, etc. [Kassay, 2001].

Gemba Kaizen or Kaizen House is expressing basic philosophy of such access, where at the top of pyramid are processes for achieving of management effectiveness and efficiency and in the House there are also methodology and processes by which effectiveness and effectiveness of management can be secured. Such Kaizen House is totally expressing whole strategy of Kaizen access.

3. APPLYING OF KAIZEN SYSTEM DURING MAINTENANCE

Goal of the research have been increasing of maintenance effectiveness in the air force through Kaizen application. In first step we have analyzed reasons of inefficiency of such process that have reflected in high cost for maintenance in air force. (Table1)

Results of analyses

According performed analysis we have found out discrepancies that resulted in following:

1. Low using of disposal time for maintenance employees.
2. High rate of operation during corrective maintenance in area of machinery maintenance – removing of defects.
3. Shortage of employees for preventive maintenance.
4. Technical shortages on the equipments during preventive maintenance.
5. Not sufficient coordination of work during maintenance.
6. Impossibility to improve term of preventive maintenance during the year in the system due to the objective reasons.

Such basic shortages lead to the fact, that we have suggested system of corrective measurements and we have quantified goal values that should be achieved after Kaizen installment.

In second step we have stated goal values that we want to achieve and we have compare them with present values and values that we achieved after installment of Kaizen activities. (Table 2)

Due to the target values we have suggested further corrective measurements:

1. Increasing of evidence efficiency in case of employees absence at the maintenance working place by regular control of attendance.
2. Securing of maintenance coordination by working position – coordinator of maintenance.
3. Operative division of maintenance employees for preventive maintenance.

4. Adaptation of terms for preventive maintenance in the system due to the objective reasons.
5. Improving of working environment at the Maintenance Department, that means arranging of activities, material and working tools.[8]
6. Installment of employees remuneration according performance due to the decreasing of loss time at the working post.
7. Change of the supplier for service parts.

After corrective measurements in the air force maintenance we have followed improvements after one year of Maintenance service. (Figure 1)

In third year we have compared target values with values achieved after Kaizen installment and we have followed up retroactively improvements also against values that have been marked before measurements installment. Values after Kaizen installment describe present value of cost from 2007, we have stated target values for 2008, we have followed up process till 2009, when there have been performed every corrective measurement. According graphically expressed contributions we can state improvement against basic situation, but also there was not achieved level of target values for individual cost categories in Maintenance service. Total improvement occurred, but during conclusions of percentage improvement we have not succeed to achieve 49 % - cost decreasing for individual categories.

Despite of the fact, that target values have not been achieved, we have marked during maintenance such improvements:

1. Specification of events at the concrete technical place.
2. Capacity planning for maintenance according technical place.
3. Following of material accessibility at the stocks.
4. Following of capacity for maintenance working places. [7]
5. Accurate cost calculation for maintenance.
6. Accurate following of annual plan filling for preventive maintenance.
7. Following of the rate between preventive and corrective maintenance.
8. Following of effective time fund for maintenance employees.
9. Remuneration of employees according performance.

Results of financial

We can induct total economical evaluation by the way of cost reduction during Kaizen system using. Results in the form of cost decreasing for maintenance presented **3510 thousand €, that means savings of financial means for the firm.** Figure 2 illustrates direct expression of individual cost in maintenance.

Massaki Imai said that Kaizen is basic key to the Japan economical success. [6] Indeed using of Kaizen brings improvement for firms mainly in area of quality increasing, productivity improving, stocks decreasing, production line shortening, loss time shortening, production period shortening. When Kaizen start to be implemented broadly to the production firms, it could bring improvement during processes management and lead to the cost decreasing for such processes. Kaizen is system, that should prevent losses, that considerably decrease value added and it helps to lead to perfect production, for example JIT.

Every innovative company, firms and business are orientated to its strategy, to the

innovation, that have various and diametric different character. It is possible to make innovation for processes, products, working conditions, organization of work, technologies and production processes, but this must lead to the permanent improvement. Kaizen philosophy is accommodating to the innovation, but at the same time in several areas of evaluation it is against innovation process

Table 1 Reasons of high cost for maintenance

Problem	Reason	Corrective measurement
Cost for repair	High failure rate of elements	Change of maintenance system
Cost for service parts	High price	New supplier for service parts
Cost for energy	High consumption of energy	Alternative of sources, savings
Cost for maintenance	Not sufficient preventive maintenance Bad organization of work	Installing of preventive maintenance
Cost for wages	High lost time, not using of effective time fund	Coordination of activities, evaluation according output

Table 2 Target values and achieved values for Kaizen application

Indicator in thousand €	**Present value 2007**	**Target value 2008**	**Improving**	**Achieved value 2009**	**Improving**
Cost for service parts	**2350**	**1500**	**36%**	**1560**	**34%**
Cost for energy	**1120**	**500**	**55%**	**700**	**38%**
Cost for maintenance	**1560**	**1320**	**15%**	**1450**	**7%**
Cost for wages	**1532**	**980**	**36%**	**1002**	**35%**
Cost for repair	**5260**	**2500**	**52%**	**3600**	**31%**

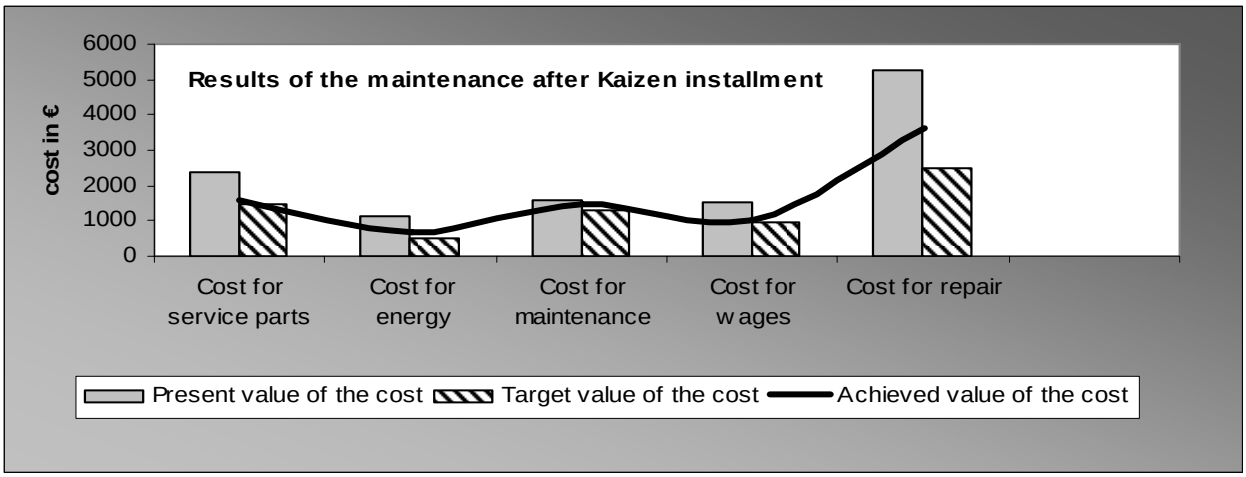

Figure 1 Contribution of Kaizen installment in the firm

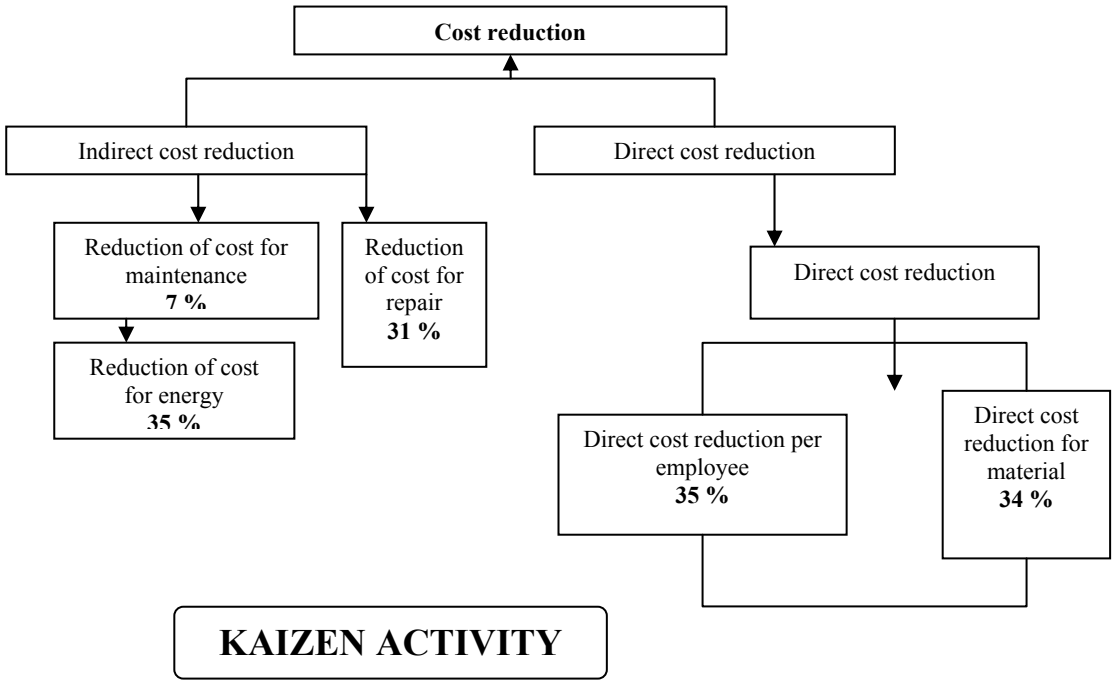

Figure 2 Model for cost reduction in the maintenance in air force

4. CONCLUSION

Kaizen method is proper and good used tool for identification and analyzing of any problem in companies practice. In present time it starts to be applied also in Slovak firms, that solve their problems connected with low productivity, unsystematic management and low work efficiency through Kaizen system, that improve and make perfect work and it

bears value added in complex measuring of values. It is necessary to use such modern tool of management, since it helps to find out shortages in individual levels of management in companies processes.

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EVALUATION METHODS FOR AERIAL TARGET-TYPE SELF-CONFIGURATION SYSTEMS DESIGNATED FOR TRAINING FIRING WITH SELF-DIRECTED AIR-TO-AIR AND GROUND-TO-AIR OPERATIONAL MISSILES

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Abstract: *The purpose of this paper is to expound testing and evaluation methods for aerial target-type self-configuration systems, designated for training firing of A/A and G/A operational missiles, in order to integrate them on MiG-21 Lancer and IAR-99 ŞOIM aircraft.*

A. GENERAL

Since 1994, RoAF MiG-21 aircraft have undergone a comprehensive modernization program aimed both for integration of modern avionics and weapons system and for developing of a new weapons configuration; this process led to expanded opportunities to address combat missions, improved operational performance of aircraft and their approach in terms of requirements applied in NATO.

Both verification and validation of ammunition performance for air-to-air missions as well as crew training run by real firing against air targets imitating the essential characteristics of operational targets. For IR/radar homing air-to-air missiles, this requirement implies the use of air targets, consistent in terms of the IR radiation wavelength with missile detection systems and capable of reflecting the radar energy emitted by guiding system or/and missile seeker head. Currently, the products observing these conditions are small air parachuted target type self-configured systems.

The constructive solution proposed by S.C. ELECTROMECHANICAL S.A. Ploiesti, integrating components made by suppliers in the field of domestic defense industry, has resulted in a product type parachuted aerial target, which obtained the validation by going through a comprehensive program of testing and evaluation, both on the ground (using existing test facilities of the national industry in field or belonging to MoD) and in flight (using RoAF MIG 21 Lancer and IAR 99 SOIM aircraft and ground based and airborne testing facilities owned or developed by R&FTC Craiova for this program).
The purpose of the testing was to check how the parachuted aerial target type self-configured system meets the Air Force requirements stipulated in the product specification and to establish the key functional performance that enable the develop of an operational use for this product. This paper dealt with the assessment methods used to achieve the objectives contained in the test and evaluation plan of aerial target type self-configured systems, created and produced by R&FTC Craiova.

B. ISSUES ON THE METHODS USED FOR EVALUATION

The methods used for evaluation aimed to deal with three main aspects, namely:

1. Checking the interfacing and the separation of aerial target type self-configured systems and IAR 99 SOIM and MIG-21LANCER aircraft;
2. Validation of IAR 99 SOIM and MIG-21 LANCER aircraft armament configurations including aerial target type self-configured systems with parachute, as following:
   - Checking products reaction in the aircraft flight envelope for armament configurations with these products;
   - Checking the products separation from aircraft, checking the operational safety and establishing the launch envelopes;
   - Assessing the product safety in operation, highlighting the peculiarities of operation and validation of operating procedures;
3. Determination of operating performance and demonstrating the operational performance of the products.

C. OVERVIEW OF EVALUATION METHODS USED

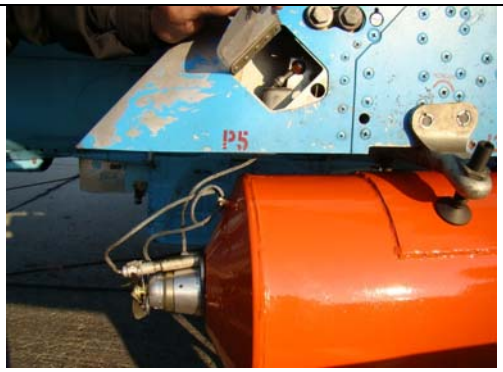
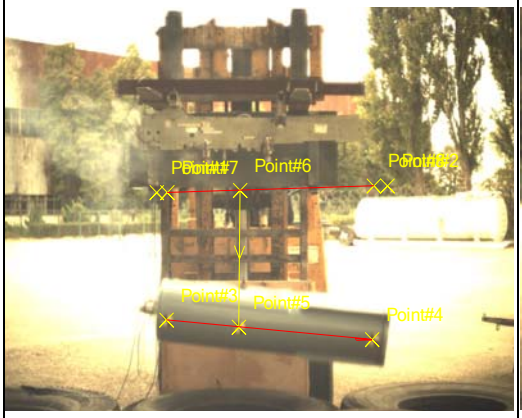
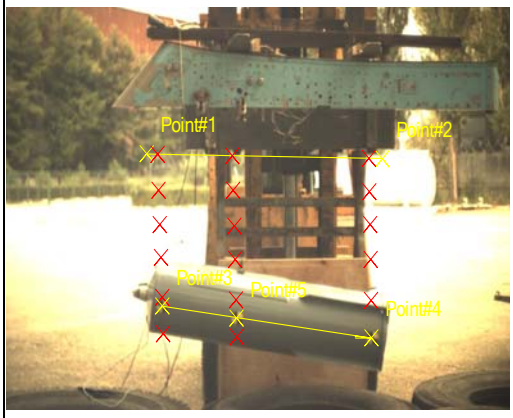
1. Products assessment methods based on processing, analysis and interpretation of data obtained from tests performed on the ground and CFD simulations.

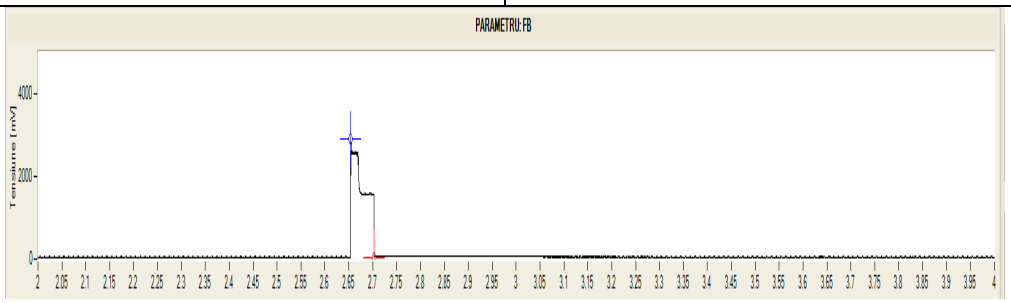
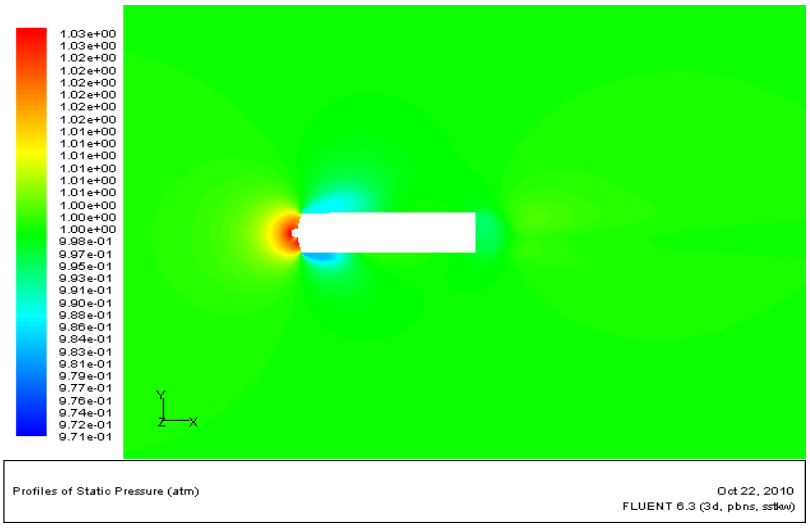
Assessment Method	Products subject to testing / Test facilities / Specialized equipment	Test and Evaluation Objectives
a. Checking product interfacing and fixing on IAR-99 SOIM and MiG-21 Lacer aircraft pylons; ***b. Checking the product separation from the aircraft pylons.*** ***- Stage 1 - Dynamic tests on the ground.***	- IAR 99 SOIM aircraft equipped with holding pylons provided with locks LA-350; - MiG-21 Lancer aircraft hardpoint equipped with locks MRU-A-000; - Load air target-type self-configured systems (model equipped with initiation systems); - Ground based acquisition system for measuring digital signals; - Quick video camera.	-Dimensional and inertial characteristics, identification and marking; - The product fixing on aircraft pylons/hardpoints; -The connecting elements between the warhead / arming mechanism and aircraft; - The product trajectory during the stage of separation from aircraft, in aerodynamic no-loading conditions; - Interfacing systems and arming fuse operation in time of 300 ms; - Product operation.
Preliminary analysis of the product launch manner.	Dedicated computer system for CFD analysis using	Determination of aerodynamic characteristics of the product in terms of carrier aircraft motion in

Assessment Method	Products subject to testing / Test facilities / Specialized equipment	Test and Evaluation Objectives
Preliminary calculation of vertical distances covered by the product from the separation until the	FLUENT simulation environment.	proximity, during the separation process. Estimation of product trajectory during the separation from aircraft, for launching points to establish the

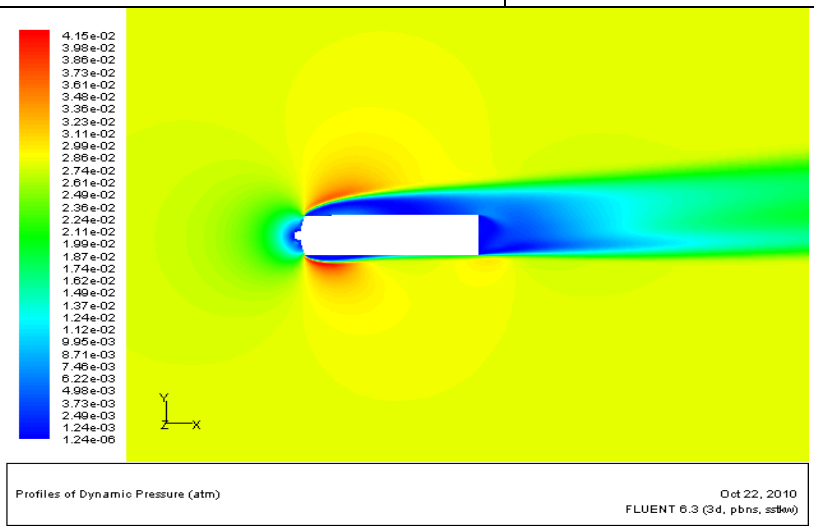
Assessment Method	Products subject to testing / Test facilities / Specialized equipment	Test and Evaluation Objectives
moment of becoming target.		launch envelope. Estimating the risk of product interference with the carrier aircraft, in the launch diagram;

The tests course:

<table>
<tr><th rowspan="2">The evaluated objectives</th><th colspan="2">Aircraft Type</th></tr>
<tr><th>IAR 99 SOIM</th><th>MIG-21 LANCER</th></tr>
<tr><td rowspan="3">Fixing the product on aircraft hardpoints and checking the interfacing between aircraft and product.</td><td>  </td><td>  </td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="2">Verification of product separation from the aircraft and determination of product motion parameters in terms of launch without aerodynamic load.</td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Acquired and analyzed parameters:
• Speed on the two axes;
• Pitch angle;
• Time;
• Covered distance in free fall from launch;
• Launch synchronizing with the movement of product;
• Measuring the interfacing electrical signal.</td></tr>
</table>

The evaluated objectives	Aircraft Type	
	IAR 99 SOIM	MIG-21 LANCER
Checking electrical control signals – Fuse arming.	 Acquired and analyzed parameters: • Control signal time; • Time of 28V signal that appears on MTI (A1); • Time of 28V signal that appears on cable Bomb (A1-MTI)); • Time interval between signal A1 and A1-MTI signal occurrence	
Estimation of the product trajectory during separation and after separation during the reconfiguration as a target. Determination of the product aerodynamic characteristics in undisturbed current and in proximity to aircraft. Risk assessment of interference between released product and carrier aircraft in the estimated launch envelope;	Estimation of product aerodynamic characteristics for different conditions of release. Distribution of static and dynamic pressure for an angle of incidence of 5 degrees and Mach = 0.2 - undisturbed current; 	

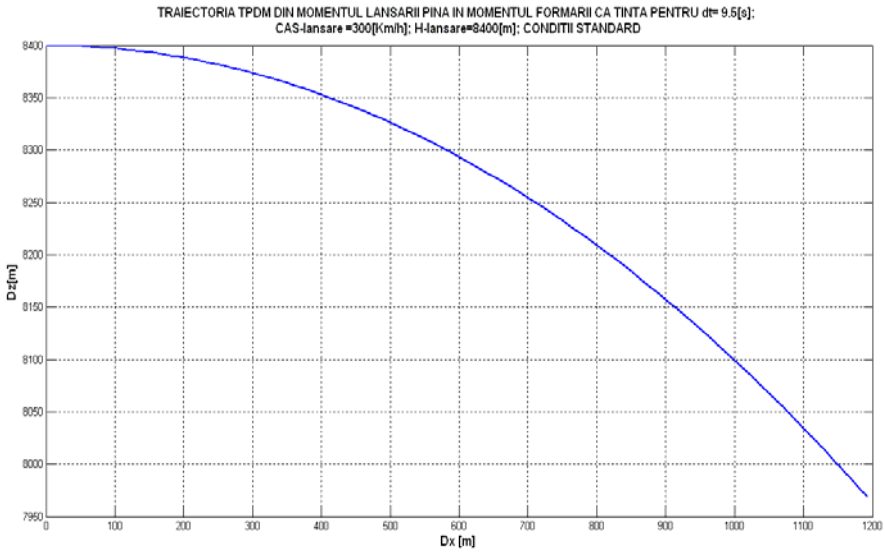
The evaluated objectives	Aircraft Type	
	IAR 99 SOIM	MIG-21 LANCER



In order to achieve the objectives, the following features were estimated by modeling and simulating:

• Aerodynamic coefficients and pressure center position during the launch of the product for different values of incidence angle and Mach flight number.

• Preliminary calculation of vertical distances covered by the product from separation until the moment of reconfiguration as a target.



Assumptions for calculation:

¬ gravitational acceleration is a constant independent of altitude;

¬ have not taken account of the influences of the wind;

¬ the atmospheric parameters are those corresponding to standard atmosphere;

¬ forces acting on products are the resulting mass and aerodynamic forces;

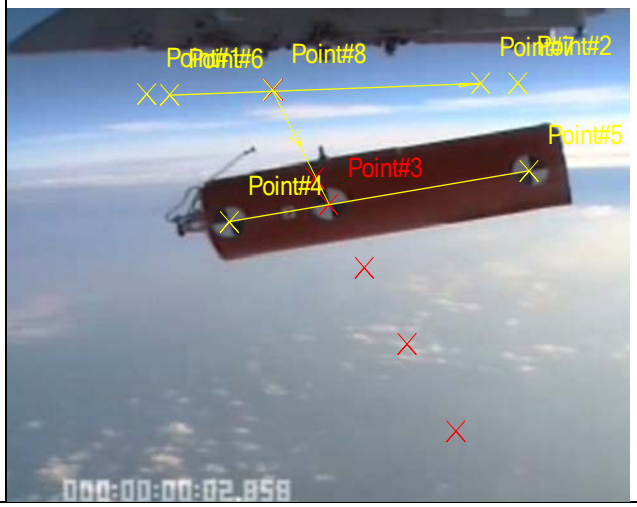
¬ not have to consider the aerodynamic moments caused by the resulting aerodynamic forces;

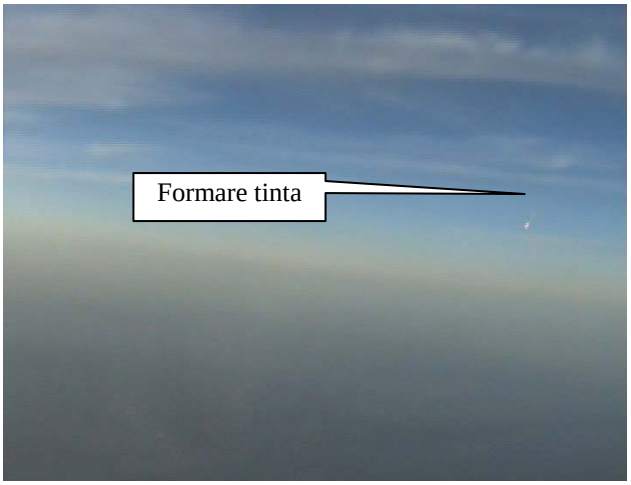
In order to determine the ballistic motion of the product were developed in Taylor series the differential equations of motion in launching

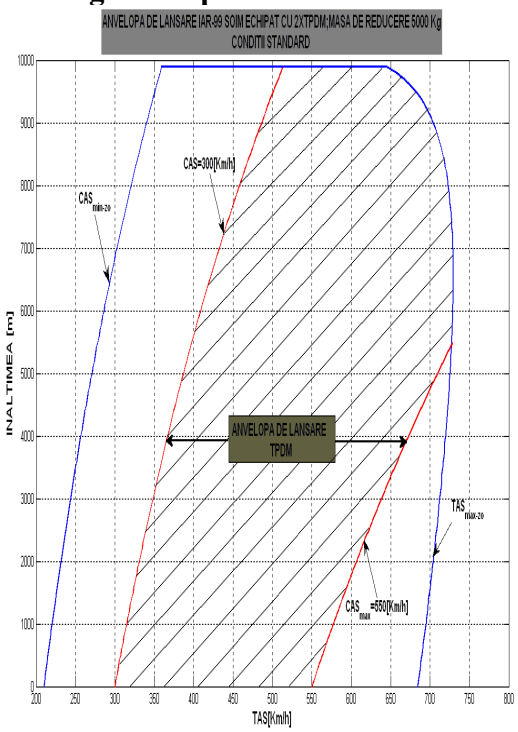
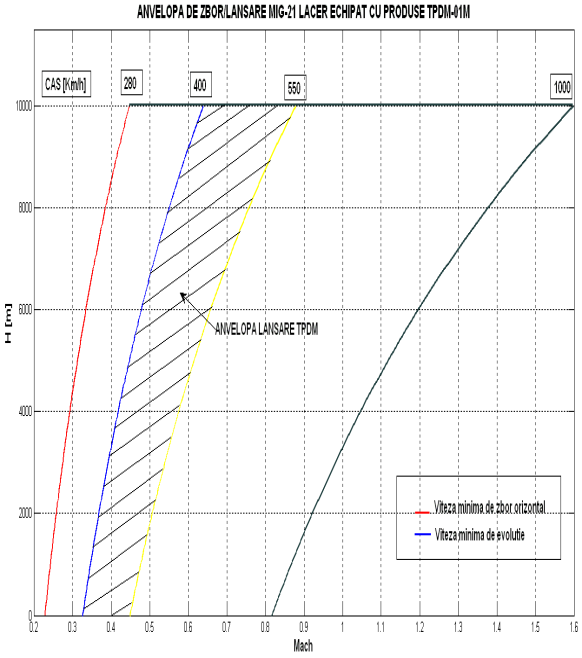
The evaluated objectives	Aircraft Type	
	IAR 99 SOIM	MIG-21 LANCER
	point for which X = Y = Z = t = 0.	

2. Products assessment methods based on processing, analysis and interpretation of data obtained from tests performed in flight.

Assessment Method	Specialized equipment	Test and Evaluation Objectives
Checking the products reaction in flight envelope of MiG-21 Lancer and IAR-99 SOIM aircraft.	- Flight data acquisition and recording system ACRA KAM-500; - loaded aerial target type self-configured systems;	- Products operational safety (in all stages of their use); - Products reaction in aircraft flight envelopes; - Products technical state after the flight.
Checking the products separation from aircraft, operational safety and determining the launching envelope for MiG-21 Lancer and IAR-99 SOIM aircraft	- Flight data acquisition and recording system ACRA KAM-500; - Real aerial target type self-configured systems; - Airborne video container boats; - Video recorder system on attendant aircraft; - EOTS system; - CRT system;	- Product reaction during separation from the aircraft; - Product reaction on the trajectory after separation; - Determination of the launching envelope;
Verification of products operational performance and safety in operation.	- video recording system on the aircraft; - Real aerial target type self-configured systems; - IR self-directed air to air missiles, MAGIC -2; - Video recorder system on escort aircraft;	- Products reaction after launch; - Products reaction on launching of self-directed air to air missile MAGIC - 2; - aiming the products after forming them as targets and igniting the torch, by IR missiles; - targeting IR guided missiles toward the product.

Objectives assessed	Results and issues concerning the objectives assessed
Product reaction during separation from the aircraft;	• ***Launching the product from IAR99-SOIM – left pylon*** 

Objectives assessed	Results and issues concerning the objectives assessed
Verification de product reaction on the trajectory after separation;	• ***Launching the product from aircraft MIG-21 LANCER***  • ***Forming (reconfiguration) as target of the product***  • **The product operation as target** 

Objectives assessed	Results and issues concerning the objectives assessed
Determination of launching envelope.	**Launching envelope *IAR-99 SOIM***  **Launching envelope *MIG-21 LACER*** 

Objectives assessed	Results and issues concerning the objectives assessed
Aiming the products after forming them as targets and igniting the torch, by IR missiles.	***Launching to MMR***  ***Launching to BORESIGHT*** 

D. RESULTS OBTAINED AFTER CARRYING ON THE TEST ACTIVITIES AND USING THE PRESENTED EVALUATION METHODS

1. During testing there were no incidents of malfunctions to affect the safety of crew or carrier aircraft.
2. The aircraft reacted normally in all phases of flight test, the flight parameters recorded during the launch showed no significant influence on the aircraft due to flight and launching the products, mounted on launching stations 1 and 2.
3. Integrated avionics and weapons system behaved according to the normal operation documentation of IAR 99 SOIM and MiG-21 Lancer aircraft, for the mode used to launch products.
4. All of the products launched by aircraft separated normally from hardpoints, were stable on the trajectory, the warheads were armed normally on the trajectory and have worked in accordance with technical specifications, so all technical and performance parameters were fulfilled.
5. Operational tests to verify operational performance on launch air-to-air missiles type 2 Magic have shown that TPDM-01M product can be discovered, aimed and followed by missiles, missiles launch

is running normally and they are directed toward the target.

6. Tests have achieved the objectives, the results have provided the information necessary for validate product configuration and validate new aircraft configurations used during testing and have allowed validation of the procedures for on ground and in flight operation of these products.

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THE EU AND THE EUROPEAN DEFENCE MARKET

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Abstract

The European Union's Member States spend hundred of billion euro every year on defence, of which the sixth part is used for defence procurement. The money on this defence procurement is not spend on a single market (the European Defence Market) but rather on twenty-seven different national markets because the European Union's internal market has not traditionally included defence equipment.

But some of EU countries do not buy their weapons from foreign defence companies (unless they do not have an indigenous defence industry or their national companies do not make the product the government needs). They have the tendency to favour their national suppliers irrespective of the price or quality of equipment they produce.

Therefore and not only it is necessary to create the European Defence Market.

THE EUROPEAN DEFENCE MARKET – ONE OF EU'S PURPOSE

EU governments are gradually coming around to the idea that they need to open up their defence markets, especially at a time when growing budgetary constraints clash with the increasing need for sophisticated military equipment[1].

In 2004 they created the European Defence Agency (EDA), and one of its many tasks is to encourage the convergence of national procurement procedures. In July 2006 the EDA introduced a defence procurement "Code of Conduct" to open up the European defence market. The basic idea behind the Code was to ensure that defence companies from any country could compete for most defence contracts across Europe, excluding multinational equipment programmes and the most sensitive goods like encryption devices. The Code of Conduct (CoC) has worked rather simply: countries that join the CoC vow to open all nonessential defence contracts worth over one million euro to foreign bidders. The code was voluntary and the EDA cannot force governments to comply with it. The Member States have so far shown very little enthusiasm for awarding contracts to outside suppliers. Their protectionist attitude derives from the fact that they regard defence procurement as an area that overlaps with national sovereignty.

But the importance of the CoC lies as much in its principle as its practice. The idea of more open European defence markets has been around for decades, but with little or no progress until the CoC was introduced. Never before have so many European governments agreed that they should open up their defence markets to each other. And the EDA should continue to build on the growing Member State participation in the CoC. For instance, EU governments could encourage further industrial consolidation by

[1] http://www.iss.europa.eu.

extending the EDA's Code of Conduct to future multinational programmes (they are currently exempt) within ten years. This would help increase the transparency of the tender procedure for multinational programmes and encourage more joint tenders and competition for contracts, which should help keep prices down[2].

In December 2007, the European Commission adopted a package of defence-related proposals, the aim of which is to help create a single European defence market for military equipment. This, according to the Commission, "without sacrificing member states' control over their essential defence and security interests". This package would bring the EU closer to its long-term goal of setting up a 'genuine European defence market' for military equipment, in a move applauded by politicians and the defence industry. One of the initiatives in the package was a proposal for a directive on public procurement in the fields of defence and security[3].

Also, this package has contained the following three elements:

- a communication with recommendations for fostering the competitiveness of the sector;
- a directive on defence procurement to enhance openness and intra-European competition in the national defence market;
- a directive on intra-EU transfers of defence products[4].

The proposed directives would open up the defence market, improve European cooperation on armaments and lead to a more competitive European defence industry. The European Commission's role in the defence market is confined to "dual-use" products that are components of both civilian and military equipment. But the defence market would benefit from the Commission's experience in policing the single market for commercial goods and services. However, given the sensitive nature of the defence market, some arms-producing countries are reluctant to give much new regulatory power to the Commission.

The procurement directive would establish four types of procedures to help streamline national procurement procedures. These are: restrictive calls for tender; negotiated procedures with publication; competitive dialogue; and negotiated procedure without publication. The proposal seems both fair and sensible, because it strikes a balance between opening defence markets to allow more industrial competition and the sovereignty imperatives related to defence procurement that governments worry about. Moreover, the text includes not only defence but also security equipment tenders. This is important for two reasons: first, because the frontier between "defence" and "security" equipment is blurring. Second, because the EDA Code of Conduct does not cover security items. Like the CoC, the procurement directive would encourage the opening of European defence markets, but with a broader approach (including security products) and it would be legally binding[5].

The Commission expressed its hope that the proposal would "pave the way for increasing industrial cooperation and optimising supply chains" and make a "crucial contribution to a more competitive European industrial and technological defence industrial base".

The Commission's initiative complements the Code of Conduct on Defence Procurement launched in July 2006, which covers contracts placed outside of EU internal market directives[6].

THE REMOVED BARRIERS FROM EU MARKET FOR DEFENCE EQUIPMENT

To achieve more effective armaments cooperation, European governments need to do a number of things such as pooling more resources,

[2] Keohane, D., *Introduction - Towards a European Defence Market* in Chaillot Paper, nr. 113, p. 7, European Union Institute for Security Studies, Paris, 2008.

[3] http://www.euractiv.com/en/trade/parliament-paves-way-single-eu-defence-market/article-178515.

[4] http://www.euractiv.com/en/security/eu-new-defence-procurement-initiative-broadly-welcomed/article-168918.

[5] Keohane, D., *Introduction - Towards a European Defence Market* in Chaillot Paper, nr. 113, p. 9, European Union Institute for Security Studies, Paris, 2008.

[6] http://www.euractiv.com/en/security/eu-new-defence-procurement-initiative-broadly-welcomed/article-168918.

managing joint equipment programmes better, and in particular opening up their defence markets. The history of European armaments cooperation shows that none of these goals are easy to achieve. NATO, the WEU, and more recently the EU have tried to improve multinational armaments cooperation for decades, with depressingly little success. Defence remains the most "national" of all policy areas, in the sense that the EU's Member States are very reluctant to give up sovereignty to international organisations.

As a result of this protectionism, a number of EU countries do not buy their weapons from foreign defence companies (unless they do not have an indigenous defence industry or their national companies do not make the product the government needs). Many still tend to favour their national suppliers irrespective of the price or quality of equipment they produce. They can do so legally because defence goods are exempt from the EU's single market rules (due to their sensitivity). But the absence of cross-border competition makes European weapons expensive.

In theory, a more integrated European defence market would allow free movement of most defence goods among EU Member States. Greater cross-border cooperation would allow larger economies of scale, increased industrial competition, and thus lower prices, particularly for more advanced equipment. Defence ministries would be able to purchase equipment from the company that offered the best financial and technical package, regardless of its national origin. Keith Hartley of York University has estimated that a single defence market could save EU governments up to 20 percent of their procurement funds.[7] EU governments spend roughly 30 billion euro annually on purchasing defence equipment. Thus, a single defence market could save defence ministries up to 6 billion euro a year.

The European Commission welcomes today's support of the European Parliament for a new directive to overcome fragmentation of the European defence market. The directive on intra-EU transfers of defence-related products, once implemented, will alleviate obstacles to intra-community trade and eliminate most transit formalities, while preserving Member States' control over their defence and security interests. The EP vote is based on an agreement reached with the Council.

Until now, national systems to control transfers of defence equipment have not distinguished between exports to third countries and transfers to other Member States. Applying heterogeneous and disproportionate national licensing systems hampers the security of supply between Member States, costs business over €400 million a year and curtails market opportunities in other Member States for competitive subcontractors from Small and Medium-Sized Enterprises (SMEs).

In order to change this situation, which is incompatible with the aims of the internal market and European security and defence policy, the Directive on intra-EU transfers of defence products will significantly simplify national licensing procedures thereby facilitating cross-border exchanges within the EU. This will help make defence industries more competitive and facilitate SME participation in prime contractors' supply chains. The new legislation should enable

[7] Keith Hartley, 'The future of European defence policy: an economic perspective', *Defence and Peace Economics*, vol.14, no. 2, January 2003, p.107-115.

Member States to meet military needs at lower cost, enhance security of supply for cross-border defence procurement and encourage industrial cooperation[8].

THE DEFENCE INDUSTRIES ARE WORKING TOGETHER TO SUPPORT EUROPE'S DEFENCE

The European defence industry makes a major contribution to the security and defence of European citizens. The key objective of the European Commission's defence industrial policy is to develop an innovative and competitive European Defence Technological and Industrial Base (EDTIB). Such an EDTIB is an important prerequisite for an effective European Security and Defence Policy (ESDP) which is designed to provide the EU with the capacity for autonomous action in order to respond to international crises, without prejudice to actions by NATO. A competitive EDTIB is also required to provide Europe with affordability and the ability to cooperate internationally in the development and production of defence equipment[9].

This industry is mostly concentrated in six Member States (France, Germany, Italy, Spain, Sweden and the UK) although companies producing ancillary equipment and systems are found all over Europe.

The European defence equipment market is technology-intensive with cutting-edge research and development in fields such as electronics, ICT, transport, biotechnology and nanotechnology. Many new technologies developed for defence have also turned into drivers for growth in civil sectors such as in global positioning and earth observation.

However, the European defence market is highly regulated at a national level and fragmented. Europe's defence-related industries (primarily the defence part of sectors such as aeronautics, space, electronics, land systems and shipbuilding) largely operate outside the internal market. Member States have maintained national control over defence equipment markets and related industries.

This fragmentation and divergent national policies creates red tape, hampers innovation and leads to duplication of defence programmes and research. Ultimately this undermines competitiveness of the European Defence industry and the effectiveness of the European Security and Defence Policy (ESDP).

Nevertheless, the situation is now evolving. The economic pressure resulting from reduced defence budgets after the end of the cold war, and the escalating development costs, make the maintenance of a comprehensive national defence industrial base impossible for any single European state. The European defence industry has therefore to enhance its competitiveness as much as possible. The technological evolution towards dual use and multidisciplinary technologies is an important new challenge presenting opportunities and difficulties[10].

THE EU AND THE DEFENCE EQUIPMENT POLICY

The EU's defence equipment policy[11] aims to promote the implementation of the European Security and Defence Policy (ESDP), the improvement of the Union's abilities to fulfill the Petersberg Tasks and the strengthening of European defence companies' industrial situation. The 2006 Code of conduct is paving the way for a partial ending of the defence industry's general exemption from EU's public procurement rules.

According to the Commission, the EU's defence equipment policy should rest on the following key considerations:

- cost efficiency of defence spending;
- maintenance of a competitive defence and technological industrial base;
- security of supply;

8 http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1981&format=HTML&aged=0&language=EN.

9 http://ec.europa.eu/enterprise/sectors/defence/index_en.htm.

10 http://ec.europa.eu/enterprise/sectors/defence/defence-industrial-policy/index_en.htm.

11 http://www.euractiv.com/en/security/eu-defence-equipment-policy/article-117487.

- better access for EU-manufactured goods to third country markets;
- need to respect member states' prerogatives in this sensitive area;
- ethics and fairness in the arms trade.

The Commission believes that "Europe's military equipment policy is in no way intended to copy that of the United States". Europe must make more efficient use of its existing resources, and to this end it must seek to harmonise its equipment standards and create a European defence market.

Besides strengthening political and parliamentary controls over the related processes, the Commission also aims to boost military equipment-related research and development, as foreseen in the 7th Framework Programme.

To provide stakeholders with a clear picture of Europe's defence industry landscape, the Commission proposes launching the monitoring of defence-related industries.

The European Defence Industries Group (EDIG) is advocating the creation of a European Defence Equipment Market (EDEM) - a more transparent and open market within Europe to fulfil military material requirements.

THE FULFILING OF A STANDARDISATION IN DEFENCE

The development, and use, of standards is largely seen as a technical matter rather than an important European policy area. However, standardization of defence equipment is an important basis for the opening-up of national markets and the gradual creation of a single European defence market. The Council of Ministers, in its Resolution on the Standardisation in the Field of Armaments (6953/03), stated "that standardisation is an important pre-condition to fulfil the building of a strong European defence industry". These principles underpin the Commission's policy in this area.

At the heart of this policy, is the development of the "European Handbook on Defence Procurement" (EHDP). The Handbook's primary objective is to provide Defence Procurement managers with the 'state of the art' standards references supported by information on best practice when specifying them in defence contracts. It is also designed to complement the work of NATO in this area and the European Defence Agency (EDA).

The work on the Handbook is being funded by the European Commission and being co-ordinated by European Committee for Standardisation (CEN).

The Commission would like to see the EHDP systematically used in defence procurement contracts. This will reduce divergence in standards, lead to better alignment of national procurement practices, support co-operation and enhance interoperability to the benefit of Member States and industry[12].

CONCLUSION

The European Defence Agency and the European Commission are trying to break up a highly protectionist defence market, which should help improve many defence ministries' bottom lines[13]. Plus streamlining Europe's defence markets would also create new incentives to reform the rules for transatlantic defence trade. If the EDA and the European Commission manage to convince EU governments to open up their

[12] http://ec.europa.eu/enterprise/sectors/defence/standardisation/index_en.htm.

[13] Keohane, D., *Introduction - Towards a European Defence Market* in Chaillot Paper, nr. 113, p. 12, European Union Institute for Security Studies, Paris, 2008.

defence markets, those benefiting would include the defence industry, which would become more competitive; the armed forces, who would get badly needed military equipment at a better price; and the taxpayers, who would get better value for money.

CAPABILITIES AND RISKS IN THE MEDIUM AND LONG TERM PLANNING IN THE AIR FORCE - METRICS AND METHODS

Ionel Hornea

Retired colonel, PhD in Military Sciences

1. INTRODUCTION

The first objective of the current Romanian defense budget, as in other NATO and EU member states, is to provide a portfolio of capabilities to meet the future uncertainty spectrum of the security environment. In this regard, since 2008, the Air Force conducted an evaluation of capacity and programming purposes resizing grounding on this principle.

Despite some progress, many limitations remain and persist in discontinuities between the assessments of capabilities and programming process at the level of the services programs. One of these deficiencies is that the capabilities-based *assessments remain anchored, unrepeatable in subjective judgments*. A second weakness is that there is a *discrepancy between the capabilities set and resources* to be allocated: financial and manpower. Planners of these services face great difficulties in terms of how to adapt programming, following an assessment in excess or shortfall of capability, especially if the relationship between the capabilities and the resources available remains obscure. A third weakness is that capabilities *assessments are* currently *performed* compared with *a single plausible future* and not the spectrum of *possible security environment*. *Uncertainty of the future* of the security environment – a central theme-based planning capabilities - *is not*, therefore, *caught in the current assessments* of capabilities and, respectively, of risks.

From this perspective, it is necessary to present a methodology for revise and how it can be implemented, based on the limitations of planning capabilities, and introduction of a new definition of capability and also current measures to implement them, to keep factors programming decision.

The *objectives* are metrics those new capabilities because:

• describe the direct relationship with the objectives set out in national planning;

• relate to program elements, definable parts of the program elements, or groups of elements of the program;

• are applicable, generally in a range of programs.

To this end, the practice of strategic planning capabilities set is defined, *first*, against the necessary resources to perform a specified level of operational activity in the defence planning scenarios. For example, the set of resources required to execute a major operation (MCO[1]) would constitute a set of capabilities, and where a number of a particular type of helicopters may be needed to MCO, then they constitute MCO capabilities.

Similar metrics can be defined for a number of means for a particular type of operations, including crisis or humanitarian operations, aid them and the state-building operations (such as banning drugs and non-combatant evacuation operations) which would involve additional funding. In this definition, the resource is not fixed, but may vary in relation to a given operational scenario. For example, a certain type of middle, designed for a particular MCO may constitute only 0.8% of the resource, compared to 2.3% as it was for an emergency operation on a

[1] MCO – Major Combat Operation

small scale. This definition of the capabilities assigns them naturally to the NAP[2], respectively, the operational objectives.

The *second step* is to quantify the resources required for each implementation of planning scenarios. We therefore have developed a prototype tool to highlight the resources required for implementation based on the amount and types of aircraft that can be deployed in each basic rule out in-flight, and some general features of basic infrastructure. These features include how the billeting are available, if available a direct supply of fuel through underground pipelines, and the degree to which the base is exposed to a high, medium or low risk, or conventional or unconventional attacks. The creation of these tools is suitable for determining implementation requirements necessary programming and also useful in the implementation phase. However, for use in regular programming, the instrument must be checked formally implemented and regularly maintained by the Air Force.

Thirdly, it is necessary to develop *algorithms for optimal allocation* of resources, both for procurement and for support. These algorithms may consider either a single programming scenario or to develop a robust program, rooted in a wide range of scenarios. Robust optimization maximizes capability sets reported to a number of scenarios, subject to budgetary constraints. Research shows (RANDOM[3]), two optimizations for scenario-based planning, using a single-set of scenarios, both recommending optimizing the allocation of costs between acquisition and support. The *first* determines the minimum cost for which all requirements specified in a set of planning scenarios, subject to the constraint that expenditure does not change more than a certain percentage from year to year. *Second*, maximize the ability to set single-scenario, given a fixed budget for each year specified.

As a result, the Romanian specialists in planning and programming (two concepts which, in the Romanian Armed Forces did not found a clear delimitation in terms of structural and organizational) should provide the analytical foundation for the development and evaluation - the defence planning scenarios. Clearly, the program aims to link planning and programming implications, expressed in terms of national objectives at the operational level tasks, rather than a single category of armed forces - in the concrete case now, the Air Force. Methodology would not only include an effective assessment program linked to a plausible future alone, but would give also the necessary robustness for a wide range of possible aspects of a future security environment.

Trends in military spending in Europe

• Total estimated total military spending in Europe in 2009 was 386 billion dollars (60 billion dollars in Eastern Europe and 326 billion dollars in Western and Central Europe).
• Expenditure increased by 2.7% in real terms compared to 2008 (2.6% in Eastern Europe and 2.8% in Western and Central Europe) and by 16% compared to 2000 (108% in Europe East and 6.6% in Western and Central Europe).
• Growth in Eastern Europe was much lower than in previous years, largely because of economic crisis.
• The largest absolute increase (in 2008 constant prices) were in the United Kingdom (3.7 billion dollars), Turkey (2.9 billion) and Russia (2.7 billion U.S. dollars)

Arithmetic of Defence Policy[4]

The campaign in Kosovo, in 1999, clearly showed the weakness of European military forces. Recognition of the consequences of this lack of capacity put into effect a new European debate on the issue of defence. However, the decline in military capability is systemic in each European country. Helsinki goals will do anything to address this decline, a fact demonstrated by the decline in national defence budgets in the last 15 years[5] (Figure 1), which have declined in

[2] National Action Plan

[3] Don Snyder, Patrick Mills, Adam C. Resnick, Brent D. Fulton , *Assessing Capabilities and Risks in Air Force Programming - Framework, Metrics, and Methods*, Published 2009 by the RAND Corporation

[4] Alexander, Michael; Garden, Timothy, *The arithmetic of defence policy*, International Affairs, volumul 77, nr. 3, iulie2001 , pg. 509-529(21)

[5] When we speak about the smaller countries, without any ambitions of power and, more importantly, lack of resources and creditworthiness to support such a large budget deficits, many have reduced their military spending in 2009, particularly in Central and East Europe. Among countries that have made deep cuts in the 2009 crisis are Bulgaria (7.6% in real terms), Croatia (8.3%), Estonia (9.1%), Lithuania (11%), Romania (13 %), Serbia (5.8%), Slovakia (6.7%) and Ukraine (11%). Largest reductions were in Europe in

real terms. While aspirations to maintain current levels of military spending were to be made, the decline in capabilities would continue.

Military equipment and personnel costs rise faster than inflation and, therefore, reduced weapons systems and personnel can be affordable each year, and the perspective shows that *there is no future* of significant growth in defence budgets of the European Member States, despite recognition of the need for a range of capabilities that allow the execution of costly post-Cold War operations.

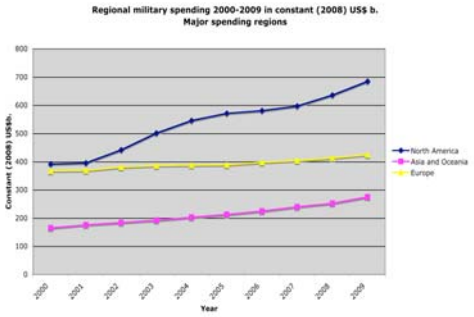
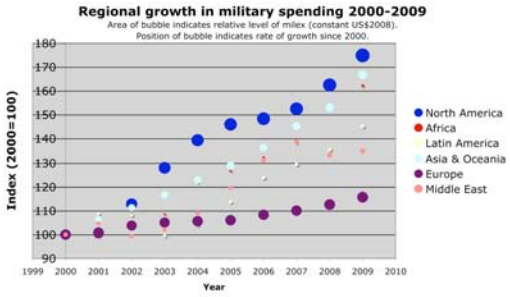


Figure 1 The level of regional military expenditure growth

Source: SIPRI Yearbook 2010, Table 5A

The meaning of studies (RANDOM) it is unlikely if palliative measures, now in testing, don't have major impact (Figure 2), the only option for European nations remaining a progressive integration of their forces to achieve efficiency savings which would allow to be maintained. There are opportunities for initiatives that would produce short-term consequences, but despite the severe political difficulties in terms of a long term plan for integration, the alternative is worse: *trying to maintain sovereignty in defence provision will mean that European nations will be ultimately unable to meet the most modest security needs, or to exercise any influence over security and defence policy at the global level* (mainly U.S. security and defence policy).



Regional growths in military spending 2000-2009

Source: SIPRI Yearbook 2010, Table

Current Air Force Planning and Programming

Each year, the Air Force[6] in all NATO and EU member states set their priorities and budgets for programs that form the basis of infrastructure, equipping and training them. The same process takes place in the Romanian Air Force too, whose size and complexity of activity give rise to a complex budget process, which runs continuously and employs a large staff of the General Staff, Air Staff and other Air Force basic structures and aimed inclusion and balance of the programs in its budget, and response to risk[7] taking for national defence.

The current system is PPBE, which divides the building budget process in four stages:

• *planning*, which provides guidance for developing the concept;

• *strategies* to meet the nation's defense needs, expressed as military objectives;

• *programming*, which translates the objectives of planning in sub-packages of resources allocated to specific;

• *budgeting*, which gives the best estimates of the costs for executing subprograms that are spending their money to complete.

Various specific structures send, on a regular basis, the objectives to the structures responsible (services, central structures, commands) for planning and programming in

Moldova (25%) and Montenegro (19%); Source: SIPRI Yearbook 2010-MILITARY EXPENDITURE, pg 2 (http://www.sipri.org/media/media/pressreleases/pressreleasetranslations/storypackage_milex)

[6] Air Force defines capacity as *"combined capacity of personnel, materials, equipment, and information in measured quantities, under specific conditions, which, acting together in a prescribed set of activities can be used to achieve a desired power"* (Air Force Instruction 10-604, 2006, p. 3).

[7] The term risk refers to the ability to hold / unrealize operational activities of the Defence Planning Scenario.

the PPBE system such as: CSA [8] (by The National Security Strategy); the Ministry of National Defense (by Defense Planning Guidance); chief of General Staff (by the Military Strategy and The Strategy of Armed Forces Transformation[9]). All these documents describe the planning environment, which in present had changed fundamentally, because in the recent past planning objectives revolved around the operational plans developed to address specific threats from opponents and reflected the uncertainties of security environment, while now they must focus on maintaining a portfolio of capabilities. This does not mean that the specific threat assessment was removed from the planning process, a variety of threats and unforeseen factors determining the nature and balance of required capabilities yet. It is a change of emphasis, from an optimal set of capabilities on a robust set, in which:

- planning to achieve optimal capability focuses on specific threats;
- planning for a robust set of capabilities is focused on ensuring the effectiveness of a range of conflicts.

This change of perspective in planning has direct consequences for programming. In the current PPBE process, Staff of the Air Force, with assistance from the General Staff, is responsible for submitting resource allocation decisions in response to and in accordance with Defence Planning Guidance, which focus on the needs for a six years period. In accordance with financial constrains, Air Force Staff is developing a set of program elements and a level of funding for these items, enabling the organization, training and equip forces to achieve the overall objectives of planning. The Air Staff orientation should be based, in large part, on commanders requests, which came in the form of integrated priority lists (IPLs[10]) and guidelines provided by defence minister through the Defense Planning Guidance[11], as I presented above. To monitor the implementation of the decisions, the Air Force Staff should organized the decision making in a corporate structure in on four levels, in

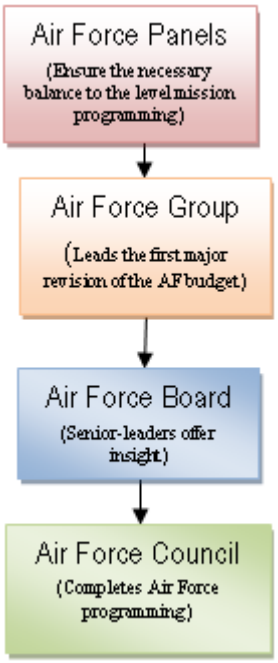


Figure 2 Implementation of programming and budget decisions in the USAF

accordance with the requirements governing the management of the projects in NATO and EU States Member's economies (Figure 2 – a variant).

Therefore, the previous scheduling decisions strongly influence current decision making process. Political problems and competition between suppliers also play an important role, as a strong factor is the inevitable subjective judgments of experts and leaders, and relatively persuasive skills of those who have supported programs and have made clear their benefits. Some of these subjectivities and rivalries are inevitable and probably in some cases, even beneficial.

However, a variety of arguments emphasizes the value of quantitative

[8] Homeland Security Supreme Council

[9] The Romanian current defence planning system does not include the *Strategic Defence Review*

[10] Integrated Priority List

[11] The ending product of the programming process are the resource allocation decisions on major sub-year program within the sub-major program the Air Force, making in accordance with Strategic Planning Guidance, provided by the Chief of General Staff.

assessments, objectives, capabilities the Air Force in the PPBE process, including:

- need to decide between competing programs;

- need to provide a robust set of capabilities (and minimum risk) to a specific, finite budget;

- desire to be balanced between these capabilities and functional areas need to provide a quantitative expression, objective consequences programming decisions MoD and where the Legislature approved.

In part to address these problems, the Air Force in all EU and NATO member states conducted a review and risk assessment capabilities process (CRRA[12]) process, which, I believe, will have to become *an immediate goal* and in Romanian Armed Forces.

Current Capabilities Review and Risk Assessment

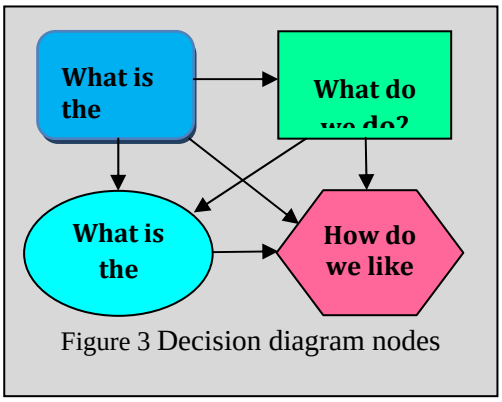


Figure 3 Decision diagram nodes

CRRA use MCL[13] as a starting point for an analysis of capacity and risk. These valuations have evolved and matured over the past years, now the central element is a set of Process Sequence Models (PSMs[14]). PSMs are maps showing the interrelationships of process activities that constitute the mission area, such as opening and base. They are essentially examples of decision networks[15] or influence diagrams[16] (Fig. 3). Nodes in the network are activities or tasks that must be completed for the mission. They assigned probabilities of success, indicating their simulations on the most important and most common areas of failure. These models, coupled with the current structure of CONOPS, binds and MCL. For example, in an agile combat support CONOPS, there are ten PSMs that do not reach other areas CONOPS, but linking the elements of MCL. In addition to these reasons, the PSM's entries include the probability of success and probability of occurrence for each node. Also included in the evaluation of functional and operational results desired, which derived from defense planning scenarios which, naturally, should be developed and managed by the Force Structure and Resources Directory of General Staff – J8. The analysis must be conducted on current and future capabilities, specified in the Air Force Program.

Finality of the analysis must indicate the node with the largest effect on operational results. In this way, limited resources are linked to indicate competence or adequacy of capabilities in a network. From this point of view, an F-16, for example, is not in itself a capability. Rather, the aircraft support equipment, necessary information for an assignment, and all other items necessary to perform the mission shape the general form of the capability. Only when all these elements are operational, those are available and the increasing of the level of available capabilities request to invest in the limiting element. This is the way to understand the efforts to provide

[12] Capabilities Review and Risk Assessment

[13] Master Capabilities Library

[14] *Assessing Capabilities and Risks in Air Force Programming*, published in 2009 by RAND Corporation
Process Sequence Models *allows* an organization:
- to *determine* what happens now is predictable and why;
- to *measure* how the process works efficiently;
- to *collect* information to understand what is useless and inefficient and their impact on the mission;
- to *develop* new improved processes to reduce or eliminate inefficiency.
(http://www.cps.gov.uk/publications/finance/process_mapping.html#a03).

[15] Examples: *Markov Decision Networks* [http://arno.unimaas.nl/show.cgi?fid=116]; *Bayesian network*.

[16] An *influence diagram* is a simple visual representation of *decision problems*. Influence diagrams offer an intuitive way to identify and display the essential elements, including decisions, uncertainties, and objectives and how they influence each other. This simple diagram describes the influence of the situation, a variable decision *"What do we do?"*, a variable chance *"What is the result?"* and our final assessment of *"How do we like it?"*. These four types of nodes are the *building blocks of decision problems*. Influence diagram (Fig. 3) gives a high-level conceptual basis of which an analyst could construct a detailed quantitative model.

a capability to review compliance with environmental requirements and risk assessment capabilities (CRRA).

Correlation programming decisions with capabilities assessments

„The keystone to satisfying these goals lies in how capabilities are defined and

Capability metrics should relate directly to plans or relating to the program, groups of program elements or subsets defined by elements of the program and is wide enough to allow their application in a series of programs. Methodology should aim to address their development to approach the programming in the agile combat support - for example, *do the funding levels of medical support and civil emergency programs provide comparable levels of capabilities?*[17] Or, *depending* on how increase (or decrease) the levels of fuel supply programs funding, *is changing* capabilities provided to civil emergencies? Are sufficient supported investments in all assets acquired? What levels of resources can be organized to best meet the uncertainties in the future security environment? Further, I propose to focus in particular on an assessment capabilities for agile combat support. However, many of the basic principles apply more broadly and should help in structuring the Air Force based on capabilities programming decisions.

Define programming capabilities

Hallmarks of good measures of capabilities are that it is intuitive and easy to understand, namely, that they meet the objectives described above. In this regard, proposing to use the capabilities definition as the *set of resources required to perform an operational level activity*. For example, the set of resources to perform a major combat operation (MCO), which refer to MCO-1, would become an MCO-1 capability. For example, where 17 helicopters of a type are considered necessary for an emergency MCO-1, then they constitute a MCO capability.

Similar metrics can be defined for a number of emergency operations - including the operations of small amplitude - removed contingencies for humanitarian aid operations and the of steady-state deployment, such as the prohibition of drug trafficking and disposal of non-combatants - might not amount to an additional level of funding. Resource capabilities are not fixed its value only in relation to an operational scenario. In this respect, two refueling planes may be 0.8 for a particular MCO, but may be 2.3 for a special event unexpectedly small. This principle is reflected in CJSOR[18] applied by NATO (SHAPE) for each Contingency Plan, respectively, for each CONOPS developed for ongoing operations and which contains the capabilities required by planning scenario developed.

This definition is somewhat elastic term use of capability, but it makes the analogy expresses the Air Force capabilities at the unit level , as the unit type cods (UTCs[19]) that specifies a capability needed by a statement of capabilities-mission. By this, a pilot unit is designated to determine what personnel and what equipment are needed to achieve the specified capability. In this way, a set of capacity and resources are equated, UTC is sometimes used as a benchmark for capability, or other resources. In the same spirit, we use the term *capability metrics* to refer both to the operational *capability of a set of resources* and the *resources determined in the context requires.*

This is why, programming with a set of scenarios, called the defence planning, is the solution most appropriate to implement this method. They are composed of homeland defense scenarios and scenarios for MCOs, unexpected, small, and steady-state deployment scenarios during post conflict period. Each of these scenarios is a unit of the developed planning capability catalogue. For each of these scenarios, it is the set of

[17] Don Snyder, Patrick Mills, Adam C. Resnick, Brent D. Fulton, *Assessing Risks in Air Force Capabilities Programming*, published in 2009 by the RAND Corporation, p. 10.11.

[18] *Combined Joint Statement of Requirements*

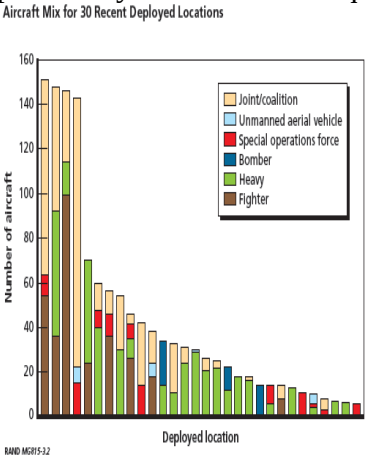
[19] Unit Type Codes

resources required executing and in this context, the set of resources is equivalent to the capacity of conducting operation[20].

This capabilities definition meets the above requirements, because the capability definition in operational terms measure the relationship between the availability of natural resources and operational results desired. By connecting resources capabilities, capabilities are also naturally related costs, both in value, expressing movement in the currency of calculation program and as a necessary dimension of human force to be employed. To address the uncertainty of future threats, capabilities analysis should take into account not just a set of scenarios in a given period of time, but the whole spectrum of scenarios defined in the defence planning scenarios.

Before we dwell on this point, it is instructive to compare these measures with some similar capabilities, currently used in the Air Force. To be more indicative of that allocation, the experts propose RANDOM us consider, for example, common metric, often used to measure combat support capabilities necessary resources to bring the operation: the number of free bases that can be opened and respectively operationalized. Using this metric, they say in another context, not surprising extent of the objectives included in the planning and analysis that follows and the average amount of fuel, and support elements in air bases used in recent operations three areas: Operation Enduring Freedom (OEF) Operation Iraqi Freedom (OIF) and Operation Allied Force (OAF).

At this stage it is not important to know the specific function of each activity, the emphasis here is the great variation in requirements for these resources (for each base), for different operations, which occurs mainly from two factors: *the use of the base* and *existing basic infrastructure*. Figure 4 shows the large variation in use, expressed in terms of types and numbers of aircraft. The figure describes the 30 locations where U.S. Air Force were recently used in support of OIF and OEF, whose intrinsic characteristics are the existence of a mixture of aircraft types and the fact that a large part of in site supports a number of aircraft from other services and coalition partners. Furthermore, it is surprising that there are a limited number of "typical" bases or sites with a number / similar types of aircraft, practically each base is unique in.



Source: RAND MG815-32

Figure 4 Variations in Use

The quantity and quality of combat support infrastructure varies considerably, not only from base to base in a theater, but also to the theater, the theater. The final effect can be seen clearly in Figure 5. OEF and OIF were held in [illegible]mmand area of responsibility of the United States, an area with numerous austere bases and without a substantial U.S. presence permanent. Therefore, there is no basis on which to perform typical air force, the number that can be supported varies depending on the type of commitment and location. These observations suggest a metric that focuses on *operational issues* rather than on considerations at the grassroots level. For example, the capability may be expressed in the way as much as, say, can help as a resource, operations in OIF. Where capabilities are expressed in such terms, rather than metrics with smaller field of application capabilities as diverse as medical support, engineer support in the field of civilian objects and actions to neutralize / suppress enemy defense inflatable can be examined and traded on a comparable basis, which directly relates to the planning target level.The challenge is then to determine what

[20] We believe that a resource is only when capacity is able of mission. Solving the problem of ensuring support costs for both sets of maintenance resources and the capabilities, it will last.

resources are needed to perform these operations of defense planning scenario, principally those in the specialized field known as the implementation requirements (represent the resources needed to perform one of the scenarios.) Returning again to Figure 4, we see the need to calculate the necessary resources for each of the different bases represented, having regard to infrastructure and other operational requirements.Note that only the deployment requirements to achieve all desired results, alone, are often insufficient, because some resources will be, at some point, inevitably, in the reconstruction, while others are set aside for training or staging bases, to be carried out only as a last resort. And these additional resources must be scheduled. The amount and ongoing requirements necessary to cover any disruption and training needs are called scheduled requirements.

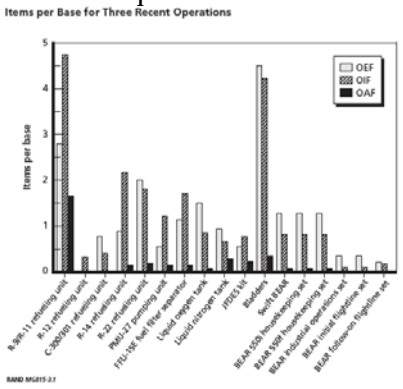


Figure 5 - USAF elements on a layout for the last three operations in the Middle East

Concordance between resources and capabilities

Now I want to propose to return to the core problem - *determining the necessary resources* to provide a fixed level of capacity. Implementation requirements for agile combat support resources can be determined in three ways. *First*, we can reunite the necessary experts in the field of programming / planning to interact with experts in operation, to create *the list of stages for UTCs*[21], called the *force data*, on Source: RAND MG815-32 implementation (TPFDD[22]). TPFDD are very expensive (in terms of time and work) to be produced. You may need about 60 experts to be assembled, whose activity is repeated over weeks or months to reach a viable solution. Part of the difficulty is the fact that the requirements for a functional area often depend on other factors. For example, in areas such as health care and civil engineering, they require knowledge about the population as a basic input for determining their requirements, but they can only be determined by summing all the requirements of all functional areas. This approach is probably the most accurate way to estimate the requirements for implementation, but it is inoperable for examining possible scenarios portfolio based programming capabilities for an uncertain future security environment.

A *second approach* is a step towards rectifying this problem. Over recent years, the Air Force in the armies of NATO member states with big technological advance led to a high UTCs sets the time and steps needed to support operational activities at an austere location. These groups are called *modules forces UTCs*. They direct the efforts already made by experts in the field, alleviating them duplicating the same analysis each time. However, as shown in Figure 4, not only that more operations are performed non austere bases, but there is a base type for all. Modules of force must be tailored to each location, and to do that, must be provided a set of experts. Although some time savings are realized, again this effort goes beyond what is possible for a flexible treatment of a scenarios portfolio.

There is *the third way*, the experts[23] advocate: *establishing a set of rules for the resources needed to implement the algorithm capabilities and keeping them current*. This is the approach developed by RAND as a strategic tool for assessing the requirements of Transport (START)[24] (Fig. 6). The tool calculates a set of UTCs needed to support operations from a location where forces were deployed and used aircraft characteristics and location, as input. For aircraft, the entries are

[21] Unit Type Code

[22] Time-Phased Force Deployment Data

[23] Conclusions of the RANDOM study - *"Assessing Risks in Air Force Capabilities and Programming - Framework, Metrics, and Methods";* Editor RAND Corporation, 2009.

[24] See too Snyder and Mills, 2004

the number of aircraft type and location, if they are stacked or used as locations a turnover stations, the rate of output, and respectively, the type of mission. For location, inputs are conventional and unconventional threat level faced by the (large, medium, or low) and some aspects of infrastructure, such as how much is available billeting, if available fuels hydrant system, and so on. With this input from the air battle order, a list of UTCs to support such operations can occur rapidly, as a tool used to determine the resources necessary to meet the full set of requirements revealed by the defense planning scenarios.

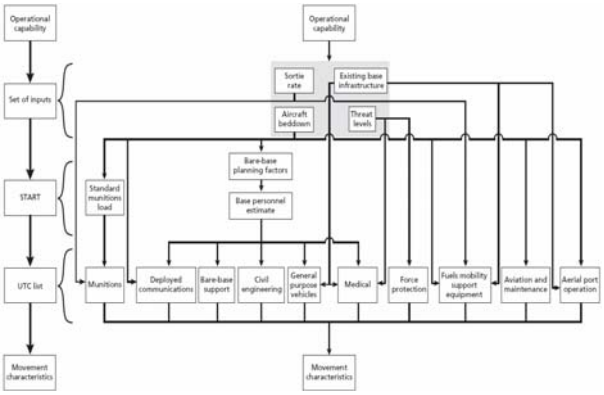


Figure 6 – Relations between functional model inputs and outputs

The difficulty in resource allocation on capabilities, required to be taken into account several considerations. In most cases, resources and capabilities are not permanently associated and therefore specialists[25] proposed to be taken into account the following four options.*First*, we must keep in mind that *a resource* or *a set of resources* can provide *a unique capability* and that *this capability* can be *achieved* only by *one single* resource or *a set* of resources. From the mathematical point of view, this is a *"one-to-one"* (or bijective) in the resource allocation capabilities. Because there are usually several ways to do this assignment, cases by this kind, strictly bijective, there are few. An example of this might be services for the deployment of a mine clearance. *Secondly, a resource* may be able to provide *several distinct capabilities*. An example might be an F-16CJ, which can annihilate the enemy air defence or combat air patrol. *Thirdly, a capability* can be provided *more resources*. For example, referring to the Air Force, a recognition capability could be achieved by a crew of by a U-2 aircraft, an unmanned aircraft Global Hawk RQ-4A, or spatial means. Another example is providing fuel, which can be supplied through tankers or pipeline system. And because the Air Force uses, often, locations, jointly with other groups working of the armed forces or other coalition nations, historically, some capabilities are not provided by Air Force organic resources. The Air Policy mission of Romanian Military Aviation, in the Baltic countries[26], was a clear example in this respect.

Fourthly, the relationship between capabilities and resources could be a mix of any of these three types. Many relations between resources and capabilities enter in the third category: the required capability can be provided by a number or different sets of resources. This situation is frequent and deliberate, giving Air Force a low risk and greater flexibility. Therefore, I believe that the planning process based on multiple assessments of capabilities and resources must consider these relationships - especially the third. The models developed show the *essence of the problems* involved in programming and are *the starting point* for modeling other complex cases. These, though they may be nonlinear, it should still be treated with standard optimization methods. If it is desirable to develop more complicated models, it depends on how much it would help in making an appointment scheduler wiser. Broader scope of a metric capability is, most probably, that a specific capability is provided by more than one resource.

It also shows a preference for operational capabilities in the PPBE programming. For example, if the capabilities were narrow metrics such as the fuel pump to a base, could create an ambiguity during programming in the terms of adequate fuel mixed with both tankers, and from hydrants. If the metric by capability at the operational level is specified, then this mixed is inherently

[25] Ibidem 23

[26] August - November 2007

specified (which has crept in the OPP as CJSOR[27]). In this sense, different operations will require not only different levels of the refueling capabilities, but also a different joint. Both this and the need to examine the usefulness of future uncertainties show the programmer to examine a range of operational metrics capabilities.

A capabilities-based programming methodology

As I pointed that the provision of capabilities is based on the Defense Planning Guidance. The programming goals are established on the basis of portfolio of planning scenarios that define of capabilities at the operational level metrics. Resources are linked to such *scenarios* by assigning a UTC approach that are necessary, from the entry level of air operations order, which, *linking* capabilities with the resources, *correlates* ipso facto programmable units, and costs arising both from need of acquire new assets and the need of sustain existing assets. Procurement costs arising from implementation requirements, recovery circuits and current stock levels. Support costs arising, also, from the frequency of use specified in the of defense planning scenarios and of attrition rates, determined empirically. Factors leading to these support costs cause also reconstituted channels - the only way all these ingredients interact each other in a complex system programming.

The challenge for the programmer is to clarify and balance all these factors, not only within a particular element to the program, but also a complete set to program elements that constitute to budget proposals (objectives, priorities, resources) which category to forces, in the our case the Air Force, subject to yearly approval by Chief of General Staff and later by defence minister. In this section, algorithms will be presented succinctly summarizes these ingredients in the draft program based on capabilities. They can be also used to assess how a proposal can be based on a set of desired capabilities (sets of operational scenarios). In this respect we developed *three approaches*, each providing a different insight into programming decisions, which are distinguished by how they treat and planning future goals, respectively, by the way that minimizes costs and maximizes capability.

The *first approach* minimizes costs (procurement and maintenance expenses), in circumstances they ensure the necessary capabilities of a set of planning scenarios, subject to constraints caused by fluctuations in expenditures from year to year. In this case, the planning objectives set include some subsets of defense-planning scenarios that are a possible future in which a state could prepare their defense.

The *second approach* maximizes the capabilities defined by the set to planning scenarios that are subject to fiscal constraints. In this case, spending limits can cause failure in achieving all the desired capabilities or costs could be high, which could lead to a glut in the capabilities, as defined by the objectives of planning. Both approaches build a future based on a deterministic program, while providing some important insights, especially if used repeatedly with different sets to planning scenarios. These approaches are not surprising, but the whole essence a robust planning, medium term security for an uncertain future and are known as *approaches a set to scenarios*[28].

A *third approach* develops robust program of an uncertain future. Since the latter maximizes the capabilities for one future alternative, the third case provides a simultaneous approach for a portfolio[29] of alternative future, subject to fiscal constraints. This method is known in the literature in the field as a *robust approach*.

[27] Combined Joint Statement of Requirements

[28] Ibidem 23

[29] Analysis which evaluates alternative investment options to various quantitative and qualitative objectives, including risk reduction. The analysis contributes to the "swinging" in an investment portfolio, i.e. a mixture of instruments. The intention is to address all the objectives and mitigate all risks, but at varying degrees, depending on priorities, budgets and achieving opportunities. http://www.rand.org/content/dam/rand/pubs/monographs/2008/RAND_MG662.pdf)

Modelling Approach

> *"To apply a rule to the letter, rigidly, unquestioningly, in cases where it fits and in cases where it does not fit, is pedantry"*
>
> George Polya, 1957, pg. 148

Each of the presented approaches involves the need to seek simultaneous values, minimum or maximum of several variables subject to constraints. Such problems lend themselves at analytical optimization techniques. The dual nature of the objectives suggest *two optimization modes*: one that *minimizes* the net-present value of the costs subject itself to all the performance requirements expected capabilities and other that *maximize* the global minimum capabilities (in time and resources), subject to budgetary constraints (e.g. budgets set; constraints on annual changes in the budgets of programs).

For all modes of optimization capabilities expected to be specified. Having regard that the unexpected is expressed in the types, probable locations and time, they will be kept as inputs in the programming, which will be specified separately by each user (program directors), depending on capability metrics, obtained either from defense planning scenarios or through an exploratory analysis of past events (e.g., OIF[30]). This flexibility allows the programmer to explore the implications of various assumptions on the process of program planning and vice versa.

In current practice, is used linear programming (LP) to find the optimal method by choice of purchasing decisions of capabilities, based on a predetermined set of contingencies. Solving a deterministic optimization and application forms are suitable for LP quick solutions to problems on an industrial scale. Thus, LP satisfies our desire to look into a wide range of resources and offers the programmer a quick review. It is flexible enough to allow confrontation with intrinsic and nonlinear components of the problem by using linear constraints, in the particular, feedback of the decisions by procurement and pricing examples resulting from procurement over time, which may affect the status of planning base.

Experience showed, however, maintain that the advantages outweigh any benefits linearity mathematics that can accumulate through the introduction of nonlinear pricing. The pricing problem can still be addressed by adjusting linear parameters, such as establishing a purchase price constraint (for example, forcing a certain minimum level of purchase at any time) and another price for acquisitions without restrictions (e.g. allowing of public to vary at zero at any value in the general budget constraints). This allows the programmer to exploit the variable effects of prices due to industrial base status, but maintains and enormous benefits of linearity.

Using in the analysis

George Polya (1887-1985)[31], one of the leading figures of mathematicians' prominent XXth century, of the issues addressed in his studies and general principles, based, as was natural, from the underlying mathematical problem-solving. The spirit of his advice is equally applicable in programming from the Air Force to analyze of the capabilities of any model. Together, these considerations require the use of a programmer trial. In addition, the programmer needs the perspective of the impact of programming decisions on the Air Force capabilities in development planning objectives and their budgetary priorities, and assesses the risk they might incur.

Cases based on a single scenario

First, we will review, briefly, the algorithms use a single scenario: (a) *to minimize costs* (on a state on a single scenario) and (2) to *maximize capabilities*, as defined by a scenario, subject to budgetary constraints. We start with minimizing costs. Figure 7

[30] Operation Iraqi Freedom

[31] **George Pólya** was a Hungarian mathematician. He is most noted for his work in heuristics and mathematics education, publishing several books on the subject, the most famous of which is the celebrated *How to Solve It: A New Aspect of Mathematical Method.* http://en.wikipedia.org/wiki/George_P%C3%B3lya

shows the optimal connection, depending on of time of the set of capabilities and resources at this type of programming. They (resources) may cover one or more program elements, programming all the requirements of a single fictitious scenario set at minimum cost subject, under the constraint that costs do not vary from year to year, with more than a certain percentage. The The ordinate of the plot show neat capability over of planning period, beyond which additional resources were needed to achieve the scenario set, specified in the plans.

Consequently, when a curve is zero, the resource at that time corresponds exactly to the requirements in scenario planning. If positive, this (plan) has more capabilities than are needed for the scenario set. Since this optimization always meets such requirements, the curves must be non-negative. If the curve was negative, it reflects a lack of resource on at chosen scenario.

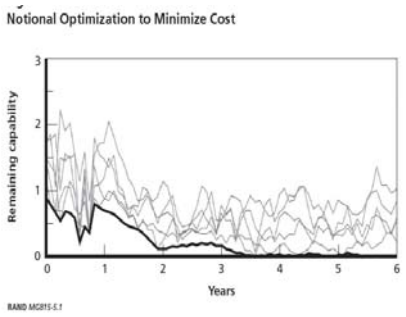


Fig. 7 Theoretical optimization to minimizing costs
Source: RAND MG815-5.1

Ordinate values depend on the choice of metric. Any metric can be selected capability, which may be remaining capability from certain major operation (MCO), emergency, small scale, or humanitarian operation for which requirements are known or can be determined. Note is that the choice of array *will only change the magnitude* of these remaining capabilities. Whether the graph *curves* portions are *positive* (or negative), the *choice* of the metrics is *independent*. Examination of a series of metrics allows the programmer to see the quantitative impact of the proposed program in relation with the different types the contingencies.

For a given set the resources from Figure 7, the limiting form the bottom. Fort his set of the resources, the total capacity is not better than the worst-performing component, so the overall capacity of the set of the resources is given by the thick curve which marks the lower limit. When this thick curve is above zero, many resources are more available than necessary for the specified scenario, set at a particular time. A positive value does not mean, necessarily, an excess of the capabilities, those remaining positive being necessary sometimes to ensure that there will be deficits in the future.

Graphics, as the one shown in the Figure 7, show that resources are in the excess, especially compared to the baseline (have always remaining positive capacity), which are critical (to a moment touching zero). The data set available to of the programmer indicates the balance of investments needed to purchase, reconstruction, and O & M[32]. This not only helps the programmer to determine the appropriate asset and its protection level, but also the possibility of the financial support, ensuring that these assets are real capabilities (able to ensure the mission), and the not remain unavailable because of lack of support. This analysis can be extended to the case of maximizing of the capabilities in relation to with the chosen scenario, a situation which is illustrated in the Figure 8. The elements are the same graph as in Figure 7, except that these curves for each activity are suppressed - only the lower curve is presented. The exact element of this analysis is to explore the risks that could be supported by a cost lower than the optimal values shown in the central chart and to determine additional capabilities, acquired in an additional expense.

[32] Operating and Maintenance

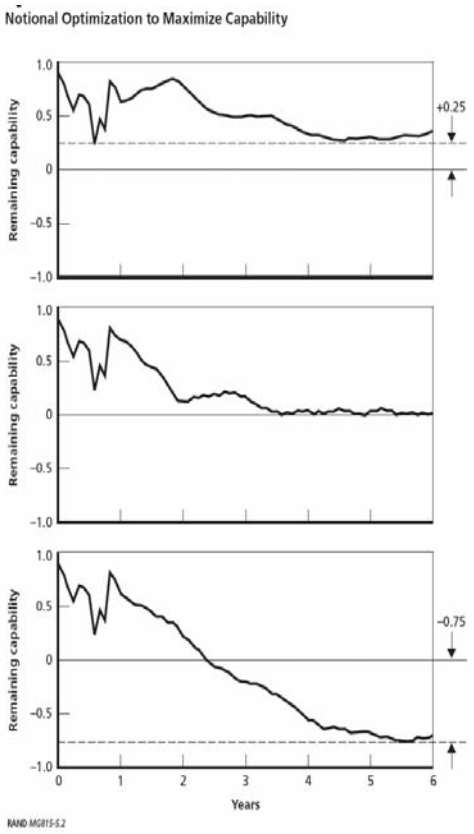


Figure 8 - Theoretical Optimization for minimizing costs (detailed version)

Source: RAND MG815-5.2

It is instructive to consider the addition and the removal of the same amount of money in relation with t presented in the central graph of Figure 8. Upper graph shows the optimal programming solution where some additional money (the example, several millions the dollars) is added in compared with the program presented in the central graph. The graph below shows the optimal scheduling in situations that money are out, say the same million dollars per year listed in the schedule as compared with the program central. Generally, the result will be shown in the figure: the same amount of money, added at an acquisition program ensure *less additional capabilities*, as well as for removal only made money for assuming risk.

The reason for this nonlinear response is to determine the smallest frames and thick curve in the figure, causing the overall capacity of a set of related resources. If a program is non-balancing (i.e., the remaining capabilities of individual resources are spread widely over the lower bounding curve), additional purchasing capacity is relatively inexpensive, since only one or two resources may need to be purchased (or reconstructed) to push up the lower bounding curve. The more capabilities are acquired, the minimum bounding curve moves up, and more resources are grouped in this curve or near the lower limits, which make the overall program is much more balanced, which is good. But pushing the curve further up, you will need to buy a part of almost all the resources and therefore the program becomes more expensive. Put another way, in a program healthy, balanced growth in purchasing power requires a lot of resources, since resources are interdependent. However, in accordance with the principle of funding from a single central resource / base, it can make a whole set of resources inefficiently.

Conclusions

Programming tools described provides a guide and not a solution to the current programming dilemmas. Uncertainty of many input factors and incommensurability - in particular risk - requires the intervention of policy makers. Subjective decisions, singly, are insufficient to build a program that spends money and manpower allocated effectively and efficiently. The approach of the methodology and programming tools, developed through the research in the field of defense planning, provides guidance reproducible, quantitative, to build a program to provide specified capabilities and way in which to assess how will work, in relation to the various challenges of future security environment.

Defining capabilities in this way, we link natural capability to plans. The first recommendation of RAND experts in this regard is that, where possible, define the capabilities to be made under the terms laid down for plans by the guidance of the Minister of Defense, rather than Air Force tasks[33].

Three key elements make this analysis possible. *The first* is *defining* the way of the

[33] RAND Corporation, *Assessing Capabilities and Risks in Air Force Programming*, 2009 edition, p. 66, http://www.rand.org

establishing of the metrics capabilities, so that feature programming decisions. To guide the planning, measurement capability must have several attributes. In a clear manner, reproducible metrics capabilities must be linked to program elements or sub-elements, clearly defined by the program elements. *Second,* metrics *capabilities must be related to planning objectives*, such as plans to set up and model directly programming. And *thirdly*, capability metrics should *link the capabilities* in general terms that apply to programs and not individuals or specific terms that apply to a program or function. Otherwise, the transaction between capabilities and programs is neither reproducible nor quantifiable.

Current metrics capabilities of the Air Force fails, generally, in to capture these attributes, which further indicates that the use of aggregated measures of how a resource provides a minimum contribution to the operational objectives, such as MCOs, crisis response operations and steady-state deployments, to establish a state of equilibrium which constitutes the defence planning scenarios.

From this perspective, the first RAND recommendation[34] in this area is that, where possible, capability should be defined according to the minister defense planning guidance, rather than Air Force requirements.

Linking capabilities of programs leads to the following key: *to determine resource requirements to achieve this set of operational capabilities*. In providing agile combat support resource requirements for implementation can be resolved at the level of the air order of battle. To make these calculations quickly, is also necessary a similar procedure to those established for UTCs: how much of each UTC is needed, which is interdependence UTCs to support specific number of aircraft types, which are the rates of exit flight data, and the locations where infrastructure can fly again? RAND research has demonstrated, primarily, the feasibility of such a rule-based tool with a prototype model[35]. To be useful in regular programming and execution of decisions, this model should be formally verified, implemented and regularly maintained.

The second RAND recommendation is "to develop and maintain a rules-based tool for generating TPFDD[36] requirements that give some order-level inputs for the air battle planning scenarios."[37]

These first two factors ensure that there ingredients for building cost-capability curves for sets of related resources, which is the foundation for the *third key element*: *a set of algorithms* for (a) assessing the impact of exchange of capabilities and (2) developing a robust commitment capabilities to cope with an uncertain future security environment. A set of resources is not necessarily a capability, unless a sufficiency to support an effort to maintain these resources able to the mission.

A third RAND recommendation is " to develop a robust program across a range of plausible scenario sets that balances asset levels with sustainment investments, in lieu of programming to meet a single challenging scenario set"[38].

Uncertainty abounds in programming. Input data such as life expectancy of resources, potential obsolescence when it might be more rapid modernization, are very difficult to collect. Moreover, the way in which will be this future is impossible to predict. It is tempting to avoid shaping the face before those uncertainties, because the modeler has to commit to decisions on the values of these parameters. However, any programming strategy makes assumptions about the values of these inputs. Assumptions made without a review are simply default and less reproducible, providing a justification for reproducible analysis, measurable targets for the budget aimed at a national level. A combination of skillful and shrewd programming decisions can build a strategy to provide a robust and agile set of capabilities

[34] Ibidem 33

[35] (See Snyder and Mills, 2004)

[36] Time-Phased Force Deployment Data

[37] Ibidem 33

[38] Ibidem 33, pg 67

that will meet the challenges of an uncertain future security environment.

FINAL NOTE

Any defence planning and force development system can be successfully implemented only if there is a more clear and stated government policy to guide planners. But to be clear, "it is folly for any defence planner to wait for such guidance is provided in official documents." Inevitably, planners are left to discern the guidance of a variety of sources, more or less obvious or obscure. For example, these important defenses planning guidance can be found in sources such as the nation's constitution, the defence laws, the officials' speeches, interviews of government and even the press. Indeed, experience leads to the idea that the usefulness of these other sources of guidance and prioritization can far exceed that of public documents, the national policy oriented. Finally, these guidelines and priorities must be promulgated in policy documents from the MoD Defence which inevitably will include principles such as defence of national sovereignty (and, in the context of NATO, respectively, of collective sovereignty), participation in crisis response operations, etc.

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CONCERNS OVER FLIGHT PARAMETERS INTERPRETATION IN ORDER TO IDENTIFY THE CAUSE – EFFECT CONNECTION IN FLIGHT OCCURRENCES

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Abstract: The study proposes an operations series to be followed by the personnel with duties in analyzing flight parameters acquired at the aircraft board during the flight exercises, in order to identify the cause-effect connection in flight occurrences. The actions flow is exemplified by the effective analyze of flight parameters registered during a specific exercise while a flight occurrence happened.

Analyzing a case study, the paper presents:

- identification of a right flight maneuvers and variation mode for important parameters during maneuvers;
- identification of the maneuver with abnormal variation of some flight parameters;
- identification of the mechanical ensemble of the aircraft affected by the abnormal variation of some flight parameters;
- explanation of the mechanical process at which the affected ensemble was subjected and that leaded to the overloading of an element from the mechanical ensemble.

Keywords: *aircraft flight parameters, flight data recorder system, flight occurrence.*

1. INTRODUCTION

To illustrate how the interpretation of an aircraft flight parameters may help identify the immediate cause of the flight occurrence, we chose Puma helicopter one.

Of high importance in such a situation is the aircraft characteristic to be equipped with acquire and registration system for as many flight parameters (Flight Data Recorder system).

2. CASE STUDY

2.1 Flight description. The helicopter aircrew had to make a flight for training, so that to simulate the occurrence of special situations on board.

At a certain point, the aircrew simulates the helicopter hydraulic system failure, the procedure involving the landing as soon as possible. The situation was timely solved and the landing was made in normal parameters.

At one point, while executing a turn, an engine failure was simulated by reducing the

right engine speed. To solve the situation, landing the helicopter with taxiing was required. Immediately after landing, during taxiing, abnormal helicopter vibrations were observed. To limit the vibrations, the increase of the right engine speed (the one reduced for simulation) was commanded to normal operation. This moment coincides with the end abnormal vibrations of the helicopter. An exterior control of the helicopter was made by the flight engineer, with the engines working and everything was normal.

Further, the aircrew performed the flight according to training.

2.2 Consequences of flight occurence.

After the final landing and the engines stop, it was found that the main rotor blades descend too much and the inferior automatic limiters remained in the unlocked position.

Weather conditions during the flight were normal and did not affect the flight occurrence.

The helicopter was moved to the repair shop, the main blades were lifted in normal position and it was found that the inferior automatic limiters return to initial position only by applying a considerable force. Consequently, for further technical investigations the main blades were removed and the articulated axles of the inferior automatic limiter were examined.

Deformations of the articulated axles were found, the maximum bending-deflections values being exceeded (fig. no 1), and the teflon bushings inside the bores limiters were damaged.

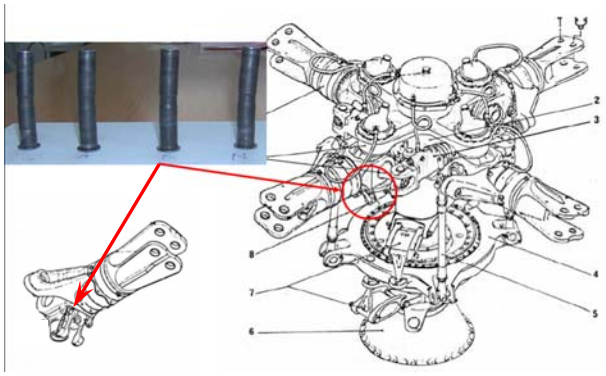

Fig. no 1 – Deformations of the articulated axles of the inferior automatic limiters. Location on the helicopter main rotor.

2.3 Flight parameters analyze. After analyzing the recorded flight parameters, the following were found:

a) Landing procedure with disengaged hydraulic system was executed correctly (fig. no 2). To achieve the landing the adjustable-pitch propeller value (P) was reduced in a period of time $\Delta T = 9$ seconds from P = 12 to P = 5.6, the vertical acceleration coefficient being Nz = 1. The engines rotation speed decreased from 88% to 76 % value.

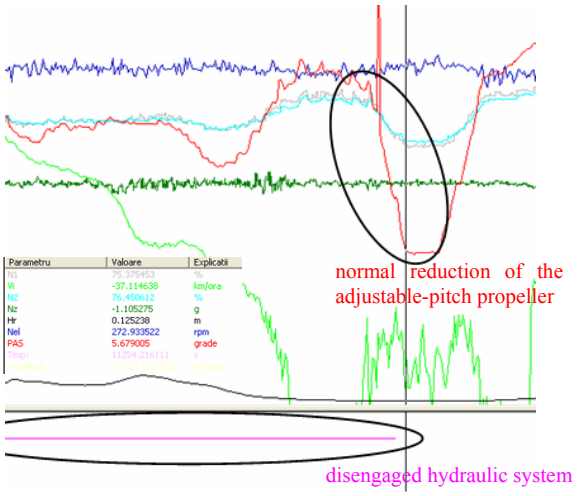

Fig. no 2 – Normal landing with disengaged hydraulic system

b) With right engine decreased, landing with taxiing was made under the following parameters: adjustable-pitch propeller value was reduced in a period of time $\Delta T = 3$s from P = 12 to P = 5.6. The left engine rotation varied during this time between N1 = 95% and N1 = 78% values.

Ample reduction of the adjustable-pitch propeller, in a short time, led to a hard landing and this was the cause of the vibrations that were felt in the helicopter main rotor hub and also in the whole structure. The vibrations are visible on the flight parameters recorded, in the ample, unnatural variation of the vertical acceleration coefficient Nz (fig. no 3), which had values between Nz = 0.6 and Nz = 1.5, for a period of time $\Delta T = 9$s. A further proof for the vibrations cause is that they stop when the adjustable-pitch propeller value increases (during the aircrew command) to P = 8.5. The end vibrations moment coincides with the

moment when the engine rotation speed is commanded to normal value.

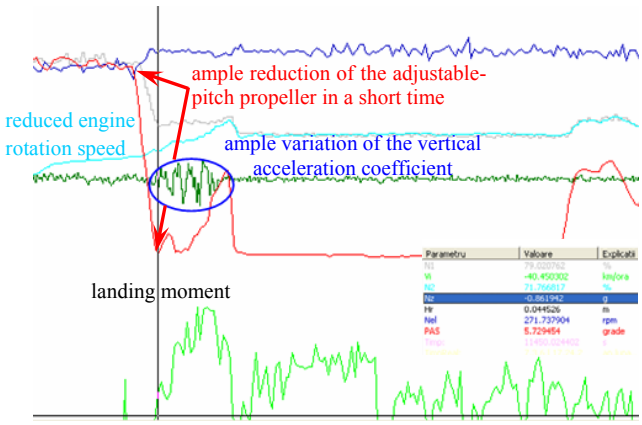

Fig. no 3 – The hard landing

2.4 Explanation of the mechanical process. The immediate cause of the flight occurrence was the ample reduction of the adjustable-pitch propeller value, in a short period of time. (P = 12.17 ÷ 5.7, ΔT = 3 sec.)

Due to the ample reduction of adjustable-pitch propeller value, the main rotor blades had a forceful beat movement, the main rotor sleeves hitting the inferior automatic limiter feeders (fig. no 4) and forcing (under the Fs force action) the articulated axles to be deformed. The pitch articulation sleeve is equipped with a limiter which stops the blades to descend under a constant value, when the engines stop (in order to protect the tail beam ensemble).

The articulated axles being deformed, the limiters springs can not longer bring the feeders in the locked positions, thus, when the engines stop, in the absence of centrifugal force, the sleeves descend to the fixed limiters level, and therefore the blades descend over the normal position.

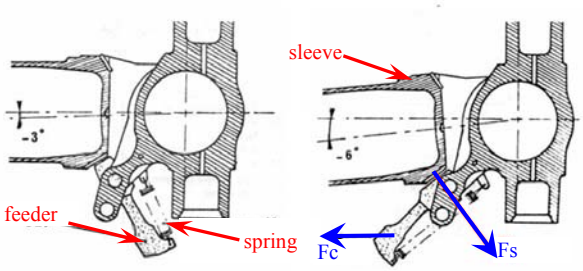

Fig. no 4 – Inferior automatic limiters positions

In fig. 4a the main rotor hub is stopped. The sleeve rests on the contact surface of the two feeders which are pulled by springs. The value of the angle (3^0) between blades and rotor disk is normal.

In fig. 4b the engines are working at normal rotation speed. The centrifugal force (Fc) acts on the feeders which, unlocked, allow the blade to have a beat movement down to the fixed limiters. The value of the angle (6^0) between blades and rotor disk is normal only in a few situations during the flight.

Thus can be explained why nothing abnormal was noticed when the flight engineer executed the visual examination over the helicopter with the engines working. In this case, the engines were working, the feeders were unlocked, but the blades weight was canceled by the lift force.

3. CONCLUSIONS & ACKNOWLEDGMENT

Flight parameters interpretation has a specific character from one type of aircraft to another, a particular role having the knowledge of the aerodynamics and constructive limits of the aircraft, the analyst's experience in exploring the aircraft as a macrosystem, as well as correlating the results

with information obtained from the flight aircrew.

By the above mentioned, this study itself takes part in the reactive activity for preventing flight occurrences, by identifying, in a particular case, a cause – effect connection which, once known, leads to propose recommendations for avoiding, in the future, occurrences with similar causes.

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COMPARATIVE EVALUATION OF RADICAL AND "DESTRUCTIVE" ORGANIZATIONS

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Abstract: *The paper describes a set of common character traits typical for members of radical and "destructive" organizations, optimal age limits for involving into such kind of organizations and cults.*

Key words: *radical organization, terrorist group, psychology.*

1. INTRODUCTION

People involved in radical groups or "destructive organization[1]" are originates from different social groups and classes. There is a set of character traits which are common for members of radical groups. These character traits are mostly similar to that ones, which distinguish adherents of religious cults. When involving a person into a religious cult and his adoption of a cult normative system, the person itself is changes significantly. Similar considerable changes, so-called "sudden change", happen when involving into terrorist organization due to person's renunciation of belonging to a certain social group, person severs relations with society and is obliged to live in secret.

Analysis of different social groups and special academic and scientific literature allows us to reach a generalization: there are the following social and character traits of individuals, who are inclined to indoctrination[2] — individuals, inclined to hysteria; persons with paranoia mood; loony individuals; dependent type of personality; persons from families with hyper guardianship; persons from incomplete or antisocial families; invalids; people, suffered of painful psychic traumas; with developed eidetic sense; inclined to confabulation; children and relatives of members of cult or terrorists.

2. AGE LIMITS FOR INVOLVING

Than the person is younger, the more the person is subject to indoctrinic influence, because of perception surrounding as educational environment.

The adulthood is characterized by active orientation on adaptation to communication patterns in a small group, in other words –

[1] **«Destructive organization»** — is a group, which activity is seen by society as destructive as respects to: a person of such society, mental and/or physical health, guaranteed rights and liberty of people, society itself, its traditional structure, culture, norms of public peace, social values and life-style.

[2] **Indoctrination** — irrational belief (persuasion), which condition is the trust, and result — faith.

adoption of rules of play in a group. This age is the most vulnerable due to its higher receptivity to suggested stereotyped behavioural reactions in a group. Moreover, especially at this age importance of symbolic parental figures, which are protectively chosen outside, is extremely increased.

The second age of higher apprehensibility is youth from 17 up to 19 years old, when real craving for self-affirmation in a society rises. But there are not enough power for it and, therefore, moral support of patron, who is a fortiori more powerful and well-educated in comparison to a young person.

It is enough to demonstrate efficiency of proper behavior in critical situations to become a cult figure for a young person. Teenage is characterized by strong motivation to formation of personal character and image, "the I", through denial of discard patterns of behavior. Self-determination and self-affirmation are reached by contrasting and keen differentiation of personal identity against observed examples of fates and styles of life. Just so the psychic politics of indoctrination is developed, orienting on offering a teenager role models wittingly different from generally accepted role models. Personal maturity becomes apparent in adequate perception of such kind of life-style, which is seen by immature individual as formal, banal, dull and grey, used up, unpromising and insipid.

3. SEXUAL ASSIGNMENT

According to statistics, the most of adult members of cults are women, but the most of cult leaders are men. Terrorist organizations show inverse situation. About 75 % of members are men. During last years the radical organizations start to involve women into terrorist activity as suicide bombers. Earlier, their activity was more planning and preparing of terrorist acts, but not performing.

4. COMMON CHARACTERISTICS

Terrorists also as cult members do not form specific psychiatric group. Different scientific papers present their definite series (from normal persons up to psychopath). Most of investigations did not prove occurrence of evident psychic pathology. Results of judicial and psychiatric examination showed that 88% of defendants as terrorists had typical aggression as reaction on probable threat from environment [2, p. 95]. In terrorist organizations also as in cults there is a large-scale percentage of aggressive paranoiac persons. They are disposed to externalization, to impose responsibility to failure on circumstances and to find external factors for explanation of their inadequacy.

Similar characteristics of religious cults are given in monographic work "The orthodox" by Eric Hoffer. It was shown that for the most of religious cults are characterized by finding a common enemy, who is accused of all internal problems of religious organization. As such enemy they can have Satan, government, other confessions. It is no wonder that Islamic terrorists keep up morale of soldiers, pointing on threat from "Creation of Satan" — United States of America.

John Mack developed term "egoism of a victim pursuer". This term means lack of compassion of a pursuer to his victim, even if a victim suffering is much higher than the level of anguish experienced by a pursuer himself (Mack, 1979; Olson, 1988). Egoism of a pursuer perhaps explains why terrible terrorist acts are done in cold blood, premeditated and sparingly (Miller, 1988). Violence requires from a person self-justification. The aims of terror and cult are so elevated, that the goal justifies any methods of reaching it. Sometimes performers are so unscrupulous, that they are ready to realize any task, not paying attention to the methods. Lyfthon developing his conception, presented in his work "Reform of thinking and psychology of totalitarianism", enlarged it with the model of "reduplication of personality". He also presented the process of "self-justification" in his work "Nazi doctors: medical murder and psychology of genocide". He tried to explain psychological mechanisms that allowed professional doctors become unreceptive to that reality that they become the most effective production line of murders

known of all history of human civilization — Nazi prisoner-of-war camps. This research concludes to a more exact understanding how people in good psychic and physical sense, educated and intelligent quite fast become fanatic of cults which ideology is completely inverse to their primary views on life. This sharp and deep resocialization of personality is a result of adaptive reaction under extreme pressure and manipulation with basic human wants. Lyfthon named it "reduplication".

Reduplication[3] consists of dividing system of personal "the I" on two independently functioning integrities. This division takes places because at certain moment a member of cult or terrorist group faces a fact that his new behavior is incompatible with his "the I" before involving in a cult or terrorist group. Behavior required and rewarded by totalitarian group is so different from the previous "the I", that ordinary psychological protection (rationalization, ousting and other) is not enough to continue living. All thoughts, belief, actions and roles, related to destructive cult, are arranged in independent system, so-called partial "the I" that entirely complies with requirements of the group. Though it is not a result of personal choice, but a self-preservative instinct in the nearly insufferable psychological conditions. The new partial "the I" acts as entire one, eliminating internal conflicts.

In general, young people because of their intellectual and moral immaturity are involved due to "lofty ideals". Young people easy accept radical nationalistic, social and religious ideas. Youth is involved usually through totalitarian (means completely overpowering personal will and liberty, governable only by power of "leader" or "teacher" and "Guru"). There are some examples of such groups named as "Aum Synryke" or "Red Brigades". Becoming a member of organization means to overcome estrangement, to start feeling as a part of the whole, to finish with severity of life, to pass on to a real life. Perhaps, reasoning from such logic, such kind of self-actualization for a terrorist is changing for a real life – the terrorist activity.

Long-term being as a member of terrorist or cult group at illegality also under intensive terrorist (religious) training including special technologies of psychological adaptation transforms them in a specific environment. As it is similar to criminal environment, we can call it terrorist environment distinct by specific type of consciousness of people that form it.

Genesis of forming and dynamic of behavior of an "involved" person depends exactly on such factors as education, training, perspectives of self- actualization in the present life and society. Mechanism of terror is situated deeply, masked with layers of moral substantiation. The most common motivation for terrorist action is a sense of despair, psychological discomfort that causes estimation of self-position as dramatic. So, recruiting into cults takes place with emotionally unbalanced persons. In general, such disbalance is due to stress related to grim impressions after tragic accident, divorce, death of near relation, and loss of work and other. Even very different terrorist and cult organizations have identical characteristic – blind devotion of their members to goals and ideals of the organization. One can consider that these goals and ideals motivate people to be involved in the organization, but it is not optional. Goals and ideals serve as rational explanation of membership. But the real reason of involvement is a strong need of

[3] **Reduplication** is different from the traditional conceptions of "splintered" consciousness and "splintered" psychological personality systems.

belongings to a group and a sense of self-identity.

In general, people from incomplete families, people severed in frames of social conditions, people lost or never had job become members of radical (destructive and terrorist) organization. The feel of estrangement in such situations forces a person to join to a group that seems to be as well as him. Consequently, strong need of belongings to a group of similar people related to problems of self-identity is a general characteristic of terrorists and cultists (Miller, 1988).

It is obvious that one can not become a member of radical and cult group at once. Before becoming involved a person comes through apathy and other forms of social disadaptation. Self-identification with asocial (radical and destructive) group gives such people social role, even negative. To break relations with such group for "involved" person is almost impossible. It means loosing self-identity. "Involved" person has so low self-appraisal that can not dismiss this self-identity. Those people not at al authoritarian therefore become members of stringently authoritarian groups. Being involved in such a group, they gain protection from their fear of authoritarianism. At that any aggression against this group is interpreted by them as attack against themselves. Essentially, any internal action increases group solidarity. This should be taken into account when organizing informational struggle against terrorist or cult organizations. In proportion as "involved" person is inspired by group ideology, one adopts absolutist rhetoric and newspeak.

This situation (process) provokes "involved" persons to attack society and opponents accepted as enemies, whoever they are. The enemy is defined by an organization leader-Guru. They define targets and methods of attack to be realized. At the same time specific groups of population (opposition or government) are insinuated to support terrorist or cult groups therefore obligations of such a group. This causes so called mutual protection that allows leaders to expect for finance, provision, concealment, supplying with recruits and other. This indirectly involves larger groups of population, creating for a terrorist or cult group its social basement and making difficulties for opposition against violence.

Is should be mentioned that cultists prefer not asking for support from social groups, but using of technologies of consciousness control to occupy and overpower them. Important feature of this situation is that "involved" member of a cult must have no private property and a cult helps him to get rid of it. Cult organizations as opposed to radical groups generally control large enterprises and top-managers. Radical organizations prefer to destroy aiming intimidation and destabilization of situation in society. Cult groups prefer to add and use to strengthen their ascendancy.

Such forcible radical and cult environment consisting of ideological centre, special units and social basement is quite effective instrument for those people who control it.

SUMMARY

Concluding aforesaid:

- "destructive" groups use the same techniques transforming intellection (consciousness controlling) as radical terrorist organizations;
- "destructive" groups as opposed to radical terrorist organizations prefers occupation of social groups (or large enterprises) for further reallocation of resources converting resources to their benefits, but not for terrorist acts aiming destroying enterprises or social leaders;
- "destructive" groups as opposed to radical terrorist organizations prefers to avoid attention of mass media;
- Internal environment of cult and terrorist organizations in mostly similar due to similar characteristics of consciousness of "involved" persons;
- Sources of terrorism and "destructive" organizations are similar, which allows to consider them together as phenomena of consciousness controlling, sociology, criminology, victimology and social psychology.

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COMMUNICATION AND INFORMATION SYSTEMS WITHIN THE CRISIS MANAGEMENT

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Abstract:

Considering the current security risks, a need arose to define critical infrastructure as a part of the infrastructure which, once destroyed, would make the developed countries face up severe economic and political consequences. Accordingly, a need arose for an appropriate security of this infrastructure in the case of terrorist attacks. Naturally, this also implies a need for implementation of modern and secure communication and information capabilities in both military and non-military operations on the territory of the SR (NATO) within the crisis management.

A coherent approach to the issue of protection and security of modern deployable ICT systems in both military and non-military operations on the territory of the SR (NATO) within the crisis management operations is a part of a complex issue and as such it requires elimination of other risks related to particular environment and circumstances, like natural disasters, emergencies, industrial accidents, physical wear out of installations (networks and facilities), lack of strategic supplies and scarce raw materials, use of mass destruction weapons, organized crime, spread of contagious diseases and many others.

Modern deployable ICT systems must be able to ensure efficient and failure free operation of all the communication and information elements of the system, be that the elements already employed or the elements to be implemented in a foreseeable future. This prerequisite is closely linked with the needs and requirements of deployable units earmarked for military and non-military emergency operations so that the successful accomplishment of the allied tasks is ensured.

Keywords: communication and information systems, crisis management, protection, security, interoperability and flexibility

Considering the current security risks, a need arose to define critical infrastructure as a part of the infrastructure which, once destroyed, would make the developed countries face up severe economic and political consequences. Accordingly, a need arose for an appropriate security of this infrastructure in the case of terrorist attacks. Naturally, this also implies a need for implementation of modern and secure communication and information capabilities in both military and non-military operations on the territory of the SR (NATO) within the crisis management.

Terrorism focuses primarily on carrying out attacks against civilian population and against the critical infrastructure of the state, with the aim to inflict heavy casualties and extensive damage, to instill fear and create atmosphere of insecurity. In addition to traditional threats to critical infrastructure like natural disasters, negligence, technology breakdown resulting in emergencies and accidents, unauthorized access and intrusion into computer systems or other criminal acts, a

phenomenon of terrorisms poses a new threat to security. A serious threat that modern terrorists efficiently use is a threat of the information and communication technology systems of the Allied forces being disabled, ruined or severely damaged.

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Security of modern ICT systems in the crisis management operation should focus, besides many others, on protection against terrorist attacks, with the following being the most likely forms of attacks:

- ***a direct action*** – a direct armed physical attack against a target, carried out by the armed terrorist groups,
- **a *bomb attack*** – an attack that is most likely to be carried out by an individual or a small group, using a non - conventional explosive charge (i.e. other than aerial bombing),
- ***CBRN attack*** – an attack using chemical, biological, radiological or nuclear agents
- ***Cyber attack*** – an attack aimed to destroy data or to ruin a computer system or to cause irreversible damage to a computer system/a computer program, normally via the Internet
- information operations – attacks aimed at gaining or misusing the information or attacks aimed to influence the information based processes (e.g. to influence a computer system in a way that it seems to be fully operational, however, the data used are being manipulated), whereas one's own information and computer systems are fully protected.

A paramount need to provide a secure environment for modern deployable ICT systems is a corollary of the fact that the current level of informatization in defence sector is very high. Equally, there is a critical need for informatization of the allied units deployed in military and non-military emergency operations on the territory of the SR (NATO).

The basic characteristics of a modern, fully deployable mobile ICT system that would be employed in military and non-military operations within the crisis management operations are as follows:

- mobility,
- modularity,
- interoperability,
- reliability,
- fully automated system,
- security,
- deployability,
- stability and endurance,
- open architecture,
- full autonomy and independence on the existing stationary infrastructure,
- the system needs to be easily and quickly put into operation.
- flexibility.
- others.

Modern ICT system should be designed as a mobile system and should not require a manual change of configuration every time that a position of one or more communication (information) subsystems (entities) is changed. Mobility should be based on fully distributed systems and dynamic distribution of data. Individual elements of ICT system should be fully functional also as autonomous entities without a need to communicate through central

management system. Mobility of the system must ensure that ICT is ready to be deployed under various climatic and geographic conditions, that is to say all over the world.

Another characteristic feature of a modern deployable ICT system is modularity. Modularity should facilitate a simple replacement or adding the HW components (devices) or even the whole blocks of machinery. With a view to available and reliable logistic support, the system should use just one type of HW components (e.g. server memory, the same type notebook, phones etc.). Software modularity should facilitate extended functions through new modules (entities) and provide a basis for integration of further customer's systems depending on the type of operation (mission).

A modern deployable ICT system with its broad portfolio of interface, modularity and fully distributed design must be able to adjust and adapt to any environment with standard interface. Interoperability of the system in question should be based on an open architecture and on portfolio of standard commercial and military interface installed in communication nodes (entities). A mobile ICT, equipped with a supporting tool X.500 protocol and transformation of directory services into a standard shape, should be capable of cooperating with many other ICT systems, be that military or non-military systems. At the same time it should be able to cooperate in the field of provision of individual information and communication services.

Individual entities of a deployable ICT system should be equipped with devices that ensure high reliability. HW components must be selected with regard to a wide scale usage, extensibility and scalability, reliability, unification with an adequate available technical support. Life-cycle of all the commercial HW components should be minimum 3 years and the individual manufacturers of HW components should provide both warranty and post warranty service, depending on geographical deployability of the system. A form and way of service to be provided should be arranged prior to deployment.

A modern deployable ICT system must be designed as a fully automated system and should not require change of configuration of individual ICT subsystems every time when the individual components of the system in question (entities) change their position. Equally, the processes of application of service packages should be automated. Low maintenance costs and easily available logistics should be ensured through the use of the so-called COTS (commercial) unified and easily available technologies and through standardization of components and interface.

A modern deployable ICT system will only be as safe and secured as its every component, entity or subsystem with the access to the system in question, be that through radio network, LAN or WAN. The use of Gate Personal Firewall, antivirus and antispyware solutions is an intrinsic part of modern ICT systems and an implied duty. Nowadays, at the time of global Internet, when remote working becomes more and more popular, which results in a need to connect to the home network through remote Internet connection, the operational systems of individual subsystems and applications must be properly maintained, operated, updated and secured. Every day the new security risks to software applications emerge, as well as threats to operation systems and applications that pose a genuine risk of ICT systems coming under attack, which might result in abuse of data or abuse of identity of users, even in serious

damage to or disabling of the ICT system as a whole, or some of its components.

The issue of automated repairs and update of operation systems and the individual information subsystems in modern deployable ICT systems is a complex one, and as such it requires maximum attention to be paid by a supplier and by a buyer of the ICT in question. Nevertheless, the system should be, at least, capable of the following:

- identification of a level of quick maintenance (update) and service packages
- testing of a quick maintenance on a pilot group of computers
- distribution of a quick maintenance to the selected groups of computers, information subsystems and the individual entities, based on the needs of the unit in question
- evaluation of a success rate of update and installation of service packages (patches)
- return to the original condition of the component, subsystem or individual entities in the case of problematic or inefficient update

A modern deployable ICT system must be designed as modular one, with a possibility to extend the ICT system (subsystem) in question and add the other communication or information elements, entities and subsystems. At the same time, there should be a possibility to integrate the system or subsystem in question into the other national or international ICT systems. The ICT system should provide a basis for integration of the other customer's systems. The system should have a sufficient capacity to address the needs of employment, super temporarily if possible, and should facilitate the use of applications on the existing HW device.

The scale of a system solution of a modern deployable ICT system should enable:

- building a communication (radio) subsystem,
- building IT subsystem,
- administration of users and defining rights on particular levels (a user, administrator, server administrator, etc.),
- file and press related services, direct or shared,
- local and remote configuration of workstations,
- remote installation of workstations,
- remote control of workstations and servers,
- videoconferences and presentation services,
- provision of electronic mail, as a minimum POP3, IMAP, SMTP, X.400,
- directory service according to a standard X.500, with a possibility of a connection to external systems,
- redundant architecture for the selected components (entities) of a system or subsystem,
- services DNS, DHCP (administration of IP directory plan),
- automated patch management of the OS and PC for the core parts of the system,
- replication of the domain information,
- replication of a file system among the individual entities or subsystems,
- server data back up using disk fields,
- remote control of servers without a need of a running one,
- hardware necessary to meet the user's requirements,
- software necessary to meet the user's requirements,
- provision of a platform for implementation of the other communication systems,
- making GPS coordinates available for the other systems or units.

A communication system should be designed to provide safe and secured mobile voice and data services through different information subsystems and radio systems with net devices and applications joined in support of communication between units within the crisis management. A communication system should provide LAN and WAN networks for the whole mobile

communication network, as well as connection to external LAN and WAN networks.

IT subsystem of a modern mobile communication system should be designed to minimize usage of WAN communication. In IT subsystem, the QoS services must be implemented that would, in critical situations, ensure that the defined type of voice and data communication is preferred. IT subsystem should be designed in a way that would ensure that WAN communication would provide the user with the following possibilities:

- replication on level AD (Active Directory) – implementation of directory services,
- file replication of DFS module (Distributed File System),
- HTTPS communication with the management,
- remote control of PC and servers,
- fully functional electronic mail (e-mails),
- access to intranet/internet,
- centralized patch management.

All the above mentioned services to be provided by IT subsystem must be optimized as to the use of WAN communication.

Likelihood of unpredictable asymmetric military and non-military threats is typical of the current security environment as well as of future security environment. With this type of threat, a rapid response becomes a vital prerequisite to success in crisis management operations. These operations require timely, flexible and agile command and control capabilities, supported by an interim local network and information infrastructure that must be fully deployable, easy to put in operation and easy to operate. It must also be resilient, stable, reliable, safe and secured.

The experience from NATO operations – primarily from Afghanistan and West Balkans – have shown that for an efficient crisis management it is inevitable, in the field of CIS, to provide units with modern deployable ICT systems based on proprietary HW and SW solutions, that would guarantee security of voice and data services in NEC-oriented environment. These systems must be based on a fully distributed modular and promptly deployable system that would create basic conditions for successful conduct of both the military and non-military crisis management operations.

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IAR-99 GROUND VIBRATION TESTS AND DYNAMICS FINITE ELEMENT MODEL

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Abstract:

In this presentation, we will concentrate on typical Ground Vibration Test (GVT) and Finite Element (FE) comparisons software. It is necessary to note, that standard GVT are obligatory for any new aircraft configuration. We can mention here the investigations of the IAR-99, modern trainer and ground attack aircraft, using PRODERA® GVT equipment. A Finite Element Model (FEM) of the IAR-99 has been developed in PATRAN/NASTRAN®, partly from a previous ANSYS® model. The results obtained with Finite Element Analysis (FEA) are strongly depending on the experience and judgment of the engineers involved in the analysis. Highly representative FEM can be used to investigate potential structural modifications or changes with realistic component corrections. Model validation should be part of every modern engineering analysis and quality assurance procedure.

***Key words**: aircraft, ground, vibration, test, model*

1. INTRODUCTION

This paper presents a study performed on the IAR-99, advanced trainer and ground attack aircraft (Fig. 1).

Fig. 1 IAR-99 Advanced trainer

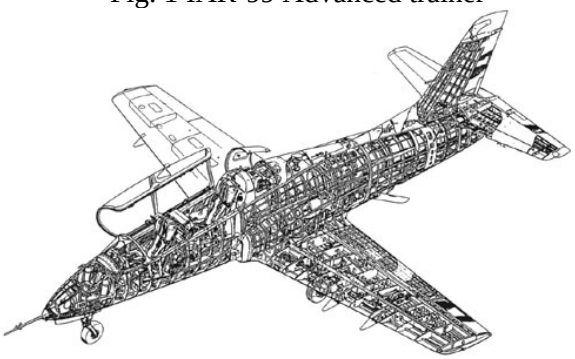

Fig. 2 IAR-99 Advanced trainer

The Romanian Air Force has 17 of the IAR-99 trainer aircraft in service with the 67th Fighter Bomber Group based at Craiova (Fig. 3).

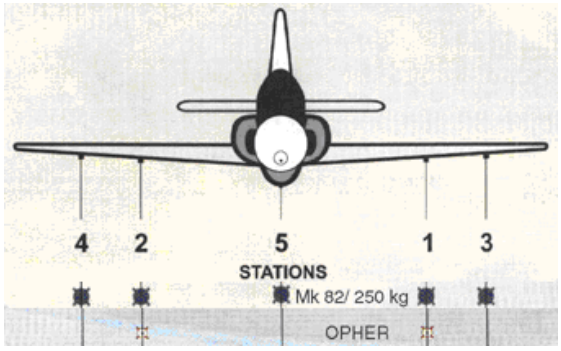

Fig. 3 Armament configuration example

2. LIBRARY OF CAD SUBSYSTEMS

A CATIA® library of CAD models of the IAR-99 and external stores has been developed (Fig. 2).

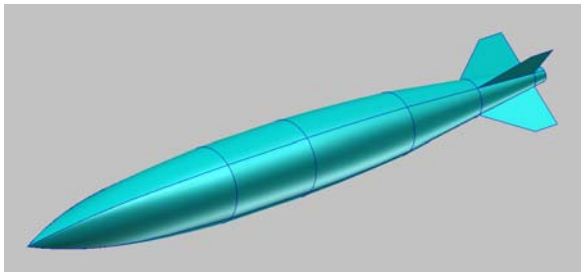

Fig. 4 CAD Library - MK-82

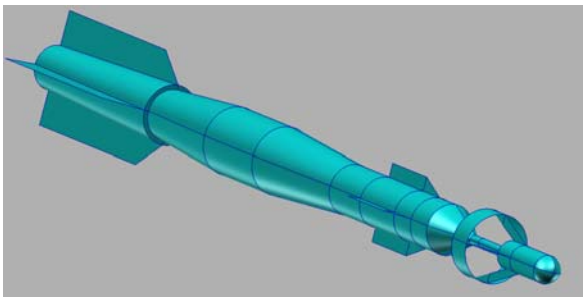

Fig. 5 CAD Library - OPHER

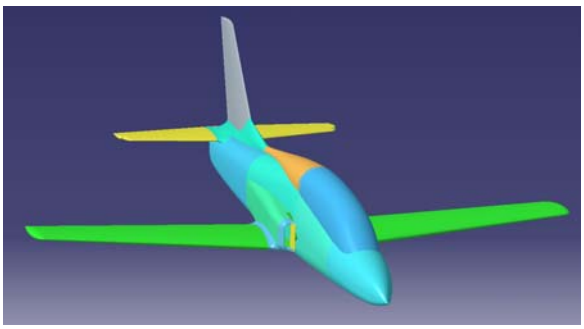

Fig. 6 CAD Library- IAR-99

3. LIBRARY OF FEM SUBSYSTEMS

As an example, the FEM of the IAR-99 without external stores, is represented in Fig. 3

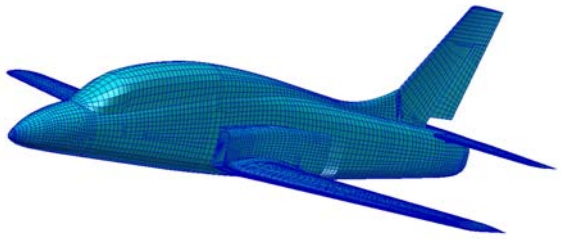

Fig. 7 IAR-99 - FEM

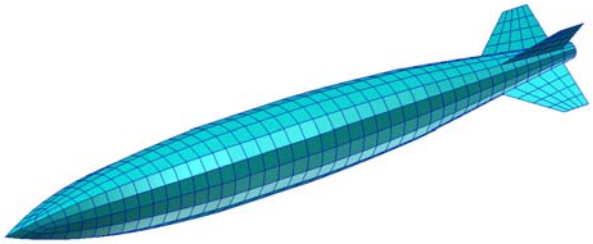

Fig. 8 FEM Library - MK-82

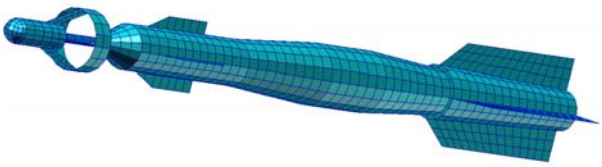

Fig. 9 FEM Library - OPHER

4. AIRCRAFT FEM ASSEMBLY

A finite element model of the IAR-99 has been developed, partly from previous model [3], using PATRAN/NASTRAN software [1].

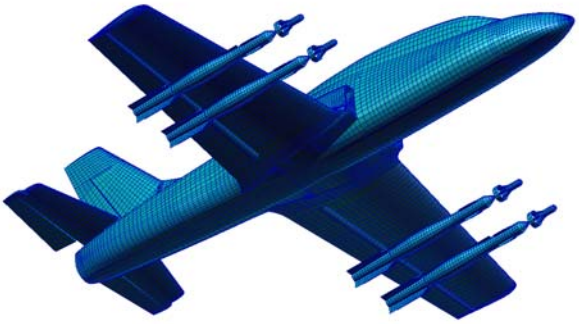

Fig. 10 IAR-99+4xOPHER configuration

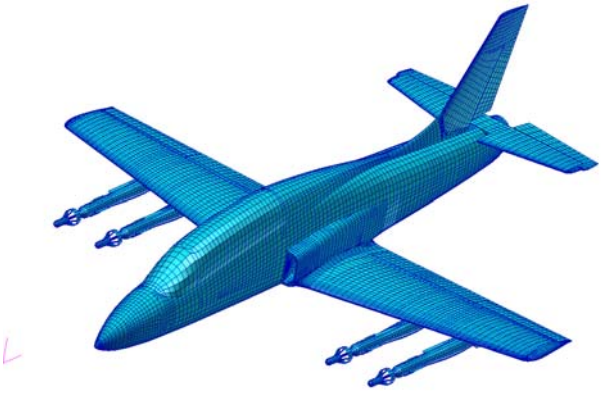

Fig. 11 IAR-99+4xOPHER configuration

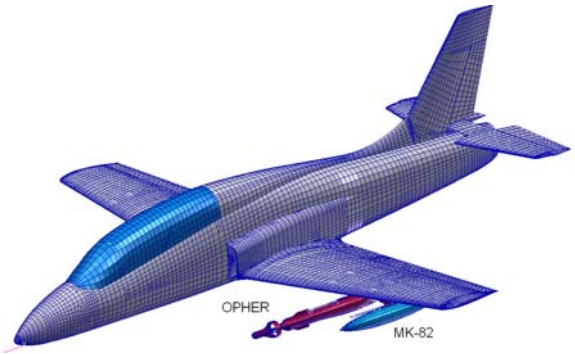

Fig. 12 MK-82 +OPHER configuration

The normal modes obtained from the FE model, represent an accurate enough estimation of the aircraft eigenfrequencies and mode shapes.

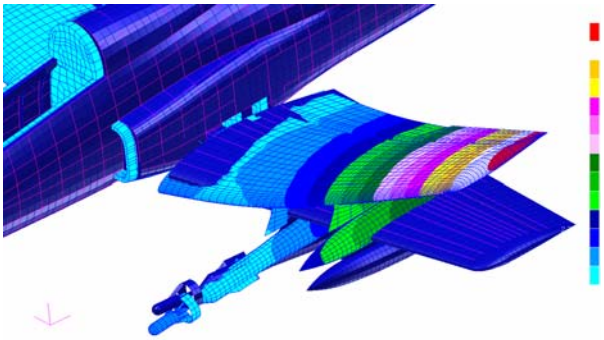

Fig. 13 Wing 1st vertical bending mode

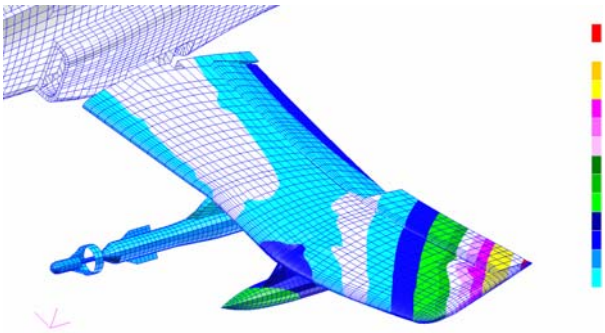

Fig. 14 Wing 2nd vertical bending mode

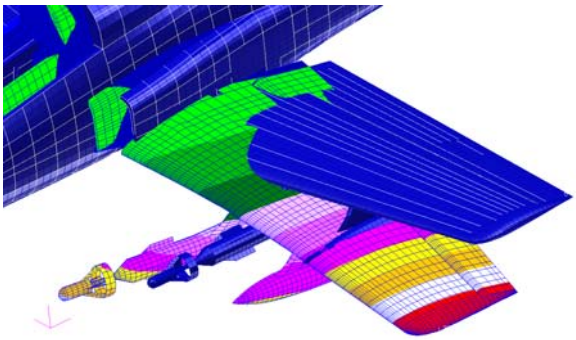

Fig. 15 Wing 1st in plane bending mode

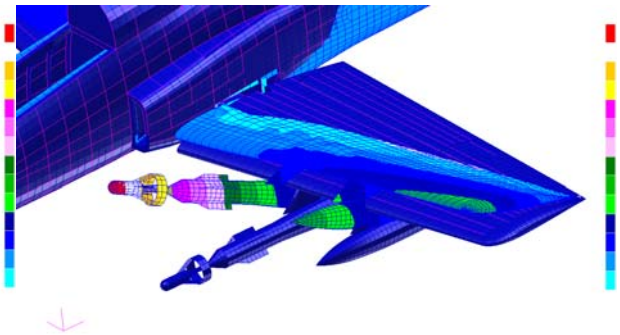

Fig. 19 OPHER 2nd gyration mode

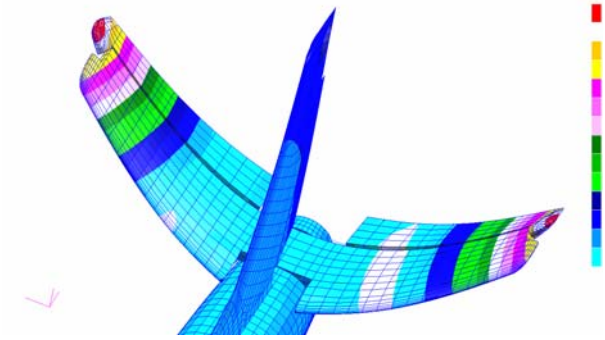

Fig. 16 HT 1st vertical bending mode

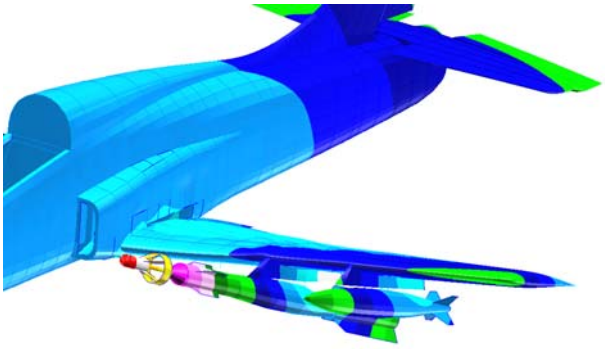

Fig. 20 Fig. 6 Wing 1st torsion mode

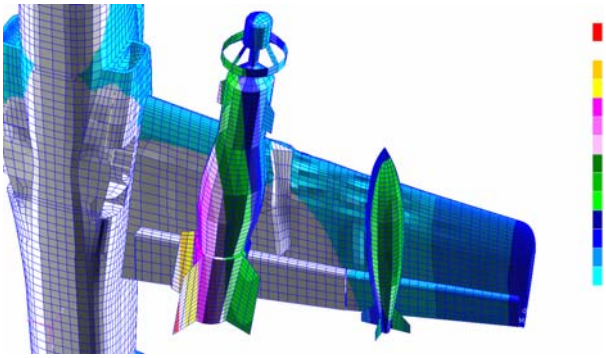

Fig. 17 OPHER 1st gyration mode

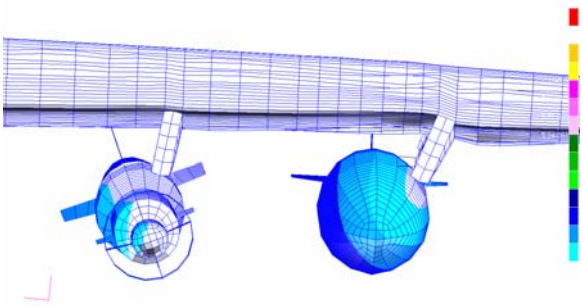

Fig. 21 MK-82 Lateral bending mode

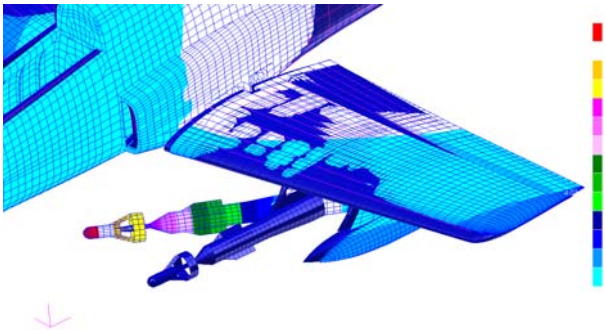

Fig. 18 OPHER 1st gyration mode

5. GROUND VIBRATION TEST

The INCAS/STRAERO stress team completed a successful GVT of the full IAR-99 aircraft, with weapons, in December 1999. During the series of tests, many different weapons configurations were loaded onto the test aircraft. After the first tests, PRODERA equipment was widely used for the GVT of all classes of flying vehicles, military and civil.

Fig. 22 GVT configuration example, [2]

During the test, the airplane was standing on under-inflated tyres of the main landing gear.

Fig. 23 GVT configuration example (detail)

For each test condition, external shakers induced vibration of the aircraft's wings, stabilizer and stores to verify the stores' effect. The aircraft's response was measured with more than 50 accelerometers and other external devices.

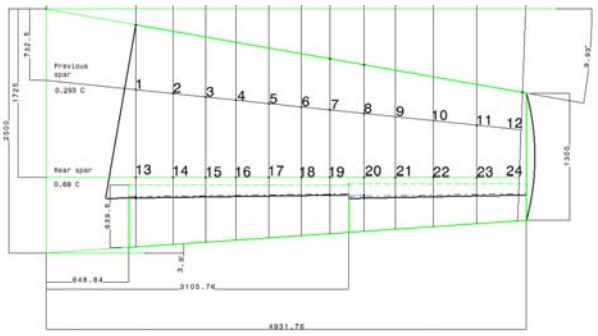

Fig. 24 Wing measuring point example

Table 1 Measuring points coordinates

Sec. No.	CURVE NO.1			CURVE NO.2		
	It. No.	X (mm)	Y (mm)	Itm No	X (mm)	Y (mm)
1	1	827	920	13	1731	920
2	2	867	1305	14	1734	1305
3	3	902	1635	15	1736	1635
4	4	934	1950	16	1718	1950
5	5	969	2286	17	1741	2286
6	6	1004	2622	18	1743	2622
7	7	1034	2912	19	1745	2912
8	8	1071	3265	20	1748	3265
9	9	1104	3585	21	1750	3585
10	10	1145	3975	22	1753	3975
11	11	1191	4420	23	1756	4420
12	12	1240	4891	24	1760	4891

Fig. 25 GVT configuration

The frequency and shapes of all four modes was used to modify the model, and the results of the updating has errors of less than 5% on each of the first three modes; and less than 10% for the fourth mode

Table 2 Test-FEA comparison

Mode description	FEM	GVT	FEM/GVT
1st Wing Bending	7.301	7.29	0.15%
2nd Wing Bending	36.05	34.32	5.04%
OPHER Gyration	12.388	12.34	0.39%
MK-82 Lateral	15.88	15.18	4.61%
HT Sym. Bending	24.83	27.58	-9.97%

At the conclusion, the ultimate goal of the IAR-99 finite element analysis effort is to have a highly representative model, which has been validated by measured ground and flight test data.

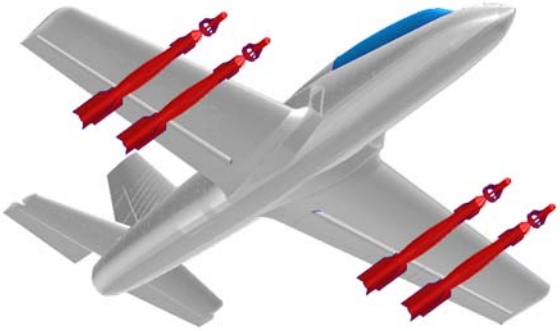

Fig. 26 IAR-99 External Stores Dynamics FEM

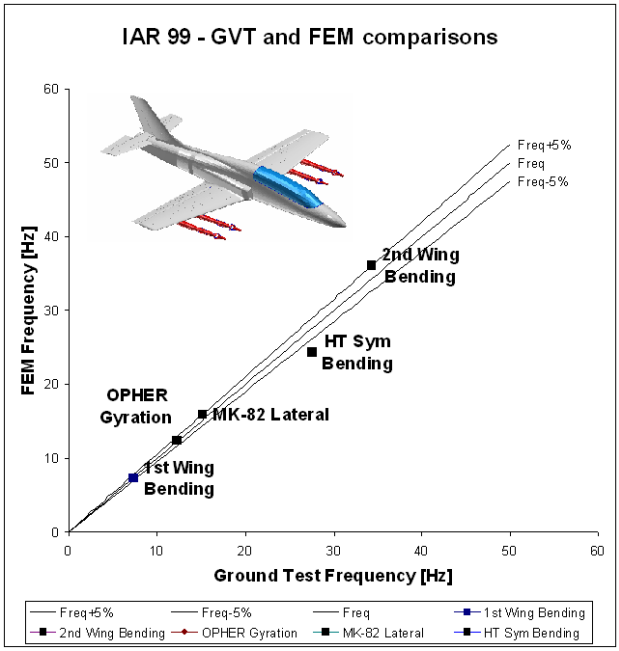

Fig. 27 GVT-FEA comparison

Highly representative FEM can be used to explore future structural modifications or changes with realistic component modifications.

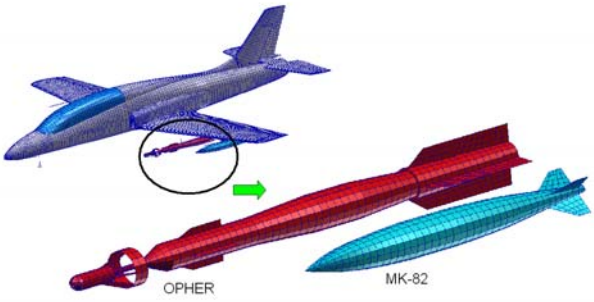

Fig. 28 IAR-99 External Stores Dynamics FEM

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REALTIME AERIAL VIDEO TRANSMISSION FROM A UAV PLATFORM TO A GROUND STATION

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Abstract: *The perspective of UAS in today's dynamic battlefield is briefly presented in this paper, followed by the description of a project that was conducted to illustrate the potential of a very cheap UAS. The main goal of this project was to successfully perform realtime video data transmission from a UAV platform to a ground station. This project represents a cheap possibility of acquiring Imagery Intelligence (IMINT) about an objective. If further developed, a number of improvements and upgrades could be implemented, that would extend the radius, payload and broaden the missions that this project can perform.*

Keywords: *UAS, video transmission, dynamic battlefield*

1. Introduction
The importance of using remotely controlled and unmanned systems in battle

1.1 Using remotely controlled and unmanned systems in battle

Ever since humans first started to wage wars against each other, there were certain aspects that they were considering: means of inflicting damage, means of protection from damage, and means of collecting intelligence. From spear and sword to bow, crossbow and rifle and from leather armor to steel breastplate, Kevlar vests and tanks, the devices of war were improved over the course of history. The next step in that improvement -- unmanned and remote controlled assets -- offers the perfect solution: a means to collect information and inflict damage while offering their user complete protection from the enemy capabilities of inflicting damage. The development of Unmanned Aerial Vehicles could revolutionize warfighting, since the full range of capabilities is still under research and testing. The military could be presented with the option of accomplishing certain missions more efficient at lower costs and with minimal risk to the fighting force. This paper will analyze the advantages and disadvantages of using unmanned and remote-controlled assets, and how their use might change the way war is waged.

Self preservation causes humans to distance themselves from potential damage: first, behind a layer of armor and shield, then inside a tank, on their way towards putting more and more distance between them and the damaging factor. The endpoint of that was creating a way to inflict damage while not being exposed(remotely). Remote controlled military robots were first used in World War II, such as German "Goliath Tracked Mines" – remote controlled demolition vehicles and Russian "Teletanks" – radio controlled tanks. Their main purpose was to inflict damage on the enemy while minimizing exposure to danger of friendly troops. The tracked mines were used to deliver an explosive payload without endangering personnel or scout a mined field. Teletanks were used in a similar

way: a normal tank crew was using radio control to drive the teletank ahead, so that it would draw enemy fire and thus not endanger the tank crew using it. The technology used was rudimentary compared to what we have available today, with only a limited set of commands that could be relayed through the radio remote control. Since then, the technology changed, was improved and expanded, its usability was broadened, but its purpose remained the same: to avoid taking damage and gain the capability to inflict damage remotely.

Robots can accomplish a broad spectrum of missions and be potentially more successful, assuming proper supervision by a human agent, than the classic human approach to accomplishing that mission. Examples of such missions are protecting perimeters (sentry duty), collecting intelligence, clearing rooms and not ultimately, active implementation in inflicting damage on the enemy or his assets. As stated by "http://www.spectrum.ieee.org" one such use of a sentry robot will be implemented in South Korea on border protection. The SGR-A1 robot is capable of detecting human border violators using its sensors, and can, if required, relay a message to them (telling them to stop and wait to be arrested or be shot). Tests have shown that the robot is capable of very accurate shots. Should an order to shoot be given by a human supervisor, the sentry would stop anybody from trespassing into the defense perimeter. These robotic sentries can become a better alternative to the use of human guards, since it will present multiple advantages. The cost of protecting the border will be drastically reduced, since it would require fewer personnel, just some supervisors that would remotely be in contact with the sentries in order to provide human input. Also, in case of a potentially aggressive act, the personnel would not be put in any danger. Even though this seems like a wonderful solution, there are some potential vulnerabilities: energy dependence, and susceptibility to jamming and/or overriding. The technical aspects of logistics in this case should be taken into consideration: How will the robotic sentries be powered? Also, other important characteristics are the political and legal aspects. What happens if children walk in the area protected by the robot sentries and they get shot due to a glitch in the system? What happens if someone reprograms the targeting algorithms of a few sentries? All these are important consideration that could influence the success of employing robotic sentries to accomplish such a mission as border protection.

In order to broaden the array of missions that robotic assets can be used for, a new concept is developed in the area of robotics called "swarm system robotics". As per "http://www.guardian.co.uk" specific research is directed towards swarm system robotics – small to medium sized robots capable of performing a specific mission such as clearing a building or keeping an area under surveillance faster and with increased effectiveness. The increased redundancy due to the large number of robotic assets (swarm) ensures a higher mission success rate and also a higher mission execution quality. By having a swarm of robots scout an area or a building you avoid endangering putting personnel in a potential harmful situation (booby traps or snipers). Also, in dealing with today's unconventional warfare, this system might prove very useful in tracking down insurgents due to its increased capability of scouting large areas really fast. The current research in programming swarms of robots to interact and accomplish elaborate tasks is very complex and progress slowly, but there is untapped potential that could prove extremely useful in accomplishing today's missions.

The unmanned and remote-controlled assets that are most used today in both passive and active missions are UAVs. Technology advancements increased their feasibility through new sensor and propulsion systems as well as payload options. These advancements allow UAVs to have increased endurance, to become smaller, more reliable, and capable of carrying more ordinances. As described in "http://www.af.mil" there is still plenty of space for improvement regarding communication link between the UAV and the UAV pilot. Such errors (when the link is interrupted) are dealt with through specific

autonomous programming that allows the UAV the remote pilot has lost contact with to fly a certain pattern until the link is re-established, or to return to base in case the link is not reestablished. This vulnerability could also be exploited by the enemy through jamming the signal, or even through remotely overriding it and potentially hijacking the UAV.

Another important aspect of using UAVs is their reach and high mobility. It is easier to dispatch a UAV to search a certain area for a target or to deal with a certain threat that it would be to dispatch personnel. The high endurance that UAVs are capable of simplify the logistical effort necessary to conduct such operations.

Using robotic assets might also have a strong political impact through increasing public support. Public support of a war decreases when there is a high number of US causalities or collateral damage that costs human lives (easily noticeable the campaign in Iraq and Afghanistan). Robotic assets would be more expendable, and if they were lost, it would not trigger important public reaction, since nobody would be losing members of their families to the war. Also, there would be less civilian causalities due to collateral damage, since robotic assets would be more capable of increased accuracy in delivering payload or lethal force. This can be seen through wars that as technology advanced, it allowed continuously increasing target discrimination, from the World War II indiscriminate carpet-bombing to smart bombs capable of taking out one specific room inside a building in order to eliminate an important target today.

Even though it seems that due to the continuous technological progress, there will be a time in which we will be able to conduct military operations without endangering humans, that could just as easily backfire and have consequences similar to the ones we tried to avoid in the first place. Any automatic or autonomous system could have bugs that went undiscovered throughout the entire testing process, or could simply be tricked by a potential enemy into mistaking the target and unleashing a lethal ordinance over civilians, or even friendly forces.

A state that relies mainly on technological assets has a high vulnerability to weapons capable of creating an Electro Magnetic Pulse. As stated in "http://www.globalsecurity.org" an electromagnetic pulse produces very high transient voltages on electrical equipment (such as radio and computer equipment, and electronics required to maintain an uplink to the remotely controlled robotic asset as well as electronics that are vital to the navigation system of the robotic asset). This irreversibly damages the said equipment and could potentially interdict the use of robotic assets. The most feasible way of creating such an electromagnetic pulse is a nuclear explosion. Even a small yield nuclear detonation would be enough to damage electronic equipment over an extended area. This vulnerability should not be seen as a certainty, since there are ways of shielding devices from an electromagnetic pulse. It is just another level of the fight to create a weapon and to create a defense against it, similar to World War II: bigger guns leads to thicker armor which leads to even bigger guns and so on. In any area of development, when referring to weapons, there is always a connection between a way to inflict a certain type of damage in a certain way and a way to defend against that type of damage.

1.2 Implementing unmanned aerial systems

The next step in the overall advancement of the military and the ways wars are fought today is large scale

implementation of unmanned aerial systems. These new Unmanned Aerial Systems offer capabilities such as collecting intelligence, surveillance, reconnaissance and delivering payloads. If further research and development is pursued, new capabilities might be available for the Unmanned Aerial Systems, such as air supremacy, and counter-air. Due to the survivability, low cost and decreased risk to the operator we should make the transition from manned aircraft to unmanned aerial systems.

The survivability factor of the Unmanned Aerial Systems refers mainly to the crew survivability. When using an UAS, the operator is at a certain distance from the actual theater where the UAS is being used. That is minimizing the exposure to danger of the pilots, while preserving their experience in case they ever get shot down by enemy forces. If manned aircraft would have been used, then the pilot would either die in the crash, thus making us unable to use his experience, or eject, and then additional resources would have to be directed for his extraction. Also, I will add the possibility of his capture, and of critical information being extracted from him, increasing the risk of the entire operation.

Another factor in which Unmanned Aerial Systems excel when compared to the manned aircraft is endurance. The first limitation of manned aircraft is fuel flight time, and second is crew limitations. The crew limitations can be either in number of sorties that crew members can fly and be efficient, the G forces they can sustain, the altitude they can fly at. An UAS does not need a life support system for the pilot, thus increasing its endurance since removing the life support decreases the overall weight of the system. Also, not being limited by human resistance for the G forces, the turn radius and maneuverability can go up and be superior to any manned aircraft.

Some concerns have been voiced over the fact that the absence of a human element in the midst of things, with the UAS, overseeing the entire situation could have more complicated ramifications than it was initially thought. That is why the Unmanned Aerial Systems will be monitored from the main base by human operators, and important decisions, such as whether to drop ordinance over a target or not will be made by humans. To try to counter this, there is the question: What happens when the connection, either satellite, or radio or the specific connection to the UAS is broken. In that case, today's Unmanned Aerial Systems have autonomous programming that allows them to fly a pre-defined pattern until the connection is reestablished, or to return to base.The information security will have to be enhanced, in order to prevent our own UAS system from being hijacked by enemy forces. That can be accomplished by high-power encryption of the data transmitted to and from the UAS. Another danger, that can affect both unmanned and manned aerial systems, is the Electro Magnetic Pulse. This weapon is still in development at this time, but it needs to be taken into consideration, since it is a weapon that can be very effective against any system that contains any electronic part. The potential vulnerability against this weapon is equal in both the case of an unmanned aerial system or a manned one.

Secretary of Defense Robert M. Gates addressed the audience at the Air Force Association's 2009 Air and Space Conference and Technology Exposition in Washington, D.C., Sept. 16, 2009, and stated that:

"UAV potential based on today's systems to judging manned aircraft based on the Wright Brothers Flyer; Large numbers of increasingly capable UAVs - when integrated with our fifth-generation fighters -- potentially give the United States the ability to disrupt and overwhelm an adversary using mass and swarming tactics, adding a new dimension to the American way of war; In future years, these remotely-piloted aircraft will get more numerous and more advanced, with great range and the ability to fight as well as survive"(http://www.af.mil/news/story.asp?id =123168156)[5,6].

Regarding the same subject, but referring broadly to use of robots, Major Kenneth Rose of the US Army's Training and Doctrine Command made references to the advantages of using robots in the military: "Machines don't get tired. They don't close

their eyes. They don't hide under trees when it rains and they don't talk to their buddies ... A human's attention to detail on guard duty drops dramatically in the first 30 minutes ... Machines know no fear." (http://news.bbc.co.uk) [7]

The transition to the Unmanned Aerial System is going to bring along important changes in the way a war will be waged, and the way the resources will be used to accomplish the mission. The combination between human ingenuity and creative thinking along with the advantages that the Unmanned Aerial Systems offer is going to optimize the warfighting capabilities and minimize the personnel causalities.

2. Realtime video data transmission from a UAV platform to a ground station

2.1Project description

The main goal of this project was to successfully perform realtime video data transmission from a UAV platform to a ground station. The military use for this project is the cheap possibility of acquiring imagery intelligence (IMINT) about a specific objective. For this project I used a radio controlled aeromodel. On this platform I mounted a wireless transmission camera (280C) and a 9 V battery as a power source for the camera. The camera and its power source were placed in specific load points in orded to maintain the stability of the aeromodel and ensure a fixed viewing angle for the camera.

I first performed a live video transmission on the ground to check if there are any signal interferences altering the video data signal. The test consisted of placing the wireless camera near the aeromodel's motor, establishing the video link between the camera and the ground station and starting the motor. The conclusions of this test were that there were no interferences and the transmission was uninterrupted.

I conducted three flight tests and tested the wireless data video transmission while airborne. After each test I operated small adjustments in order to improve specific aspects of the transmission.

The first test was performed at 1700 using a standard 9V battery. The battery measured voltage was 7.89 volts (due to the battery being a little old). The conclusions were as follows:

- Transmission radius was considerably reduced (radius was about 30 meters);
- Ambient light was too low (due to time being 1700 on wintertime) and the video was too dark;
- The realtime transmission had a 3-5 second delay due to a problem with the software used for video capture;
- There were no visible interferences due to the motor powering the aeromodel;

The second test was done at 1500, using a brand new 9V standard battery (the battery measured voltage was 9.87 V – bigger than the previous 7.89). The conclusions of this test were as follows:

- The transmission radius increased (to a radius of about 50 meters);
- Ambient light was very good – resulting in good quality video
- Realtime transmission was performed with no delays as a result of changing the video capture software;
- There were no visible interferences due to the motor powering the aeromodel;
- A brief loss of video signal during a barell roll – due to obstructing the transmission line between the emitting and the receiving antenna.

The third test was conducted at 1540, using a brand new 9V standard battery (battery measured voltage was 9.63V). The conclusions were as follows:

- the transmission radius remained at 50 meters;
- ambient light was good;
- good realtime transmission again, with no delays;
- no interferences;
- better viewing angle due to repositioning the camera to another location on the body of the aeromodel;
- the same brief signal loss when doing a barrel roll.

Fig.1 Picture taken from the first flight test

Fig.2Picture taken from the second flight test

Fig.3Picture taken from the second flight test

Fig.4Picture taken from the third flight test

2.2 Materials used for this project

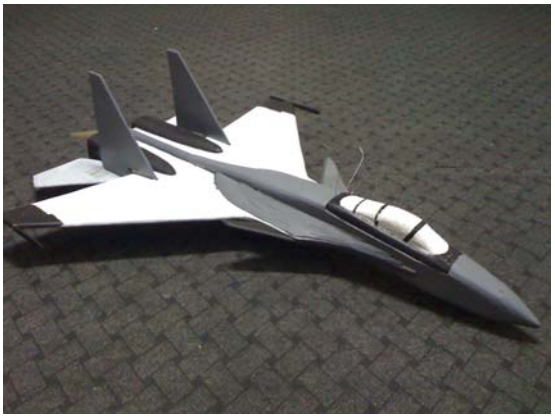


Fig.5The aeromodel used for the project

Fig.6 Remote control used for controlling the aeromodel

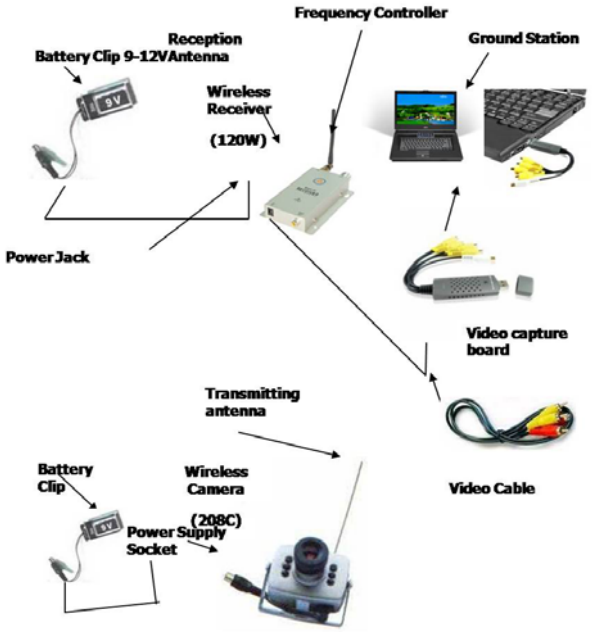
Wireless Video Camera 280C

Technical specifications:

The 280C CMOS Wireless camera offers a medium quality video transmission. The most important aspects of this wireless camera is that it has a decent transmission

radius, it is very small and it has a low weigth and power consumption.

208C – 120W Connection



208C Video camera Specifications:

Receiving Radius	Up to 300m direct LOS
Resolution	380 lines
Scan Frequency	EIA: 60 Hz
Minimum lighting	2 LUX
TV system	NTSC
Output power	200 mW
Power supply	DC 8V, 9V/12V
Energy consumption	< 960 mW
Dimensions	25 mm x 33 mm x 33 mm
Receiver dimensions	59 mm x 115 m x 20 mm

Producer specifications for the video capture board:

- - 4 video inputs
  - 1 audio input
- Capture specifications:
  - Resolutions: 320x240, 352x288, 640x480
  - Framerate: custom from 1-30 fps
  - Compression: MPEG4
  - PAL, NTSC, SECAM
- Minimum system requirements:
  -OS: Windows 2000 or later
  -CPU: Intel Pentium 4 or Equivalent
  -HDD: 5 GB HDD Space
  -RAM: 512MB
  -Display: Windows with minimum resolution of 1024x768
- USB: 2.0 and USB powered

Any laptop or PC can become a ground station after the video capture board is connected and its drivers are installed. The software can be used for direct in-flight observation and it can also be used to record everything that the camera sees in a file on the HDD.

Costs:

Specific Part	**Price (RON)**
Kit Wireless Camera208C(camera + Receiver)	176
4 channel DVR USB 2.0 Easy Cap	116.76
Futaba FF-7 (T-7CP) 2.4 GHz F7029	1190

Specific Part	Price (RON)
TR 35-30C 1100kv Brushless Outrunner	57
Turnigy AE-25A Brushless ESC	33
Servo micro SG90, 9.6 g/1.3kgcm@4.8V (X2)	47
Rechargeable battery NiMH 9.6V/ 1100mAh KAN	72.5
Rechargeable batteryNiMH 4,8V/ 350mAh (KAN)	27
Materials and work for aeromodel body	100
TOTAL PRICE	1 819.26

THIS PROJECT WAS A SUCCESS AND IT ACCOMPLISHED ITS GOAL – THAT OF PERFORMING REALTIME VIDEO DATA TRANSMISSION FROM AN AIRBORNE UAV PLATFORM TO A GROUND STATION. THE TANGIBLE RESULT IS A TOOL THAT CAN BE USED IN ACQUIRING IMAGERY INTELLIGENCE. THE FOLLOWING IMPROVEMENTS AND UPGRADES CAN BE IMPLEMENTED IN THE FURTHER DEVELOPMENT OF THIS PROJECT:

- *LOWER THE MINIMUM SPEED AND INCREASE THE PAYLOAD THROUGH USING ANOTHER UAV PLATFORM (BETTER GEOMETRY THAT OFFERS BETTER LIFT AND STABILITY)*
- *INCREASE ITS RADIUS BY USING A MORE POWERFUL EMITTER (SENDING DATA VIA SATELLITE IS AN OPTION)*
- *INCREASE THE SECURITY THROUGH SIGNAL ENCRYPTION*
- *IMPLEMENTATION OF A GPS NAVIGATION MODULE*
- *IMPROVEMENT OF THE SENSOR BY REPLACING THE CAMERA THAT WAS USED WITH A BETTER ONE HAVING A BIGGER RESOLUTION AND A LARGER FIELD OF VIEW. NIGHT VISION AND A ZOOM FUNCTION ARE OPTIONS.*
- *ADDING NEW SENSORS TO COLLECT AND TRANSMIT FLIGHT AND VEHICLE INFORMATION (SUCH AS ATTITUDE, AIRSPEED,, ALTITUDE, BATTERY POWER)*

3. Conclusions

This area of development is at its beginning; the same way many other areas were just a few decades ago. The Marechal Fardinand Foch, a french strategy professor at the "L'Ecole Superieure de Geurre" (The French Superior War College) said about airplanes that "Airplanes are interesting toys but of no military value."(www.permanent.com/quotes.htm) History proved him wrong. The submarine was first imagined by a science fiction writer, Jules Verne, and it proved to be a versatile weapon less than 30 years later. Nobody can claim they know exactly what direction will the warfare methods take, but the contemporary trends can be analyzed and conclusions regarding those trends can be drawn. The today's trends in warfighting methods tend to lean more and more towards the use of robotic assets, and significant improvements are made in those areas. It seems that combat methods evolve towards minimizing human losses, maximizing accuracy and precision, combined with an overall fine-tuning of those methods, in order to achieve maximum efficiency.

The UAVs acquire informations through sensors, they evaluate the information acquired and act in accordance with their programming. At the same time, the acquired information is relayed to the human operator, and he can relay back instructions in case of an unforseen situation not included in the programming.the means of communication, the means of generating power for the various subsystems, the sensors and the decision factors (microcontrollers and computers) have been improved and their size was reduced due to technological advancements in design and manufacturing. All these improvements contribute to the increase of the autonomy, the payload and the radius of the UAV. Research

conducted in areas such as AI (Artificial Intelligence) and Neural Networks will lead in the near future to a further increase of the autonomy and the type of missions that the UAVs will be able to perform.

The integration of robotic assets into the armed forces should be seen as exactly what it is: integration, not some kind of replacement. In order to employ the robotic assets towards protecting human lives, we should strive toward balance: integrate the human assets with the robotic assets in such a way as to minimize human losses, and at the same time maintain control and close supervise the robotic assets that we have at our disposal. Too big a deviation towards either dismissing the robotic assets or towards overemphasizing them could lead away from the goal of minimizing causalities both military and civilian. A balanced combination between the human assets' ingenuity and potential along with the robotic assets' precision and accuracy would ensure the optimization of warfighting capabilities and minimization of personnel causalities.

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TYPOLOGY AND PHYSIOGNOMY OF FUTURE CONFLICTS

Col Basil MAIER

ABSTRACT

Our days political and military tendencies warning that the threats of a present war or a future war, no matter of local, regional or continental or any other type and nature was not overcome, being a neuralgic problem of political military state and international body.

Keywords: *Information system, military capability, command and control (C2), decision superiority*

We are currently witnessing an intense process of studying war, held concurrently with the launch of a series of projects to limit armaments, military or reduction in the number of armies. It is more significant that it tends to suppress or reduce the national armies and replace them with international military forces, serving the United Nations. The fate of humanity lies in her hands, as Gaston Bouthoul appreciate the great French strategist, referring to the war: "If the war does not depend only caprice or malice of men, should be changed human nature. But since it is a social phenomenon, observable, subject to conditions and laws, even approximate, we hoped to dominate, dominate today as gravity and electricity[1]. "

Since ancient times, mankind has heralded a move by several points, facts, actions and activities but, of all these wars were and chronological points of reference are the most distinct boundaries that mark the great turning-points. Over the millennia, civilizations have been destroyed by war who have made their mark on human evolution and development, but also by war and civilizations have emerged in November. One can appreciate that this phenomenon is complex and dominated by its contents, established or sanctioned levers that have generated a certain kind of society for a significant period of human evolution.

While all great civilizations have been convinced of the destructive and inhumane nature of wars, something highlighted in the main masterpieces, works of art, worship, etc.., However, they constituted only way to achieve certain goals and interests. Political and military trends of today warns that the danger of war or future wars, whether local, regional, continental or any other kind and type has not been exceeded, remain a sore issue for political and military leaderships of all Member and international bodies.

Sun Tzî the phenomenon perceived war as "a matter of vital importance for the state, area of life and death, the path to survival or to destruction."[2] This view is placed at a time when Chinese society was undergoing a process of economic and social change at gentilico-tribal group or organization. The

[1] Gaston Bouthoul, *Războiul,* Editura Militară, Bucureşti, 1978, p. 121.

[2] Sun Tzî, *Arta războiului,* Editura Militară, Bucureşti, 1976, p. 31.

design of this great military thinker, considering the war and is determined by five fundamental factors, namely: morale, time (weather), terrain, leadership and rule or doctrine. Throughout the ages, this concept was expressed in accordance with the specific representation company, with the spiritual values and their evolution to higher levels.

All these reveal that the phenomenon takes place between subjects, as written or unwritten rules, rooted in time and space under the binomial order. Morale problem can be analyzed and the idea of subordinating knowledge ideology which may take forms such as religious, nationalist and anti-Semitic Semitic, Marxist, etc. idealistic. and that mankind during its evolution, it has embraced or rejected them. For these questions, it may draw the conclusion that since ancient times this has been perceived and theorized that a deep and clear with a benign nature, as a result of complex interactions between biological act, evolutional characteristics of individual experience and social environment, based on specific types of activity time.

Amid the development of human society, both materially and culturally, analysis and interpretation of this phenomenon becomes more profound, but gains and diversity issues. The concept expressed by the French Marshal Foch, "war is an art, like all other arts, with his theory and its principles."[3]

In this idea, Gaston Bouthoul, paraphrasing a Roman dictum, said: "If you want peace, know war,"[4] which expresses the need for penetration of the mysteries, mechanisms and relations caused by this phenomenon, at least in theory. According to his theory - and in contrast with the views of biologist and psychologist who have accumulated evidence in support of history, archeology, anthropology, sociology, etc.. - War is a socio-historical phenomenon, from the social order of human existence and does not depend on human nature. For this, consider that "war is an absolute fact generally met in all human civilizations from the ancient to the modern."[5]

Following the idea, G. Bouthoul remarked that "the dynamics of military phenomena depend primarily international policy developments in the next century, the extent to which it will resolve or not the trend and will succeed or not to establish an effective arbitration system."[6]

Nicolae Iorga, this phenomenon of war as "an expenditure of force, an action that may be longer, shorter, completed in a few days, lasting many years, even decades, which seeks an end, and is generated by a company organized"[7] .

The evolution of media and techniques, the lessons drawn from the armed conflicts of the times led him and the French General Andre Beaufre to analyze the phenomenon of war from a new perspective. It held that "war is a phenomenon present and future, but with a number of features that distinguish it from the great conflagration, perhaps having a local character with new strategic rules."[8] Under this view, the French thinker highlights two strategic trends of future armed conflicts, which are widely applied today, that the strategy of fait accompli and overall strategy.

The emergence of nuclear weapons has revolutionized the concept of war, and especially how the theoretical and practical behavior. A. This prompted Beaufre to say that "modern war military issues are very complex, making it very difficult so the correct wording, and addressing them effectively."[9]

The vision of Cornelius Soare, although it appears that "the tendency to change the relationship between war and politics by violent means reversing the transformation ratio and the international policy instruments for peace,"[10] however, "war can not simply be removed abolished, but it must be replaced by other social institutions to exercise its

[3] F. Foch, *Principiile războiului. Conducerea războiului,* Editura Militară, Bucureşti, 1975, p. 35.

[4] Gaston Bouthoul, op.cit, Editions Seghers, Paris: 1952, p.153

[5] Ibidem, p. 164.

[6] Idem, p.173

[7] Nicolae Iorga, *Stări sufleteşti şi războaie*, Editura Militară, Bucureşti, 1996, p. 25.

[8] Andre Beaufre, *Introducere în strategie. Strategia acţiunii,* Editura Militară, Bucureşti, 1974, p. 13.

[9] Ibidem, p. 5.

[10] Corneliu Soare, *Recitindu-l pe Clausewitz,* Editura Militară, Bucureşti, 1993, p. 191.

functions without violence and destruction. "[11] There were and there opinions but that the evolution of the concept and conduct of the war depends on how the development of support material (weapons, and means of warfare) and its information. The level of armament and combat equipment, existing at a given moment, determined character, form and type of war held.

Touching, speaking theoretically, the possibility of total destruction of the opponent while the occurrence of some major risks in the use of such weapons has resulted in search of other forms and means, less conventional, achieving goals, but with substantial human and material destruction lower. In other words, he sought and still seek to achieve those forms and types of war "with a human face."

Perhaps the most representative illustration of this hope is the war of "third wave" described by Alvin Toffler, the Sun's ancient definition is dressed Tzî change objectives of the post-industrial and pre-cyber. According to his theory, now and in future will be manifested in particular the "war of civilizations," Plastic expressed thus: "When the waves collide history, entire civilizations collide"[12].

Development means aero cosmic air and caused both the use and the use made of their theorizing, thus making the battlefield classic "three-dimensional battlefield, creating the possibility of concepts such as" air war "," air-land warfare, "" aero-space war, "" Star Wars.

War beginning of this millennium will be heavily modified and will require a greater concentration of military force, the integrative potential and possibilities for maneuver to lower echelons, up to the fighter, which will be as a result, a consummate technician. The battlefield of the years 2020 - 2030, in our view, could be characterized as follows:

• Three-dimensional - caused by intense exploitation of the third dimension, the vertical;

• transparent - through actual performance of research systems, detection and determination arranged in space;

• dynamic and pulsating - because both combatants will require a motion in the horizontal and vertical planes to strike the decisive center of gravity of the opponent;

• Multiangle - whereas with reduced forces, the benchmark, you can run missions with strategic value, operational and tactical, in large pieces, in different conditions;

• Automated - because they will use weapons systems that will incorporate a high degree of robotics, artificial intelligence, expert systems and simulation in decision making;

• digitized - through the use of high technology and miniaturization of the computer;

• integrated - using all types of military forces;

• multinational - of the use of forces from many countries in the alliance relationship.

Also, the forces intended to carry out actions in the battlefield must meet the following main features:

-high availability - understood♣ as the level and degree of preparation - and a short-term unit will be ready to fulfill a mission;

- technological capabilities and♣ mobility - understood by its ability to adapt to the missions that strategic uncertainty could a commercial;

- mobility and autonomy - as a♣ suitable response to the diversity of possible action scenarios;

- interoperability - understood♣ as the capacity to work together with forces from

[11] Ibidem, p. 193.
[12] Alvin Toffler, *Război şi antirăzboi,* Editura Antet, Bucureşti, 1996, p. 31.

other allied nations;
- adaptable - can be determined♣ by the properties in a short time new forms of action.
Future operations will be complex and multidimensional, and forces will have to adapt quickly to operational changes, from high intensity combat operations to peace and stability. Emphasis will be placed on increasing the integrated application of all instruments of power, military and non-military planned to create effects that would result in goal. Forces and capabilities must be able to address a coordinated and concerted way political, military, civil, economic, governmental and nongovernmental organizations. Priority will be operating in the manner and character integration meeting. Multinational operations in the framework approach will allow coverage of deficiencies in capabilities.
Military operations will be conducted on a solid legal basis, in accordance with international law. Coordination and close cooperation between national and international organizations in all phases of operations, will be extremely important.
The employment of military forces in post-conflict activities to support, reconciliation, reconstruction and stabilization, will be part of the strategic approach and the transition from combat operations to post-conflict operations will result in significant changes in planning, doctrine and training.
Armed conflicts will take place between states (interstate conflict), within states (intra-state conflict, including domestic terrorism) and non-state actors and other countries (international terrorism).
War will confine future, primarily in political-economic sphere, and its general purpose will focus on major economic projects, such as strategic management, access routes and markets for their restricted access to advanced technologies, the control politico-military on some "hot spots", etc..
By combining conventional aggression economic, cultural, psychological, religious, computer, electronics, symbolic and perception, influence and authority will follow the opponent in all aspects.
Thus, the war will carry fingerprint information society and will be characterized by:
• meal replacement army professionalized armies, equipped with powerful means and intelligent;
• annihilation of the enemy through indirect actions and supervisory control, the domination of confrontation in the area of management;
• planning and decision-making bodies of the war will have a composition mainly politico-military and act from a distance;
• information will be dominant confrontation armed conflict, and information superiority will become a true power factor.
Future war will change the whole nature of the belligerents, namely:
- movement of military conflicts of the real causes (economic) to the predominantly ethnic and religious opponent is no longer "alien" that can not communicate through language, but relatives, friends, the speaker of the same language or dialect, more precisely it can be stated that the economic area, the conflict in the moral-religious past, then the ideology, and today, the moral and ideological vacuum is introduced, ethnic and the religious racist;
- moving from a brutal form of using force to more subtle ways: armed intervention to support or installation of a constitutional regime or not favorable to politico-military interventionist power, imposition or peace, blockades etc., In other words, the emergence of new types military operations against the classic other than war;
- combining classic type with new types of aggression: aggression economic, cultural, psychological, religious, computer, information, among which plays a symbolic role. Information warfare has become a reality in a world of signs and symbols of consumption. In fact, this type of war can be defined as conquest and domination of the mind through signs, symbols and consensus on the interpretation thereof, will be a clash of civilizations, and why not a war of cultures. It will be a total and absolute war, whereas the target is the entire population of a state, and the purpose is, ultimately, the change of attitudes and values. In fact, the battlefield will be the world we think;

- armed forces, military means will retain the role of "best solution" by which power can impose its interests to restore or maintain political order, to enforce or maintain peace in the area of interest. The new army is currently being built will have to change their orientation to space, time orientation, acting

is shaping a force to meet present and future imperatives. A key feature will be in the future, namely professionalism, which will increase the strength of employment, based on competence and responsibility;

- adequacy of military doctrines in order to increase capacity to project power at great distance, high speed, with emphasis on joint operations between the various services, multinational operation, simultaneous attacks, synchronized, real-time execution control and tempo of their struggles and the greater development of the initiative and a greater confidence in the quality soldiers. Military Doctrine - A. Toffler notes - continues to change all the armies of the world. But if you listen to, whether the terms are formulated in Chinese or Italian, French or Russian, the central themes remain those of air-ground combat and air-ground operations. In the new military doctrine of nuclear weapons remains the role of deterrence and threat. The main goal of NATO nuclear forces - are shown in documents Alliance-policy remains: preserving peace and avoiding war or any kind of constraint. They are designed and introduced new technologies, high-tech weapons that defy the old military doctrine. Placing them on the battlefield itself as the new doctrine to focus on close coordination between ground and air strikes on echelons in depth to prevent one, two, and next to reach the theater of operations and, most significantly, the use of new technologies to hit targets previously assigned to nuclear weapons[13]. This reduces the risks of nuclear confrontation;

- military action, fighting in particular, will differ greatly from those in the Second World War and postwar military conflicts. Today, as in future military action is individualized, in comparison with the postwar by: scale in time and space, forces and means, complexity, intensity, sudden changes of situations at all levels warfare will result in all environments, both on land, water, air, underwater and in space, the use of forces and diverse means superior tactical and technical characteristics, having a greater mobility, firepower, battle, precision, increased effect desolation and destruction, which makes technological surprise and to take measures of prevention will continue to play an important role, particularly manevrier character actions, insisting in particular on the surround and back, high consumption of ammunition, fuel and other materials destruction of communication channels and nodes, works of art, and huge population displacement on ethnic, religious., tend, in most cases, to avoid direct confrontation, front, on the actions taken by small parties, with a fire power, relative autonomy in action, through a variety of tactical methods, particularly the sides, every depth device and the enemy where and when they least expect it.

- success on the battlefield will be based in future on a thorough organization and preparation of action in the smallest details, but a normalization clear, precise and flexible. In this sense, the armies of almost all developed countries in Europe, North America, Middle East and Asia have increased concerns for the development of new

[13] Cf. *Organizaţia Nord-Atlantică, Parteneriat şi cooperare,* A.I.S.M., Bucureşti, 1994, p. 45.

regulations to fight in line with strategic objectives, the development of modern technology and organizational structures adopted or pending, with new design concepts to the military and for situations other than war, and that today's commanders and future action on the lowest step of the military hierarchy is consistent with policy objectives conflict followed by the highest authority.

The military will evolve with developments in postmodern society. The transition period will be marked by numerous conflicts in which the armies of the doctrines, structures and equipment company specific information will prevail. Asymmetric reactions to modern military action probably will last a long time, they taking the place of conventional military conflict.

Such types of wars (military conflict) will be taken by states / coalitions of states that have strong economic and scientific development, able to support the cost of preparing the forces and means in a position to conduct modern warfare. Modern battlefield is determined by a number of probable and potential factors of instability:

• balance of power - now fully defined, located in a reconfiguration process, attended all the tension and friction;

• nationalism - or globalist manifestation integrate trends at regional or continental determine reaction forces sees this as an attack on the existence of nation or ethnic group;

• religious disputes - collisions caused by European religious trends: Orthodoxy, Catholicism and Islam - the superiority and supremacy over other ones, the idea can be extended to other religious currents that we refer to those of the world;

• rivalry - between different groups of countries and organizations are expected to capture and maintain leadership in the areas of political, economic, military and informational;

• Demographics - population growth, (especially) in areas with seizures will cause feeding problems and ethnic and religious conflicts, and significant population shifts to new areas with physical attractiveness;

• difficulties of governance - growing problem, caused by inefficient economic policies and inability to solve the problems of development and distribution of goods;

• Increase technology - allowing states and private companies have new technologies that enable the emergence of instabilities in both domestic and international economic and military components generated by the export of strategic, smart weapons and ammunition;

• Environmental risks - caused both by natural disasters, as well as artificial ones (pollution, radioactive contamination, chemical or biological, nuclear accident, etc..) That may be the germs of interstate tensions;

• proliferation and modernization of weapons systems - is a phenomenon whose magnitude is increasing, being directly proportional to the support of possible threats to internal and international stability and security.

All these factors, which may be added and others who now are not taken into account, can become the seeds of future conflict and may imply the existence of simultaneous operations against various threats and risks.

Renewal of permanent technological and doctrinal change of the precursor elements are to conduct future warfare. Spectacular developments in these areas lead unequivocally to significant changes in the form of ongoing management and especially military operations. This will occur as a result of applying new technologies in military systems, which will combine with new operational concepts, which involve substantial adjustment to improve organizational forms character and leadership of military operations, causing a significant increase in their effectiveness and potential fighting. These acquisitions have qualitative influence on the amplitude of battlefield management, simultaneity of operations, means of communication and application of war.

Therefore, the most important characteristics of future war could be: the use of strategies "ennobled" as a result of the use of sophisticated weapons and weapons systems, performance, featuring more intelligence and significantly reduce human inaccuracy, loss of the class of confrontation and fluid battlefield use, digitized, three-dimensional dynamic, aggressive actions to promote philosophy

peaceful activities concealed significant, subtle use of lethal weapons to defeat the enemy and only in critical situations of the lethal but limited duration and strategic objectives; implementation of flexible military structures, modular, mobile, efficient logistic support, timely and effectively, promoting the management system based on the principle of accountability in the controlled setting decision, the widespread use of specific procedures guerrilla warfare, the psychological influence and media poisoning communications while simultaneously engaging the entire battle space, using conventional means and techniques that involve mind, the image, the physical and physiological fighter.

Mutations produced in the company require a true revolution in military art, a revolution to reflect new economic and technological functions. Science and communication will be the twenty-first century engines. Produce smart weapons smart tools. Nothing better than showing how conflicts were conducted in the Persian Gulf and Yugoslavia, which may be characterized as a war of spirit against matter.

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THE FIRE FLY ("LICURICIUL") – A VERSATILE TARGET FOR ANTI-AIRCRAFT DEFENCE

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Abstract: *The aviation employment, as way of determent and enemy's combat ability weakening, by defeating the infrastructure and the means of communication, implies an adequate training of the operators within the anti-aircraft defense system. This training could be performed either on simulators, which virtually recreate the space where the hostilities are developing, or by employing a type of target that precisely pattern after the enemy aircrafts configuration. This paper presents an aerial target that could be used for training the operators (crew) performing the troops close defense, using IR anti-aircraft guided missiles, radio-controlled anti-aircraft missiles, up to ranges of 6-7 km, and a.a. guns and machine-guns. The target named "Licuriciul" is able to travel with speeds up to 120 km/h, being fitted with two smoke candles that generate smoke for maximum 3 minutes, and four infrared emission tracers, operating on three wavelengths of: 2-2.7μ, 3-5μ and 8-14μ. Moreover, by coating the wings with metallized plastic film, the target may also be detected by the anti-aircraft defense systems radars, KUB or OSA type. The drone may be programmed to fly, on ranges up to 6 km, and it could also perform reconnaissance missions.*

Keywords: *Licuriciul, aerial target, anti-aircraft defense system, operators training, autopilot*

1. INTRODUCTION

The aerial targets are a few hundred years old and they have first been used for the hunters' practice, being known as plates or clay doves. Together with the manufacturing and development of aircrafts as air combat means, the need of training the operators within the ground and in-flight anti-aircraft defense system has also occurred, as the targets realistically simulate the characteristics of the enemy aircrafts. In the same time, the testing of some anti-aircraft defense means, like the fighters, the missiles, laser guns or the artillery ammunition was developed by using full-sized or to scale aerial targets, by simulating the main features, like: the radar reflection surface or the radiant energy of the power plants [2].

2. INTERNATIONAL SITUATION

The rapid development of the military aviation in the 20th century accords with an increasing of the requirements complexity for anti-aircraft defense systems, especially for the anti-aircraft artillery. The development of a modern aviation and anti-aircraft defense network led to the improvement of the requirements for the aerial targets, which had

to simulate the hostile threats within the anti-aircraft defense and the pilots training programs [3].

One of the first aerial targets was developed in the middle 30s by CALIFORNIA RADIOPLANE COMPANY, a division of NORTHROP AIRCRAFT COMPANY. They built a radio-controlled model airplane, which formed the basis for the subsequent development for the aerial targets designed for the anti-aircraft artillery troops training. Between 1940 – 1951 there have been designed and built about 15 types of aerial targets, manufactured in over 5500 copies.

At the end of the 20th century, the targets were not more complex than the radio-controlled model airplanes. They used the towed target sleeve as payload [4]. In time, the targets became more sophisticated, being fitted with countermeasures means, devices for the shooting estimation, active or passive radar equipments, towed targets and much more complex programming systems.

The modern targets are usually launched by aircraft, or from the ground, by using rocket assisted take-off boosters, hydraulic, pneumatic or electromagnetic catapult. Very small target drones can be launched by an elastic bungee catapult [4]. Some of the known targets are fitted with landing gears, and parachute recovery, or skid landing.

Below there are a few of the currently employed targets, having characteristics similar to the *FIRE FLY* ("*LICURICIUL*") aerial target.

The US Army:

- *FQM-117*, a relatively complex target, designed for the training of troops operating the anti-aircraft artillery, having the dimensions a little larger than those of a RC model. The first piece was built in 1979, and about 30.000 copies of this model were manufactured. Since then, the target has been slightly improved, and received the FQM A, B or C codes, by approaching some different nose models and tail configurations, to better simulate the Soviet aircrafts *MIG-27* or *Sukhoi Su-25*. Overall there have been manufactured over 100.000 pieces [4].

In the table below there are presented the characteristics of two of the *FQM-117* target variants, and in Figure 1 there is a photo of the target.

Table 1. *FQM-117* Characteristics [7]

	FQM-117A	*FQM-117B*
Length	0.91 m	1.83 m
Wingspan	1.6 m	1.68 m
Weight	3.9 kg	3.6 kg
Speed	148 km	120 km
Altitude	3000 m	
Endurance	12 minutes	
Propulsion	1.2 HP *K&B* two-stroke heat engine	2 HP two-stroke heat engine

Figure 1. *FQM-117* Target [4]

- *MQM-170* "Outlaw" designed as a multi-function, not too expensive, target, which can also have the role of unmanned air vehicle. It is fitted with an autopilot and GPS that provides the waypoint autonomous navigation. It is really adaptable, it can accomplish different missions and it can bear many sensors and load types. It is currently used by US Army as aerial target, for the training of anti-aircraft forces [6].

The main characteristics are those in Table 2. The target is presented in Figure 2.

The target is powered by a two-stroke engine and a "pusher" type propeller [4]. It is launched from a pneumatic launcher and recovered by "belly" landing. On request, it may be fitted with a landing gear for the conventional wheel landing. The plane may be manually controlled, within eyeshot, with a platform that also allows the simultaneous control of more targets. There is also the

possibility of the waypoint autonomous navigation, on a pre-programmed flight path. The plane is figured so as to cover some automated recovery procedures on the occurrence of nonconformities like losing the satellite connection, or the radio communications. It may be recovered either by wheel landing, or by "belly" landing, or by parachute opening. The maximum effective load is of 18 kg. This may be: an IR amplifier or a laser multi-integrated system, a night operations illuminator, a smoke generator or a Doppler radar system for the shooting estimation.

Figure 2. *MQM-170 "Outlaw"* [6]

Table 2. *MQM-170* Characteristics [6]

Length	2.7 m
Wingspan	4.15 m
Weight	54 kg
Speed	max: 193 km/h; cruise: 95 km/h
Altitude	4900 m
Endurance	standard: 1 h; max: 3-4 h
Propulsion	17 HP *3W Model 150i* two-stroke heat engine

The European armies:

- *ULTIMA* has been developed for the homologation of *MISTRAL* anti-aircraft missile, currently owned by the Belgian army, also used as UAV, which is able to be deployed on a 12 km range. The first launching took place in 1994, and in 1997 it was improved for the automated anti-aircraft armament firing, by using a shooting estimation system. It is made of composite materials, with the fuselage wooden reinforcement. It is also fitted with a specially designed autopilot, with smoke and IR radiations generators.

The most important characteristics are presented in Table 3, and Figure 3 shows a target image.

Table 3. *ULTIMA* Characteristics [1]

Length	1.92 m
Wingspan	2.0 m
Weight	9.0 kg
Altitude	3000 m
Endurance	20 min
Propulsion	4.1 HP two-stroke heat engine

Figure 3. *ULTIMA* target

- *X-SIGHT Airframe* Germany is an aerial target designed for the training of the operators and crew within the close anti-aircraft defense systems. It is fitted with reflector prisms, or Luneberg lens, IR tracers and smoke generators. It disposes of a parachute recovery

system, and for higher payloads, the take-off is initiated by a launcher.

The main features are those in Table 4. In Figure 4 you can see the target.

Table 4. *X-SIGHT Airframe* Characteristics

Length	1.96 m
Wingspan	2.65 m
Weight	16.0 kg
Altitude	3000 m
Endurance	1- 3 h
Propulsion	3,5 HP two-stroke heat engine

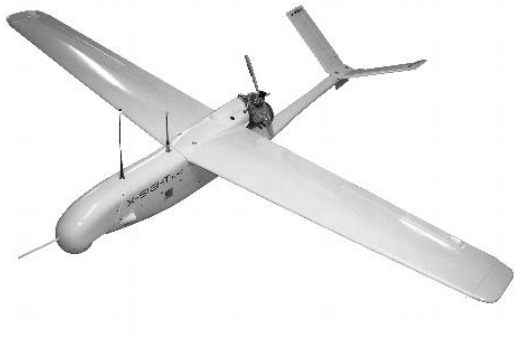

Figure 4. *X-SIGHT Airframe*

3. LICURICIUL – THE TARGET AIRPLANE

It is conceived as a low-priced aerial target, for the training firing and skill improving of the operators and crew within the close anti-aircraft defense troops.

The aerial target can be used for training and skill improvement firing with close-range anti-aircraft missiles, *STINGER*, *MISTRAL*, *STRELA 2, A94* type, as well as for anti-aircraft artillery firing, with calibers between 20 and 130 mm. An aerial target system is made of three fully-equipped platforms, enclosed in containers, a radio-control station and a computer, necessary for the flight programming.

LICURICIUL is able to simulate an aerial target, flying with a speed of max. 30 m/s, for 15 min, at an altitude between 100 and 1500 m. The target may be hand-launched by two operators or by using a light launcher, and it may be recovered by direct landing. For payloads larger than 3 kg, the target is fitted with a rolling gear.

The radiolocation reflection surface may be increased by covering the wing with a metallized thermo contractile material.

Figure 5 presents the target, and in Table 5 its main features are specified.

Figure 5. *LICURICIUL*

Table 5. *LICURICIUL* Characteristics

Length	2.15 m
Wingspan	2.0 m
Weight	15.0 kg
Altitude	1500 m
Endurance	15 min
Propulsion	*OS MAX* 4.1 HP two-stroke heat engine

For the point-to-point autonomous navigation, the Ardu Pilot Mega auto-pilot, Ardu IMU Shield inertial measurement unit and Mediatek GPS were enclosed within the target, and they are showed in Figure 6.

The flight path programming is made by a USB serial interface, on a Google map, displayed on the computer screen.

The auto-pilot has programming facilities for automated take-off and landing, or for reset to the start point coordinates and for making a circular flight, until the taking-over of the manual control.

Figure 6. Ardu Pilot Mega, Ardu IMU Shield and Mediatek GPS

The target fuselage is made of composite materials, based on epoxy resin, glass fabric reinforced and carbon tape hardened. The wings and empennage are cut from polystyrene, covered with 1 mm thick balsa wood and a layer of glass fiber, vacuum formed. Figure 7 presents the 3D general assembly.

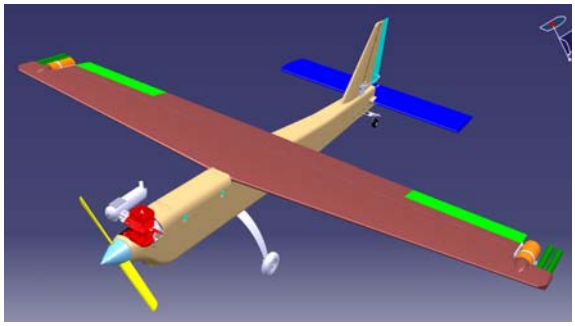

Figure 7. 3D general assembly

One piece of the target airplane "Licuriciul" was built, and it already passed through the first flight stage. In the next period of time, it will be subjected to the tasks of the test-evaluation program.

4. CONCLUSIONS AND PERSPECTIVES

1. The target airplane "*LICURICIUL*" is a training opportunity for the anti-aircraft defense troops.

2. The plane can develop a programmed autonomous flight, thus it could also be used as a reconnaissance airplane, its autonomy currently being of approximately 6 km.

3. The plane may be fitted with different payloads, like smoke candles, IR tracers, video or photo cameras.

4. The maximum effective load is 3 kg, with the possibility of increasing it to 5 kg.

5. The low cost price, compared to other similar targets, makes *LICURICIUL* an optimum alternative, under the current circumstances.

6. In so far as the potential beneficiary purchases more systems for internal use, the target modernization and even the export is possible.

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MUTATIONS AND LINES OF EVOLUTION OF MILITARY SYSTEM IN THE CONTEXT OF GLOBALIZATION

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Abstract: *The army represents in the vast majority of countries around the world, one of the important state institutions. It is appreciated and perceived by both population and the public, political parties and civil society as a state structure of trust, which behaves like a strong arm preserving a high-quality of the civic, and the national traditions. At the same time, it is considered by both public authorities, and the population as a substantiated support, the need in natural disasters, critical social status or crisis, both for the entire nation, as well as local communities. Because of the nature and content of the tasks entrusted to it, the army plays an important role in society in which it activates.*

Keywords:

- aggression *is the use of armed force by a State against the sovereignty, territorial integrity or political independence of another State, or any manner inconsistent with the United Nations Charter, as follows from this definition*

*- **traditional tasks** that they perform any military always, in this context, it is to guarantee the sovereignty, independence and unity of the state, territorial integrity and constitutional democracy.*

-special missions *of the army regard first of all the implication in a rightful state, in the guarantee of the constitutional democracy; these type of missions refer to the participation of the national military structures in the execution of various tasks of military nature or not, beyond the national borders where national interests so require, and obligations assumed by the state through international treaties and conventions.*

-occasional military *missions and actions are activities that are received from those assumed with the law or only when the actual situation of the country require.*

Physiognomy of the military action is printed on the behaviour of armies, which are preparing, and will prepare, influencing and shaping themselves to enter into partnership agreements or conflicting with other similar institutions of other states. States and thus armies were forced to seek new ways to approach and counter threats to national security, new doctrines Us, strategies, tactics and procedures [1].

Categories of armed forces of a country are more or less independent in their area of use (land, sea, air), but increasingly more and more they are integrated into an organization responsible for conducting joined army operations, consistency means and covering a number of joint services (health, education, military, intelligence and command systems, infrastructure). Each category of forces retains the prerogatives that regard matters of training and forces availability.

Due to the impact that phenomena's and social processes, economic, political, cultural and military, domestic and international, on one hand, and globalization and regional integration, on the other hand, national armies have extensive knowledge of phenomenon's and their change processes , in all aspects and all plans. In the last years of the last century and the beginning of the current century, we assist at the emergence and manifestation of phenomenon's and processes such as: transition from mass armies and / or mixed with those of professionals, transformation, feminization and professionalism of national armies, participation in international military coalitions and political-military alliance aimed at ensuring peace and stability in the world, outsourcing military activities and services, establishment of private military companies which tend to be actively involved in specific defence and national security operations and not only [2].

Trends in human evolution, environmental changes in international security strategy, the emergence and development of the disturbing factors of sustainable development, good governance, peace and global stability have a significant impact on the mutations that their national armies will encounter. From these I mention: international terrorism, organized crime, proliferation of weapons of mass destruction and means of delivering to their target, alarming demographic increase in countries that are underdeveloped/or in development and an ageing population in most developed countries.

Currently at international level, there are wide debates, particularly in universities, political and military, on the concept of defence. From these debates the specialists showed concern in international law and the ranks of civil society organizations on the interpretation of national defence and/or collective consensus with the strategic interests of some powerful countries at the demographical and military level and of some international politico-military or financial organizations.

Most of the processes that define the national army's developments at the beginning of the 21st century are determined by domestic factors predominantly:

-economic, political, military, cultural, political social. The decision factor, sustained economic and social are being felt in matters of defence and national security.

Soldiers and the army as an institution of the state are actively involved and responsible, in all matters concerning defence and national security, but don't decide the adoption of a solution or another. Political factor is the one who has the responsibility of adopting and decision making in matters of defence and national and collective security. Currently, world states must deal with a various broad of dangers and risks and threats of defence and security. If during the Cold War each state knew who the potential aggressor and what are the main threats that must make the girl task, now this is no longer possible.

Come In a regional climate global, complex and fluid, they world states are not pleased only with the measures taken by the international community, but each seek solutions viable to the dangers, risks and threats that may cover their defence and security. In this aspect, there were established political-military organizations (NATO) or of other nature (EU), to ensure a collective defence, and i.e., common, have been concluded bilateral military treaties (source of a mutual military assistance, desirable and effective), were set up national systems of modern defence, flexible and supple (fundamental principal of any national defences) [3].

However, it seems that owing to the rapid development of information technology and communications, the environmental impact of globalization upon the national security environment, regional and international event and the outbreak and the world scene of numerous actors non-state-multinational companies, terrorist organizations, organizations belonging to organized crime- economically and financially

strong or significantly motivated by specific ideals, a number of countries opting for a combination of individual national defence collective defence.

The defence is national because is not referring only to the military and armed forces , but to all powers of the state structures responsible for defence and security. That's why states develop and organize military defence and also both economic and civil defence either on its own forces, either turning to alliances and partnerships. Usually military organization followed the society political organization.

Progressive centralization of government was extended by the state monopoly on legitimate violence. In this context, the army become the institution seeks to use violence, and legally necessary to perform the tasks entrusted to it, both internally and externally. For this purpose it has adequate organization, qualified personnel, diverse combat capabilities, normative acts that it justifies the existence and legal use of violence in realization of its tasks in society. Practically it become specialized means by which a state defend his specific attributes: independence and political sovereignty, territorial integrity, unity and security of its citizens.

Basically, the military forces represent various structures and military means on a state which enshrines the implement of its policy of defence and security. Its first mission is to ensure state security, its own interests and both population and territory protection of a foreign military threat. Also, it can get in an international frame, mission of maintaining, restoring or imposing peace, humanitarian and post conflict missions. In general she takes part in implementation of other public policies: foreign policy, internal security, civil security, public health, environmental protection.

During many centuries, the armed forces have been considered the resurrection of national sovereignty. They present themselves as guarantors of independence and state sovereignty, of territorial unity and integrity. Therefore, they often were and are still perceived by the population as an essential component of national identity of a state as a bearer of tradition and a defender of those values in their respective nation. Armed forces know over time a number of mutations, changes and developments due to evolution of the security environment, globalization and the society in which it exists. Basically joint military and/or mass reproduced from a social perspective, to a certain scale, the society which subsystem was. Today military forces are increasingly involved in mission that goes well beyond its ordinary tasks (protecting the independence, sovereignty and territory, or more generally, citizens) who assures him more often humanitarian missions in case of emergency (natural disasters, for example) both internally and externally as well as various international missions. In addition, due to increasing environmental complexity and security dynamics (international, regional and national) states are moving towards achieving a viable system of collective defence and security.

Therefore the armies of the Member States of such alliance have now the mission to participate actively and responsibly to defend its allies and collective security. Hence, it was necessary for almost all states to redefine the concept of defence.

Society constantly engaged in democratic states, civilian control over the military. Practically exists a system of civilian

democratic control of the military. It does not reduce the status and role of the military in the rightful state, but puts the relationship between the military institutions and its staff and political legitimate leadership of the state under the constitution provisions and laws of the country. Parliament, the president and the government of the country, elected by vote of the electorate, lead all state institutions, including the army, according to the mandate entrusted by voters. Soldiers are required to advise politicians and to incorporate the practical policy decisions taken by those in law in matters of national defence and security and collective/Common.

The army of professionals consists only of career soldiers and volunteer soldiers . Translation from an army of mass/joint venture in the military professionals, in most European states, is a natural process required by a combination of factors of military nature, economic, social and security. Armies start the endowment of ever more sophisticated means of fighting. They claim to be operated by specialists thoroughly trained and motivated, first, because of technical knowledge and complex struggle of the training skills required to fight now than the earlier period, because it cost very much. In addition, the military equipment used today has a greater power of destruction and a similar precision. This leads to the next on conclusion: professionalizing of soldiers improve serving modern technique is mandatory in fighting while reducing herds to strictly necessary, without diminishing power of appropriate fire. In this context, replacing the army of mass/mixed with professional army by relying on voluntary appears necessary. But the army of professionals is faced with some shortcomings. Among these is counted and the fallowing [4]:

-*The army social representativeness,* the assembly of the specialty literature is an important component to the social problem of those who become professional soldiers.

-*representation and social legitimacy of the army*, usually, into the collective thinking, the army represents the nation and is in its department. Practically, the army of the democrats must reflect, in terms of social structure, the nation for which she fights. If broad segments of the population are not linked in a interpersonal manner with the army of professionals, then there is a risk of splitting with broad segments of the population to ignore or not military support activities. However, the vast majority of sociologists consider that representativeness cannot be and must not be completely accurate;

-*effects of structure*. One of the first effects of the transition from an army of mass/joint venture to an army of professionals is a slight ageing of the military society. The amplitude depends on one hand, the modal term contracts and the rate can, on the other hand. Mainly, in an army of professional the officers constitute 15 percent of the personnel and NCO 35 percent, others being soldiers volunteers (soldiers and measuring) and civilians.

-*nature of army reports-power politics.* Forces professionalizing raise the fact of types of relations that the military organization will sustain with those that exercise the political power. There is a civil democratic control over the army, on one side, and the soldiers understood the role that they provide to their country on the other side.

-*The emergence of the private sector in military affairs*, the army professional is accompanied by the emergence of private sector being preoccupied with the defence and security domain. From this, she profits through outsourcing of services and activities you is that of the armies of mass and joint ventures, they obeyed soldiers coming through abnormal;

-*the social rupture between youth and the army,* in the military level the army of professionals is efficient considering that its personnel are highly specialized and qualified. Each soldier knows what he must do, when, why and by what means. Practically, an army of professionals is capable of imposing because of economical demands, and especially for the

nature of the new missions now and in the future. In the present the missions that oversee the security and national defence that an army has to cover have grown and diversified.

In the current international environment of security, owing to changes that took place in particular after 11 September 2001 and Globalization implications military talks intensely about new features of defence national /collective. And they can lists: preventive defence; and interdependence which enhanced with the elements of specific defence and security; active involvement of the international community in matters of defence and security; the tendency of States around the world of a transition from one solitary National Defence in a collective defence Joint; pro-active character pronounced phenomenon of defence.

A special aspect that is most significant for defence in general and for preventive defence is the legitimacy of the strikes that will be applied to the country symbolizes the "danger" or the imminent threat, thru its future effects, for a certain state or even for the international community. From this the necessity of establishing by the competent international organization regarding defence, evaluation and the requirements of identifying a real threat that appeals to a state or international community. They also established forum which has adopted political decision authorizing the preventive coups. The Forum may be one State or one non state organization ONU, e.g.

"Whoever would be the one who decides its decision preventive of coups and of putting them into practice, above all, should ensure the legality of the proposed measures. In this aspect, are required to be solved four important aspects of preventive coups: circumstances in which the decision authorizing such strikes will be taken; manner in which the decision will be put into practice; determining moment in which a danger becomes sufficiently for the imminent justified the strikes, credibility and veracity of sources and information on which it based its decision to implement this type of strikes.

All the preventive measures have a common point and i.e. cannot be justified only if the danger is imminent and very serious. However, if it is this reasoning, the concept of gravity puts a terrible dilemma when it comes to weapons of mass destruction. Chances of success are undoubtedly better if measures are taken against the danger quickly possible. Instead, in this case, is much more difficult to an emergency situation be demonstrated and to have support from internal and International public opinion. Given this dilemma, it seems difficult to find a consensus definition of this type of emergency.

Another specificity of designing, organization and materialization of national defence/collective in the current state of security constitute an increased interdependence of specific elements of defence with those of security. In other words, today, national defence/collective pair makes more with national security/collective.

Protection of national territory against military threats or any forms of prejudice to the security remain fundamental. In this respect, countries have an overall design on their defence, designed to fend off the time of any form of aggression. An essential element of this mindset is the conversion of the armed forces, the entire national defence system so as to gradually become a viable system of security.

The current context of security requires professional forces, well trained and able to use new technologies in the effectiveness of multinational and joined transactions. In turn, the new technology offers and supple solutions rapid to operational problems. Romanian army, in the process of transformation, has adopted measures to modernize the technique of fighting endowment and for the purchase of new types of such means, and optimization of training and development of his professional staff.

Active involvement of the international community in matters of defence and security means specificity essential to national defence. Thus, the Article 1 of resolution 3314 of 14 December 1974, the UN presented the circumstances required defining right to self-defence by States: "Armed aggression is the use of force against a state sovereignty, territorial integrity or political independence of another State or any manner inconsistent with the United Nations Charter, pre arising from this definition". Self-defence collective consists in right for a state unthreads directly to intervene in the name agreements on defence concluded with the state attacked. World trend of member shift from a national defence solitary at a collective defence joint join another specificity of national defence organization. The current strategic environment and development are the possible responses, to questions on defence and security in the 21st century, to be almost always the collective nature. In fact, is passing from the principle "Each for itself" in matters of defence ,to the principle of "Solidarity" in the face of dangers and threats to security and defence. This change is required by the emergence and event of new multiform dangers and threats against world states security and defence, in fact, upon the inhabitants. The evolution of the threats especially express through translational networks at two levels:

a) Tough core formed by the: terrorism, illicit trades, organized crime;
b) the entire social and economic phenomena imbalances originates from contemporary world (flow of people make uncontrollably, environmental catastrophes, pandemic).

Another important specificity to national defence is the pronounced or proactive character. This involves, among other things, building a device of defence capable of coping with the present multiform threats in matters of security and defence. In fact, membership Romania into NATO and EU calls for the achievement of a defence device suitable for the new status of the country and new risks and threats to security and defence. However, this new status of the country cannot be a substitute of the national effort in one area or another. At the same time, as NATO and EU member , Romania responsibilities are no longer limited to ensure national territory defence policies, or to preventive diplomacy, but also to policies that promote national interests and which supports the global stability in any region in which NATO has missions, and the EU is involved in politics to foreign security policy. . In this context, is due above-mentioned participation assets of our country with military structures on different Theatre of operations in the world (Iraq, Afghanistan, Bosnia-Herzegovina, and Kosovo).

In recent years, there were also changes of essence, often in a manner consistent with the status and national army in society role, resources and distributed relationships on which it maintains with civil environment for the national territory, and military structures, as part of international military alliances or coalitions, the foreign operations. At the same time, military missions have been converted, at least in Europe, by the disappearance of once massive threat on strategic territory interests and vital parts of Europe member.

Military missions in the current geo-political context, jointly with other changes occurred in the system and military missions suffered changes. They are required to be collected, both by army personnel and other members of the company, the existence and juridical, specific military institution. At the

same time, military missions can be seen as a concrete answer, appropriate and flexible in its promotion and defence of national interests, both within the country, as well as outside. Also, they constitute a way of alliance between her, as subsystem and society, the general system, and with other state institutions in charge of the National Security and Defence fields' country. In general, army missions can be classified as their character, the traditional missions, special missions and occasional missions [5].

Traditional missions are those which any army accomplishes them. In this context, it comes to guarantee the sovereignty, independence and unity of the state and territorial integrity of the country and the Constitutional democracy.

Special missions of the military concern, before all, in the involvement of its significant guarantee of the Constitutional democracy, in a state of law .Then, this type of mission relates the participation of military structures at national execution of various tasks, military or not beyond the country frontiers, where the national interests, as well as obligations of state from the treaties and conventions is required.

Occasional missions of the military are activities and actions on which it receives from those in law or only when the factual background in the country is required.

After their nature army missions are military missions and non-military missions. Military missions include: defend national territory against any military aggression; military alliances and frames of cooperation in matters of Defence (NATO) or the collective security (the UN and EU) and the cooperation (OSCE); military contribution in order to maintain international peace and stability.

Non-military missions include a wide range of activities and actions executed so independent (i.e. under the command national) national military structures, and the multinational military structures. Among these are: humanitarian missions; the observation mission of areas relatively unstable from the military, political and social point of view; mission to rebuild the armies of states to walk on the path of democratic development; military diplomacy.

Among the new national armies missions count the military intervention of the international community in the areas of armed conflict in which produce loss of human lives. It should be noted that after 1990, army missions are becoming more humanitarian, humanitarian action which requires accompanying or military intervention. These missions cover two aspects, tipping local population protection in place of refuge or where the populations are threatened. They require military intervention in the controlled zones: the multinational armed forces are placed under the UN aegis and come to impose ,to stand between belligerents.

Currently, national armies meet a new type of mission i.e. fight against international terrorism. This mission has two components: an internal one and other foreign. At first army components, together with other state institutions empowered with matters of defence and security, will carry out actions to prevent terrorist acts and defend national territory. On the Foreign Affairs level, national armies participating in structures of the international coalition military, created coalitions, for the fight against international terrorism. Currently, such a coalition is present in Iraq and acts in both directions, establish democracy in this

country, as well as against terrorists belonging to international terrorist organizations.

Regionalization and Globalization of relations military and security processes are not contradictory. In the context of globalization risks, dangers and threats to national security are the more diffuse and no longer have a character exclusively military.

Projecting power allows a State alliance, a coalition, international body, etc.) To exert influence in an area, according to the interests and needs. The projection of power can be exercised to a regional, continental or global scale. She put in game the will of leaders, expressed by political means, diplomatic, linguistic, economic, cultural, military sources and depends on power.

Military Forces projection is an expression of power projection. It is to use man, that means real success of the interests and put the troops into today scheduled game, most often, together with allies in the form of coalition or under the auspices of international bodies recognized by the international community for imposing readiness as regards stopping conflicts, conflict crises, stability and security [6].

The vision of Humanists relating the right of using force it requires to be supplemented with the idea that, sometimes, the force is necessary to ensure compliance with the law. This is achieved, most times, by force projection. Strategic balance never manages to get through by disturbing the balance power. In this respect, there are some achievements, and some programs, projects such as: the creation of a rapid reaction force of European Union (FRRE); creating employment in response to NATO (NRF); creation of joint forces, the projectable Theatre (Eurocorp, Euromarfor etc.).

The acquisition status of Member State of a military alliance by a country represents an evolutional process characteristic for national armies after leaving the Cold War. Whereas international military alliance is an agreement in which Unites States have a common interest to discourage and/or stop the threat of enemy, to save peace. According to international law, any member is entitled to make military alliances with other States or to remain neutral.

The power structure and the great powers have influenced actions and will always influence in the future, in a decisive manner, the military status of each State compared with other. In fact, the great powers established safety standards (military and non-military) and, depending on the other states will distribute potential defensive units. On this aspect, some designers showed that power is the essential reason in an armed conflict. War is an unbroken chain of battles for resources, territories and power.

In conclusion we consider that the phenomenon of globalization in the contemporaneous military field may contribute to the reconfiguration of democracy and sovereignty autonomy, which indicates the pillars of a young and new type of nation.

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MILITARY TRANSFORMATION IN THE CONTEXT OF GLOBALIZATION

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Abstract: *The present paper focuses upon military transformation in the context of the present-day globalized world. Globalization is the one which moulds military strategies and, implicitly, decisional processes, these being the component parts of the transformation management. What is emphasized here is the evolution of military organizations through alliances formed all over the world. These alliances aim at maintaining peace and creating military protection for all their Member States. Military strength can only be achieved with great investments and that is why poorer countries find it difficult to adapt to the conditions of such alliances as NATO, EU or OSCE. From this point of view, the supremacy of the U.S. army is underlined, not only because of their resources, but also because of their way of thinking. This paper also brings into the spotlight the fact that global cooperation in the defense department, and not only, brings significant advantages from the technological, economic and political point of view to the Member States. Military globalization can be perceived as a network which develops military connections at a global level, accompanied by the impact of new technologies. This paper also points out what are the key factors in conducting a successful operation and what should necessarily be taken into account when taking military decisions.*

Keywords: *military transformation, organization, globalization, interoperability, interchangeability, alliance, compatibility.*

1. INTRODUCTION

Transformation represents a set of activities which contribute to the rise of the functional performances of organizations. Through these functional performances, they become more efficient, humane, rational, innovative, useful to the society, profitable for their owners, convincing for their members, democratic, stable and flexible. Military transformation is a process that shapes the changing nature of the military competition and cooperation through new combinations of concepts, capabilities, people and organizations. Change becomes a way of life when dealing with unstable and uncertain conditions. The main objective of the engine, which fuels change, is to create new organizational, political and cultural values.

On the one hand, regarding the main theories of organizational change, the contemporary organizations function in a chaotic world, where social paradox is leading. On the other hand, a system may be based on three categories: *incremental change,* which takes place unnoticeably, but leads, at the same time, to significant transformations; *discontinuous change,* which does not follow a prior established course, but rather relies on exploration; *radical change,* which implies major modifications under all the aspects of the organizational environment. Change essentially depends on elements in the external environment (the macroeconomic state, legislation). The impact of change upon the leading techniques requires an analysis because the decisional process is a main point in the transformation administration and in the assurance of the organizational performance. The correct initiation and implementation of change require both the understanding of the external climate of the organization and the internal dynamics of it. Transformation implies a bidirectional analysis: the process itself and the impact upon military organizations and their constituents.

2. TRANSFORMATION PROCESSES OF MILITARY SYSTEMS IN THE GLOBALIZED WORLD

Military globalization is a reality, and more than that, it foreshadows the globalization phenomenon as a whole. NATO represents, at the same time, a fact of military globalization and acts as a stimulus to this huge process. The new strategic concept completes the defense of national sovereignty: protection of the State's economic interest, here included the borders. In the past, conquering territories pertained exclusively to the military force. Nowadays, this sphere of influence surpasses the attributes of the army, thus the traditional military interventions and the annexation of new territories fell down on a secondary plan. NATO is a materialization of the military affairs globalization, with global missions, global actions and global partners. Taking into consideration NATO's engagement to ensure energetic security to its members, the militarization of the vital centers of the world, especially of oil and natural gas pipes, of international waters and maritime corridors used by petrol ships, becomes obvious. Moreover, this is the reflection of the clear impact of globalization over military affairs and especially over the typology of the contemporary military conflict.

In the present-day political and military context, it is impossible to take decisions without considering terms, such as: interoperability of command and control, technology transfer, collaboration of multinational defense industries or migration off the global markets of defense industries. Analysts point out that the global market will more evidently incorporate the defense-security sector. Global cooperation in the defense department brings significant advantages from the technological, economic and political point of view. The decisional transformation is enriched by the defense sector. While the allies concentrate more upon regional conflicts and do not consider their imposing position, in every situation, as being important, the U.S. has developed an army which is capable to react unilaterally and to win major conventional conflicts. Furthermore, this difference of perception and approach creates discrepancies at the decisional level.

The transformation of the military organism is submitted to the influences of globalization through the chain loop of change management at different echelons and through the way in which taking decisions has to respond to these challenges. The U.S. considers that there should be a correspondence between the fundamental reorganization of the military system and the transformation of the military resources and capabilities. The other Member States of NATO maintain the proportions and cannot keep up with the investments of the DoD because of financial restrictions. In the actual situation of global financial crisis, the liquidity restriction of markets and the extremely negative impact upon economy as a whole, will lead to the redefining, rearranging and reprioritizing of the transformation process

regarding military resources and capabilities. Globalization moulds military strategies and, implicitly, decisional processes, the component parts of the transformation management. The production globalization affects the defense industry, which, in its turn, influences the acquisition policy. Military globalization can be perceived as a network which develops military connections at a global level, accompanied by the impact of new technologies.

2.1 Interoperability

Interoperability represents the ability of units or forces to provide services to and from other units or forces and to use the services so exchanged to enable them to operate effectively together. NATO interoperability represents the capacity of enlisted men of different member countries to work together efficiently. The differences related to the objectives, strategies and doctrines, the incompatibilities in communication, the variety of planning systems, the execution and weaponry, all these can endanger the missions' fulfillment and affect their efficiency. Concrete problems of interoperability in military action can occur at all levels: belligerent, strategic, operational, tactical and technological. The political implications cannot be ignored and the allies must identify and exterminate the causes which generate difficulties in the interoperability process. The success of an operation depends mainly on the flexibility of the organizational structure, doctrines and procedures. Furthermore, the transcendence of linguistic and cultural boundaries of the Member States, massively contributes to the fulfillment of multinational missions in safety conditions and at necessary standards. The process of interoperability requires time, effort and capital investments and the present global crisis affects and endangers this process. Thus, because of change resistance, political implications (which institutionalize military power), and the limited financial resources, interoperability has become a complex and provocative desideratum. The assurance of the NATO interoperability environment is possible because of three approaches: the operational approach, which is related to tasks, activities, organizational and operational elements and information flows supporting the military forces or the fulfillment of consultative functions; the systemic approach, which is developed by the host-State and which identifies and describes the internal and external systems, the necessary support connections of military forces and fulfills consultative functions; the technical approach, also developed by the host-State, describes the interaction and interdependencies between the system's elements and considers the restrictions stipulated in the systemic approach. Moreover, the technical approach provides the fundamental set of principles which govern the selection of standards and relevant products for the achievement of interoperability. In general, the objective of NATO's interoperability policy is to develop four skills: to communicate, to support, to operate efficiently and to teach/instruct.

2.1.1 Compatibility

The capacity of a Member State's army to act efficiently along with other armies in the alliance, irrespective of the conditions of the mission, is called *compatibility*. In the documents of the Ministry of Defense of the U.K., *compatibility* is defined as the appropriate character of products, processes or services used together in certain situations in

order to fulfill the requirements without undesired interactions.

2.1.2 Standardization

Taking into consideration the great diversity of nations and cultures, which characterizes both NATO and EU, it becomes obvious that a main role in assuring common action is played by standardization. Standardization is a key element of NATO's policy which targets three domains enumerated according to their importance: compatibility, interchangeability and common action. Standardization should be a must for all the Member States of alliances, such as NATO or EU, because it is the fueling engine of interoperability.

2.2 Interchangeability

Interchangeability consists of the possibility of replacing one entity with another, fact which does not affect the good functioning of the system. According to NATO and EU's documents and requirements, interchangeability is tightly linked to the standardization of all categories of resources, equipment, weaponry, technologies, procedures, etc., its aim being the fulfillment of the interoperability criteria of all fight systems, on which the flexibility of multinational forces depends. Interchangeability of products inside an alliance is important because during conflicts, peace keeping operations and training exercises, State Members must use the same units. It is worth to mention the fact that interchangeability is still not realized in NATO or EU, mainly because of the linguistic barriers and the significant differences between the partner States from many points of view, such as: experience, amenity, cultural characteristics, etc.

The actual multinational expeditionary actions vise internal conflicts in which the decision to dislocate military forces cannot be based exclusively on correct information and clear criteria. This is the main reason why the international community is reluctant to its intervention in the home affairs of a State. On the one hand, this intervention implies risks and loss of resources, and on the other hand, the result is not beneficial for those who interfere in these conflicts. Although, the beneficial effect of military implications in humanitarian actions is unquestionable. Firstly, the equipment and technology offered by military organizations are often superior to those pertaining to the humanitarian organizations. Secondly, in uncertain and unstable situations, military organizations do not only contribute to the protection of the population, but they also help humanitarian organizations to develop their activity under safety conditions. Thirdly, in the post-conflict period, military forces deploy mine clearance, monitoring demobilization operations or surveillance of the refugees who return to their native countries. The army's necessity to carry out defensive actions is iterated in the official documents of the EU. These documents underline that collective security and defense policy play an important role in the priorities of this alliance. Thus, both military and civilian resources will be used in peace keeping actions, of preventing conflicts, stiffening security, demobilizing, rescuing people, of military counseling and supporting, of post-conflict stabilizing. All these aspects contribute to the achievement of the major objective of fighting terrorism and they are in accordance with the principles mentioned in the UN Charter. In contrast with the period of the Cold War, when problems were predictable, static and, exclusively of military nature, the actual phenomena are unpredictable, asymmetrical, dynamic, and threats are not always of military nature. Hence, problems cannot only be solved by military means, but also by using a portfolio of economic, civilian and political methods. As Kugler and Frost [2] assert, the EU is not a simple economic and political organism. Furthermore, it has become an organization which is perfectly capable of developing diplomatic actions and coherent defense policies. In other words, this whole transformation process aims at creating a united Europe through regional and global organizations, such as: NATO, EU and OSCE.

3. CONCLUSIONS

Military action cannot be restricted to its traditional role. Nowadays, it has to respond also to humanitarian challenges because the new realities we are exposed to determine the diversification of roles in all fields of activity.

Moreover, the diversification of multinational operations is a result of globalization, which, in its turn, has generated the appearance of new types of conflicts. Two decades ago, these new types of conflicts, such as the informational and/or electronic war, the ecologic war, the economic war, the media war, etc., did not even exist at an imaginary or conceptual level.

`Globalization is the process of growing international activity in many areas that is creating ever-closer ties, enhanced interdependence, and greater opportunity and vulnerability for all. Events at the far corners of the earth are now affecting each other, countries and regions are being drawn closer together, key trends are interacting as never before, and the pace of change is accelerating. Because of it, the 21st century will be the first truly Global Century` [1].

Events which take place in a certain part of the world echo in another part of the world, the rhythm of change is more and more accelerated, the old boundaries between foreign and domestic as well as between economics and national security are rapidly eroded.

To conclude, the central features of globalization are the rapidly growing and uneven cross-border flows of goods, services, people, money, technology, information, ideas, culture, crime and weapons. Due to globalization, international and transnational activity is growing exponentially, and the rate of change is accelerating almost everywhere, often faster than governments and institutions can respond.

Military transformation has to keep the track with this accelerating process in order to maintain the balance between the Member States of the alliances formed all over the world.

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V-22 OSPREY: WAGING ITS OWN WAR

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Abstract: *The V-22 Osprey, an aircraft that has been in development for about 25 years and has a very controversial past and uncertain future. It was designed for future irregular warfare environment covering full scale of missions, especially in third-world conflicts with lack of infrastructure. But its operational problems and deployment experience raise serious questions whether the aircraft can accomplish the full range of missions of the helicopter it was intended to replace, or the range of missions provided by other modern helicopters.*

Keywords: *Osprey, tilt-rotor, missions, aircraft restrictions, crash, deployment.*

1. INTRODUCTION

The V-22 Osprey is a tilt-rotor aircraft that takes off and lands vertically like a helicopter and flies forward like an airplane. For taking off and landing, the aircraft's two wingtip-mounted engine nacelles are rotated (i.e., tilted) upward, so that the rotors function like a helicopter's rotor blades. For forward flight, the nacelles can rotate as much as 90 degrees forward, so that the rotors function like an airplane's propellers. It features a cross-coupled drive system so either engine can power the rotors if one engine fails.

There were three planned versions of V-22. MV-22 for the USMC (United States Marine Corps), Air Force variant CV-22 and HV-22 for the Navy.

The MV-22 is designed to transport 24 fully equipped Mariners, or up to 20,000 pounds of internal cargo or 15,000 pounds of external cargo. Its cruising speed is about 250 knots (about 288 mph), exceeding the performance of the Marine Corps CH-46 medium-lift assault helicopters that MV-22s are to replace. The CV-22 has about 90% airframe commonality with the MV-22; the primary differences between the two variants are in their avionics. The CV-22 is designed to carry 18 troops, with auxiliary fuel tanks increasing the aircraft's combat radius to about 500 miles, systems to detect and defeat radar-guided and heat-seeking missiles, enhanced navigation, communications and avionics systems.

The V-22 program began in the early 1980s, based on the XV-15 tilt-rotor prototype developed by Bell Helicopter and first flown in 1977.

The whole program has been revised numerous times over its history and the aircraft has experienced a number of development challenges relating to affordability, safety, and program management. The George H.W. Bush Administration proposed terminating the V-22 program in 1989 as part of its proposed FY1990 budget. The cancellation efforts were

through 1992, but Congress rejected these proposals and kept the V-22 program alive.

Finally, after more than 20 years of development, the MV-22 made its maiden combat flight when deployed to Iraq in October 2007 while CV-22 was declared fully operational in March 2009.

2. INTENDED MISSIONS

The V-22 was projected for vast scale of combat or non-combat missions from peace evacuation operations, humanitarian assistance and disaster-relief mission to assault transport, medevac, aeroscout, tactical recovery of aircraft and personnel, raids conducting and support of widely dipersed units.

The Marine Corps are the lead service in the development of the Osprey. The Marine Corps version, the MV-22, will be an assault transport for troops, equipment and supplies and will be capable of operating from ships or from expeditionary airfields ashore. The Navy's HV-22A will provide combat search and rescue, delivery and retrieval of special warfare teams along with fleet logistic support transport. The Air Force CV-22A is built for conducting long-range special operations missions.[1]

3. COSTS AND FINANCIAL CUTS

Like some other aircraft, the number of V-22s projected for production has reduced over time. First order in 1989 was set on 663 aircraft. Now the Department of Defense (DoD) plans call for procuring a total of 458 V-22s—360 MV-22s for the Marine Corps; 50 CV-22 special operations versions for U.S. Special Operations Command, or USSOCOM (funded jointly by the Air Force and USSOCOM); and 48 HV-22s for the Navy. No HV-22s have yet been procured for the Navy.

V-22s are currently being procured under a $10.4 billion, multiyear procurement (MYP) arrangement covering the period FY2008-FY2012 (Fiscal Year). The MYP contract , which was awarded on March 28, 2008, covers the procurement of 167 aircraft—141 MV-22s and 26 CV-22s [2]. DoD expects the multiyear contract to save $427 million when compared to the use annual contracting. [3]

DoD in February 2008 estimated the total acquisition cost of a 458-aircraft V-22 program at about $53.3 billion in then-year dollars, including about $9.9 billion for research and development, about $43.1 billion for procurement, and $262 million for Military Construction (MilCon). The program was estimated to have a program acquisition unit cost, or PAUC (which is total acquisition cost divided by the number of aircraft), of about $116.3 million and an average procurement unit cost, or APUC (which is procurement cost divided by the number of aircraft), of about $94.5 million. [4]

In addition, operations and support costs are expected to rise. The current cost per flying hour is over 11,000$ - more than double the target estimate for MV-22. [5]

4. CRASHES/LOSSES

Like other types of aircraft during development, testing or the operational phase didn`t avoid several crashes and fatalities. There were five crashes and several notable incidents enregistered till the end of 2010.

1. 11 June, 1991 - An Osprey crashed three minutes into its maiden demonstration flight at a Boeing helicopter flight test center in Wilmington, DE. There were no serious injuries in the crash, which was blamed on gyro wiring problems. Two crew members safely ejected, and the aircraft was badly damaged the accident.
2. 20 July, 1992 - Seven crewmembers lost their lives when a prototype of the V-22 Osprey fell into waters off the Quantico, VA, Marine Corps Air Station. The crash occurred after an engine caught fire as the aircraft was completing a 700-mile non-stop flight from Eglin Air Force Base. mechanical failure was found to have triggered a fire that disabled an engine. The identified design deficiencies were corrected and incorporated in all production aircraft.
3. 08 April, 2000 - An MV-22 crashed during a noncombatant evacuation

evaluation mission. The crash claimed 19 lives -- the deadliest air disaster for the Marines since 22 died in a helicopter crash in 1989. The Osprey was one of four flying from Marine Corps Air Station Yuma, Ariz. It crashed at Marana Airport near Tucson. The mishap aircraft was one of five production aircraft delivered to the Marine Corps for operational use. Officials said that an examination of data did not indicate any mechanical or software failures. In the last seconds of its flight, the mishap aircraft was in a high rate of descent at a relatively low forward airspeed. These characteristics can lead to a condition known as power settling (or vortex ring state) which can result in a loss of lift on the rotor system. Power settling is a phenomenon common to helicopter flight. The primary cause of the crash was the pilot descended too quickly -- 250 percent the acceptable rate.

4. 11 December, 2000 - An MV-22 Osprey crashed in North Carolina during a night training mission. Four Marines were killed when the MV-22 crashed in a remote wooded area about 10 miles outside Jacksonville. The crash was the fourth accident involving the tilt-rotor aircraft since 1991. The Navy and Marine Corps grounded all MV-22 Osprey flights until further notice. The accident investigation concluded that a leak in a chafed hydraulic line, coupled with a software glitch, had caused the crash. The software problem contributed to the aircraft going out of control, rather than compensating for the hydraulic leak. [6]
5. April 8, 2010 - a CV-22 Osprey, crashed approximately 11km west of Qalat city in Zabul province in southern Afghanistan attempting a night landing at a desert landing zone. This was the first loss of CV-22 in combat. Two of the three cockpit crew members — pilot and flight engineer died. The co-pilot who survived, told the invetigators, that he didn't have a clear memory of the flight's last 30 seconds. Also killed were a soldier and a contractor — two of 16 passengers in the cargo compartment. A Taliban spokesmen claimed responsibility for shooting down the Osprey helicopter, however, enemy fire,

brownout or engine failure have been ruled out by the USAF investigation. The true causes of the crash may never be known because no irrefutable evidence exists to substantiate either explanation - the wreckage and black box recorder were destroyed. [7]

5. LIMITS

The Joint Personnel Recovery Agency (JPRA) claimed that the V-22 along with the H-53K are "particularly limited" in their ability to perform vertical extraction of patients and rescuers since they "do not have a hoist or are not practical options for hoisting live personnel due to excessive **downwash**." This feature is critical for rescue aircraft which often cannot land at rescue sites. [8]

V-22 operational tests and training exercises identified challenges in maneuvering limits that affect air crew ability to execute correct evasive actions. Moreover, due the large footprint the Osprey is restricted in the number of places it can land. This can pose serious troubles in urban environment, forested terrain or on shipboard. Identified challenges could limit the ability to conduct worldwide operations.

Worse, safe engine-out landing is a major unresolved issue for the V-22. Emergency landing after the sudden failure of both engines in the Conversion / Vertical Take-Off and Landing modes below 1,600 feet altitude are not likely to be survivable. The V-22 cannot autorotate to a safe landing. [9]

In conjunction with resuming flight testing, the Navy Department modified certain V-22 requirements. For instance, the V-22 is no longer required to land in helicopter mode without power (also known as "autorotation"), protection from nuclear, chemical and biological weapons has been eliminated. The V-22 is no longer required to have an "air combat maneuvering" capability; instead it must demonstrate "defensive maneuvering." Also, the requirement that troops be able to use a rope or rope ladder to exit the cabin at low altitudes has been eliminated. [10]

6. DEPLOYMENT EXPERIENCE

As of January 2009, the 12 MV-22s in Iraq successfully completed all missions assigned in a **low threat theater** of operations—using their enhanced speed and range to engage in general support missions and deliver personnel and internal cargo faster and further than the legacy helicopters being replaced. In addition, the MV-22's ability to fly at higher altitudes in airplane mode enabled it to avoid the threat of small arms fire during its Iraq deployment. This agility allowed the Osprey to operate at far lower operational risk while at higher tempo. Three Marine Corps squadrons that have been deployed to Iraq have flown over 9800 hours while executing more than 6000 sorties, carrying over 45,000 passengers and lifting 2.2 million pounds of cargo without lost a single of these aircraft in combat. The Osprey has shown that it can carry an operational load of 24 combatloaded Marines out to a combat radius of 300 nautical miles at altitudes above the small arms and rocket-propelled grenade threat envelope. [11]

On the other hand, the Marine Corps admit that during the deployment in Iraq, Osprey was restricted to a very limited role due to its vulnerability to hostile fire, its lack of maneuverability and its unreliability in the heat and sand of Iraq.

Experience from deployment shown need for a new upgrade program. Unfortunately, planned upgrades to the aircraft could affect the aircraft's ability to meet its requirements. A limited-coverage, ramp-mounted defensive weapon was installed on aircraft deployed to Iraq. The program plans to incorporate a mission-configurable, belly-mounted defensive weapon system that will provide fuller coverage. For missions requiring the new weapon, however, the interior space needed to integrate the system will reduce the MV-22's troop carrying capability below its key performance parameter of 24 troops, as well as reduce its internal cargo capacity. The program also plans to integrate an all-weather radar into the MV-22. This radar and an effective de-icing system are essential for self-deploying the MV-22 without a radar-capable escort and deploying the V-22 to areas such as Afghanistan, where icing conditions are more

likely to be encountered. However, expected weight increases from these and other upgrades, as well as general weight increase for heavier individual body armor and equipment may affect the MV-22's ability to maintain the key performance parameters, such as speed, range, and troop carrying capacity.

While in Iraq, the MV-22 also conducted a few AeroScout raid and external lift missions. These types of missions were infrequent, but those that were carried out were successfully completed. Such missions, however, were also effectively carried out by existing helicopters. AeroScout missions are made by a combination of medium-lift aircraft and attack helicopters. Participating in these missions, the MV-22 was limited by operating with slower legacy helicopters—thus negating its speed and range advantages. Similarly, external lift missions do not leverage the advantages of the V-22. In fact, most of Marine equipment requiring external transport is cleared only for transit at speeds under 150 knots calibrated airspeed (kcas), which is in the contrary with higher speeds at which the MV-22 can travel with internal cargo or passengers. According to Iraq-based MV-22 squadron leaders, the CH-53 [12], which is capable of lifting heavier external loads, was more readily available than the MV-22 to carry out those missions and therefore was generally called on for those missions, allowing the MV-22 to be used more extensively for missions that exploit its own comparative strengths. [13]

The MV-22's Iraq experience has also demonstrated some limitations in situational awareness that challenge operational effectiveness. Crew chiefs and troops pointed out on lack of visibility outside to the activity on the ground from the V-22's troop cabin as a result of small windows. The combination with brownout [14] caused by the tiltrotor`s powerful downwash was considered to be a significant disadvantage.

Another key upgrades concerning the war experience are adding forward firing countermeasures to enhance the aircraft`s survivability, modifying the engine air particle separator to prevent engine fires and improve system reliability.

7. SELF-DEFENCE

Back in 2007 and prior to the type's first operational deployment, the USMC decided the aircraft needed a self-defence capability to supplement the machine gun fitted to the aircraft's rear ramp. The US Marine Corps operated a ramp-mounted. 50-calibre gun on 10 MV-22 Ospreys deployed to Iraq, but this configuration limited the weapon to firing on only rearward targets. [15] At the time, BAE Systems were developing the Remote Guardian System, a belly-mounted turret fitted with a 7.62mm mini-gun that could fold into the fuselage while on the ground but slide down under the belly of the aircraft during flight.

The gun is operated from inside the aircraft by using a controller. The operator can rotate the gun 360°and acquire targets using a monitor that is fed colour images from a forward-looking infrared sensor. But after using the gun with some success in Afghanistan, recent reports say the marines are ditching the gun system as the drawbacks frequently outweigh its benefits. At 363kg the gun is heavy and this limits the payload the aircraft can lift in Afghanistan's hot and high altitude environment. It can also cause nausea for the crewman operating the system since they must stare at the screen while the aircraft manoeuvres. United States Air Force (USAF) and USMC say they are now looking for a long-term solution. [16] The future system

should be perhaps installed in the nose of the aircraft or in the hell hole.

8. FUTURE OF V-22

Every new design is struggling with problems such as unreliable component parts and supply chain weaknesses, which led to higher operations and support costs and low aircraft availability rates. The V-22 is not an exception. The deployments confirmed that the V-22's enhanced speed and range enable personnel and internal cargo to be transported faster and to extended ranges than is possible by the helicopters it is replacing. On the other hand, lack of autorotation capability makes the aircraft vulnerable especially during final approach to landing. The low-threat missions assigned to Ospreys in Iraq were accomplished at high level. However, questions have risen whether V-22 is the best suited to accomplish the full mission repertoire of the helicopters it is intended to replace, as the current Marine Corps plan is to replace all of its medium-lift helicopters with the MV-22. The question is whether mixed fleet of MV-22s and legacy helicopters would be better. Warfare needs indicate, that the V-22 may not be best suited for the full range of missions requiring medium lift, as the aircraft's speed cannot be exploited over shorter distances or when transporting external cargo. In addition, attack escort helicopters are not be able to keep pace with the Osprey. Over the years, the aircraft has been the subject of controversy for development delays, highly publicized crashes, and many funding debates. Osprey has strong supporters but equally tough critics, both sides claiming that it is either better or worse than conventional helicopter alternatives. Those favoring the program cite its speed, range, and altitude advantages over helicopters, characteristics that make it possible for Marine Corps forces to execute operations from increased distances. Those against the program cite its troubled developmental history and its high cost (relative to helicopters). Moreover less expensive helicopters can just as effectively support ship-to-shore deployments, amphibious landing operations, and various amphibious assault missions.

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PERFORMING PHYSICAL EDUCATION IN THE ARMY

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Abstract: *The purpose of this study was the observation of staff performing physical activity required, collective and individual, and conscious participation and involvement in these activities.*

Study shows:
- identification of diseases and their causes
- identification of advantages of practicing physical exercises
- illustrating the benefits of exercise on the human body.

Keywords: drill, physical activities, practice, healthy.

1. INTRODUCTION

Work environment, personal life, concerns about the future, lack of time for relaxing and energizing activities is a risk factor for the health of the military, and this in turn is a risk factor for its sustainable performance and, therefore, for the efficiency of military structure.

2. CASE STUDY

Health or better said health maintenance, the main objective of physical activity should be addressed not only as absence of disease but as well a physical, emotional and social development, which is the main resource of every employee to make good work. In terms of the institution, the lack of military health be it a teacher, instructor, student, has negative effects on labor services:

- low physical participation (the military man is currently at work, but the yield is far below the maximum)
- errors or accidents in work tasks;
- extended breaks during the program;
- irritability and conflicts between colleagues;
- lack of interest, involvement in solving problems;
- inefficient management of time.

Also, lack of health effects both professional life and family life and causing social disturbances such as:

- an increased frequency of sick leave;
- lack of concentration at work;
- low participation in social life;
- irritability and conflicts in family life;
- use of time for medical treatments.

2.1 Reason for research

The reason behind this study and analysis started as soon as I entered professional life, in a profession that although it is linked to general and specific physical education, military, cannot be related to sports performance and sports life than to a lesser extent, because you take more time than you realize, and through the weekly objectives, daily stress and pressure makes you forget that have to eat, do sports, to get a life outside

workplace.

Thus, all students go from school to working life habits gradually forgetting a carefree life (balanced diet, life sports, recreation, and lack of stress) and start a daily life with family and professional responsibilities.

It is generally accepted that the inclusion of sporting activities in daily life has a beneficial effect on general health.

2.2 Purpose

Highlighting the positive influence that some sports have over reducing illnesses characteristic of staff through optimum management of sport.

Many military men, whether we want to admit it or not, have risen above the permissible level, body mass index, which is to be appreciated as unfit, even if they satisfy the scales to assess the level of physical fitness.

Being overweight is a condition characterized by weight gain over the optimum level, by storing excess fat tissue. Obesity reflects the existence of strong hormonal imbalances in the body, being one of the most common diseases of modern society. In recent years, the global number of people suffering from obesity has doubled. According to estimates by the World Health Organization experts, up to 2010, more than half of Western population will be affected by obesity. Not even developing countries and poor ones will get rid of this scourge in the coming years provided a substantial increase in obesity. Cases of childhood obesity are alarming, with dramatic proportions in the United States and more recently in France.

Among the causes of obesity there is he excess consumption of food or irregular diet, especially those rich in fat, protein and carbohydrates and reduced physical activity. Some social factors, such as too low family income or lower educational level were also associated with obesity.

"Lack of physical activity, through weight gain which is the main element, takes us to obesity. In its turn, this disease is prone to other many diseases - peripheral vascular and venous insufficiency or stretch marks (varicose veins), especially for those found operating in the office or go passive, joint disorders and osteoarthritis (rheumatism of the hip) or depression because these people who are not moving do not participate in the active life. Muscular disorders are severe and go to muscle atrophy or muscle weakness."(C. Dumitrache)

Obesity is a risk factor favoring serious chronic disease:

- sleep apnea and respiratory problems
- increasing cholesterol
- coronary heart disease
- stroke
- gall bladder disease
- diabetes
- hypertension
- osteoporosis
- malignancies in the following organs: uterus, breast, colon and rectum, kidney, gall bladder)

As well, these conditions generate a series of psychological disorders on the human body:

- psychological disorders: anxiety, depression, panic attacks etc.
- menstrual disorders
- complications in pregnancy
- hirsutism (excess hair present on body and face)
- incontinence caused by stress (involuntary disposal of urine due to a lack of control over bladder muscles)
- increased risk of developing complications if surgery
- high mortality rate

To these we add the negative impact on the entire metabolism. Fat storage begins at the internal organs, which will be "suffocated" by the pressure of accumulated fat deposits around them. This installs functional imbalance in the internal organs and organ systems. The first organs affected are the liver, the heart and the kidneys.

Dr. Kevin Kendall, a prominent American epidemiologist, said that in the civilized world there are only three diseases: mental stress, sedentary and irrational diet.

The rest of diseases, he said, are only consequences of the first three listed.

3. BENEFITS OF SPORTS ACTIVITIES PRACTICE

3.1 Weight reduction or maintenance

The percentage of fat is an increasingly acute problem of modernity. It is directly related to inactivity and improper nutrition. When those rates exceed the optimum values set by medicine, the water deposits become a danger to health. The source of energy required is produced by aerobic decomposition of glycogen and free fatty acids favoring the presence of oxygen burning body fat.

By engaging in aerobic physical activity-specific (aerobics, swimming, jogging) energy consumption appeals to the body fat deposits which lead to a rebalancing of metabolism and a better functioning of the ratio between active mass and passive mass, reducing fat mass.

3.2 Strengthening the cardiovascular and respiratory functions

Many studies have shown that engaging in physical activity decreases the risk of cardiovascular disease. A regular exercise program keeps your body healthy. A daily trained body resists better than the untrained one when encountering a disease.

The aerobic drill has the effect of improving consumption of oxygen in the body, increases vital capacity, total and reserve lung volume increases and improves blood circulation. During these activities, the amount of blood circulating through the body increases, causing the necessary oxygen for the processes taking place in cells and tissues. Anaerobic effort influences muscle strength and flexibility.

3.3 Balancing and harmonizing the body shapes

Harmonizing body shapes can be achieved by training the specific muscles to develop and improve its activity. Gymnastics drills offer a wide range of variations of movement that can handle all areas of musculoskeletal selectively. This extremely complex influence is one of the advantages of aerobic gymnastics maintenance cycle to the kinds of exercises like running, cycling, swimming, always usig the same muscle groups.

3.4 Involvement of movement of the whole body

Systematic application and enforcement of long-term exercise and their connection to volumes and well controlled weights, lead in time to the emergence of adaptive effects manifested by:

- increasing or even doubling of glycogen storage in muscle
- muscle increasing efficiency through more economical use of energy resources
- later appearance of fatigue
- producing smaller quantities of waste products in muscles as a result of effort
- improvement of energy resource recovery rate after exercise

The exercises can be adapted to each age group. They improve the conduct of various performances enhancing movement capacities necessary for daily activities. Among those mentioned are:

- the relative strength (relevant for the work chains of muscle groups)
- general and local resistance (from the different parts of the body)

• mobility of joints, ligament and muscle systems

• Ability to cope with different requirements concerning contraction actions, stretch and / or relaxation

• the moving alternation ability quickly and efficiently of different types of labor muscle in static and / or dynamic regime

• coordination between muscular and intramuscular capacity

3.5 Through sports activities we will obtain:

• increase muscle mass and strength - and by default will look athletic and balanced, and self-confidence default

• help maintain mobility, balance, and in maintaining bone hardness and density

• reduces the risk of degenerative diseases, such as arthritis - increased volume of blood pumped by the heart, better oxygenation of the whole body, and avoiding cardiovascular disease • efficient burning of fat

• helps reduce the amount of cholesterol

• help in activating and maintaining wellness by activating the release endorphin

• help maintain a healthy and mentally strong psychic status and reduces symptoms of anxiety or depression, better oxygenation of the brain, increasing the concentration capacity

• increased chance of longevity and quality of life

• risk reduction for diabetes

• body weight reduction and efficient way to relieve emotional stress

• increase male testosterone levels and all along comes a higher sexual appetite • generally, there is a noticeable improvement in the quality of sexual life

4. CONCLUSIONS

Although in school we learn about the benefits of engaging in physical exercise, we do not believe in them or we do not apply them. After the observation of military men in different structures I came to conclude the following:

- without a legacy of physical culture, physical activity occupies a very small percentage among everyday activities;

- most subjects under notice, who show importance to physical activity, both for their role in maintaining physical health as well as emotional and social benefits, live in environments with a strong sports character

- without legislation to support both military institution in shaping a policy to promote physical activity, they will be seated languishing in our lives.

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AIRLINES PRIVATISATION ASPECTS

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Abstract: *Explain and work out aspects and effects of airlines privatisation in relation to globalisation. Show advantage and disadvantage of the change of the owner from government or state to a private person or various kinds of companies.*

Key words: *airlines, privatisation, globalization.*

1. INTRODUCTION

Privatisation is the incidence or process of transferring ownership of a business, enterprise, agency or public service from the public sector (the state or government) to the private sector (businesses that operate for a private profit) or to private non-profit organizations.

In a broader sense, privatisation refers to transfer of any government function to the private sector - including governmental functions like revenue collection and law enforcement.

The term "privatisation" also has been used to describe two unrelated transactions. The first is a buyout, by the majority owner, of all shares of a public corporation or holding company's stock, privatizing a publicly traded stock, and often described as private equity. The second is a demutualization of a mutual organization or cooperative to form a joint stock company.

Globalization - the process by which regional economies, societies, and cultures have become integrated through a global network of political ideas through communication, transportation, and trade. The term is most closely associated with the term economic globalization: the integration and interaction of national economies of different nations into the international economy through trade, foreign direct investment, capital flows, migration, the spread of information technology, and military presence. However, globalization is usually recognized as being riven by a combination of economic, technological, sociocultural, political, and biological factors. The term can also refer to the transnational circulation of ideas, languages, or popular culture through acculturation. This process has effects on the environment, on culture, on political systems, on economic development and prosperity, and on human physical well-being in societies around the world. To find the right balance between benefits and costs associated with globalization, citizens of all nations need to understand how globalization works and the policy choices facing them and their societies.

Why to privatizate

The air transport system is an important contributor to the quality of life of people and an essential part of world business

globalization. Increasing passenger and cargo traffic places further demands on airlines to provide adequate, facilities and services to ensure safety, regularity and efficiency of aircraft operations in the air and on the ground as well.

The effort and reason of majority of countries was clear. Generaly, state owned enterprises have not better functions and profits than private ones. One of the best engine for running of money wheel is money or profit. This idea is realy old and came out from historical development and experience. Private profit is closer than social welfare like it is in case of socialist property.

Process of Privatisation

In 1987 Western Europe began cautiously to deregulate its airlines, inspired by the lower ticket prices and greater competition that this policy had achieved in United States of America. In a very fresh history, appearances suggested that not much had been changed. In 1 Ailing state-owned airlines still queued up for government bail-outs; national flag carriers still accounted for 80% of traffic; and all but 10 % of domestic routes were served by a single airline. But with full liberalisation of the market due under European Union (EU) policy in two years' time, at last there were signs of a new competitive breeze stirring Europe's skies.

Legislative support

The same or very similar laws were adopted in US and later in Europe through EU and its Commission. All of them had to help and also forced the privatisation of airlines. The process of adoption was slow, accompanied by early-new raised problems.

There was plenty of the familiar old bad news at those times, however. Spain's state-owned Iberia was poised to receive up to Ptas130 billion (Dollars1.1 billion) in subsidy from its national government, just three years after its last, and supposedly final, bail-out. The European Union would like to see an end to the laws that stop foreign airlines from owning US-based airlines. The EU would like the laws governing ownership of US airlines scrapped as a part of the plans to create a common aviation market with the US, according to EU officials. The open skies talks between the EU and the US were expected to resume later after being interrupted by the US events like presidential election. In the past, open skies talks have failed over cabotage, which could allow EU airlines to fly domestic routes in the US.

The US has reportedly offered to allow EU airlines the right to own up to 49 % of the voting stock of a US carrier, which is an increase from the previous 25 %, but EU officials have indicated that this may not be enough. An official issue of the European Commission transport has said that it is archaic to demand that you have to be American to own an American company. The European Union wanted to see an end to the laws that stop foreign airlines from owning US-based airlines.

One of the fragments creating the cost of the air ticket is the charging of air navigation services costs.

By last new Regulation on Single European Sky charging to make flying cheaper and more performing the European Commission adopted on 16 December 2010 a new Regulation on the charging of air navigation services costs, which marks another major step towards a truly performing and sustainable Single European Sky.

The charging Regulation will make sure that this target is achieved by a mechanism of risk and opportunities sharing which replaces the automatic full cost recovery system that had prevailed for several tents of years.

Under the previous system all costs increases were automatically added to the cost bases and charged to users, without any possible control except of legal compliance. Furthermore the losses incurred by air navigation service providers because of tradic decrease were automatically carried over to airspace users in the following year. This created a vicious circle when reduction in traffic during years of crisis automatically led to an increase in tariffs, exacerbating the already difficult financial situation of airlines.

On the other hand, any profit made by air navigation service providers due to good

management and cost control had to be returned to airspace users. The air navigation service providers had no possible reward for good management.

This vicious circle is now broken: Member States and air navigation service providers set in advance their "determined costs" in real terms, and these are capped for the duration of the performance reference period. Good cost control may generate profit that will be kept by the air navigation service provider. If traffic is above or under forecasts, the difference in revenue, positive or negative, will be shared in a fair manner between airspace users and air navigation service providers.

Facts and Figures on the European sky

Today

- European Aviation market: a €140 billion business in 2006;
- +/- 150 airlines;
- 730 million passengers in 2006;
- 1,000 airports;
- 25,000 aircraft on average per day;
- 1,000 air traffic control sectors;
- 12 traffic bottlenecks account for 80 % of delays;
- Air traffic control/management costs €8 billions for 9 millions flights per year;
- Airlines incurred €9 billions losses in 2009 because of the crisis;
- The volcanic ash cloud crisis costed airlines some €1.26 billion in a week;
- In 2007, delays generated an additional €1.3 billion of costs to airlines;
- Flight inefficiencies generate substantial additional fuel burn – estimated at more than €1 billion per year - and generate some additional 16 million tonnes;
- of CO2 per year.

Tomorrow

- Reduce the cost of flying by 50 %;
- Decrease the environmental impact of flights by 10 %;
- Allow continuous increase of capacity while reducing delays;
- Further enhance high level of safety;
- De-fragment European airspace by creating nine Functional airspace blocks;
- Improve performance of air navigation services with regard to safety, environment, cost-efficiency and capacity;
- Establish a single authority to manage the European network, in order to allow optimum use of airspace and allocate scarce resources.

2. POTENTIAL POSITIVES OF AIRLINES PRIVATISATION

The aviation transport industry is going through an exceptional transformation that has driven the market towards increasing levels of competition. Additionally, major investment programs are required to meet the expected growth in air travel demand (particularly in some emerging regions, such as Asia).

Airlines have historically been considered as essential components of the national aviation system, and hence both with airports were regarded as public utilities. Due to this approach, operational and handling activities were contemplated as being fundamental for the development of the airport and airlines business, and commercial activities had a less important role to play. For that reason, airport assets and property have always been publicly managed and commercial activities have occasionally been contracted or outsourced to

private companies. The same effort is observed and requested in access to airlines. Within such a framework, economic regulation was seen as superfluous. The traditional airlines management model becomes visibly unsustainable when most governments begin to be concerned about the burden of airlines financing and its lack of efficiency. However, for many years, a majority of airlines around the world have continued to operate under this model and some still remain attached to it. Since the 1990s, the industry started to evolve with changes being brought about in the traditional airlines management model. Currently, governments are progressively regarding airlines as potential profit-making enterprises rather than merely considering them as part of the infrastructure suppliers.

There are three main potential economic gains obtained from privatisation, namely improvements in operating efficiency (the private for-profit business model more often leads to a further exploration for means to cut costs and boost revenues than public management), the introduction of new management styles and marketing skills directed to serve users with a more consumer-oriented approach, and better investment decisions.

However, in many cases, these investment decisions might also imply under investment or capacity reductions, which mandates the presence of a regulatory environment. It is necessary to remind, that the main result of the success business and profits still depends also on the factors coming out from history (the old roads connecting Asia and Europe, old colonies), market demands, airport facilities, atractivity of destinations and many various economic and nature inputs.

For example Deutsche Lufthansa AG is an aviation company with operations worldwide. The Lufthansa Group operates in five business segments: scheduled passenger air traffic (Passenger Airline Group) through Deutsche Lufthansa AG, Lufthansa CityLine GmbH, Swiss International Airlines AG, Austrian Airlines AG, British Midland Ltd., Air Dolomiti S.p.A., Eurowings Luftverkehrs AG and Germanwings GmbH; scheduled airfreight services (Logistics) through the Lufthansa Cargo group; maintenance, repair and overhaul (MRO) through the Lufthansa Technik group; information technology (IT Services) through the Lufthansa Systems group, and catering (Catering) through the LSG Lufthansa Sky Chefs group. In September 2009, Austrian Airlines AG was taken over by Deutsche Lufthansa AG. In July 2009, it acquired 45 % of the parent company of Brussels Airlines, SN Airholding SA/NV Deutsche Lufthansa is an interesting company, formerly controled by government created more entrepreneurial opportunities. Lufthansa was totaly privatisated in 1997.

3. RISKS AND NEGATIVES OF AIRLINES PRIVATISATION

Regardless of all its potential benefits, privatisation also involves risks and requires prudent management from the public authorities. Several policy issues have not to be contemplated by the governments if the public interest needs to be safeguarded as much as they are for airports.

The end of activity or start-up of well-profiting airlines has not so serious impact to the region if there are more of them.

Aviation is a high-investment industry. To start an airline requires the purchase of planes, access to domestic and international booking systems, links with travel agencies as well as catering and service subsidiaries, and all-important access to terminal space at airports. It simply doesn't make sense to duplicate this infrastructure several times over.

The privatisation of government airlines went hand-in-glove with the deregulation of the industry. This was justified by the argument that "free" competition would lower prices and give customers more choice.

What goes hand in hand together with airlines but more dificult are significant and similar changes at the airports during the period of last 30 years. For example, the eventual externality, negative or positive effect imposed by airport users over non-users or other users, generated by the provision of airport services or strengthened market position gained by the airport operator after privatisation should be carefully considered. In

this respect, a regulatory regime (in terms of charges, safety, quality, and noise intensity or spatial planning) should be designed before privatisation takes place and the regulatory role ought to be delegated to an independent body. The main diferent is that the airspace is relatively "free" area, mainly over the oceans and seas.

The start of the process of deregulating domestic air travel and privatising government-owned airlines caused that the safety standards have fallen, services to regional areas were in crisis, airline workers who still had jobs were putting up with worse wages and conditions and air services had deteriorated. Some airlines on the other hand in last years went belly up.

In the southern hemisphere of the globe was an example in Australia where they collapsed as Ansett after its 66 years of operating and have resulted in the largest mass sacking in Australia's history. Of Ansett's 14,000 workers, just 3000 were likely to be employed by Virgin Blue or Qantas. For the workers who were lucky enough to be re-employed, things were not the same. While 98 % of Ansett workers were in a union, less than 10% of Virgin Blue workers were, and Virgin Blue spent 40 % less than Qantas did on wages, conditions and training. Qantas was arguing that it "must" reduce workers' wages and conditions in order to "survive". Qantas and Australian Airlines (formerly Trans-Australian Airlines) were fully government-owned from 1947 to 1993. During that time, Qantas maintained the best safety record in the world and one of the world's best track records for being on time. With a fully unionised work force, workers had a secure, reasonable wage.

The Australian aviation industry has excess capacity. Flying many half-empty planes, all competing with each other, makes no environmental or economic sense. Nobody is going to invest in building more terminals at Sydney airport when, because local communities refuse to allow their lives to be further disrupted by aircraft noise, there are hourly limits on aircraft movements and planes cannot take off or land 24 hours a day.

Regional and rural areas have been worst hit by the airline industry's crisis. The airline industry crisis was a direct consequence of two decisions by federal Labor governments in the 1990s: to privatise Qantas and Australian Airlines, and de-regulate the pricing structure and government control over new entrants.

The debate over selling Qantas began in earnest in 1990, when Prime Minister of Australia announced the government's intention to sell 49 % of the airline.

The proposed privatisation was very unpopular with working people. Federal cabinet attempted to shut dissidents up by arguing that the government couldn't afford to purchase new planes and carry out necessary safety re-fits. The cost, the government argued, would be upwards of $2 billion to keep Qantas "competitive". The government painted Qantas as a debt-ridden liability — likely to collapse in the face of fierce international competition.

Despite this, the government allowed Qantas to purchase Australian Airlines in 1992 for $400 million, integrating domestic and international services.

In 1993, the government quietly injected $1.35 billion into Qantas, just one month before it sold 25 % of the airline to British Airways for $665 million. Qantas held a 40 % market share of international travel to and from Australia. The remaining 75 % of the airline was sold in a public float in 1995. The total sale price for the airline was just $2.1 billion.

Shortly after privatisation, Qantas launched a war on its workers, extending outsourcing

and competitive tendering to every aspect of its business. As a result, staff conditions were undermined. In a 1997 submission to a Senate committee, Qantas argued that its priority since privatisation was "productivity increases", which it had successfully achieved "by increasing the direct communication between the company and staff".

Far from acknowledging the sale was underpriced, the ALP declared it a huge success, because of the number of small shareholders that had profited in the first few days after the sale. It was left to anti-privatisation advocates to point out that Qantas shareholders' profits came straight out of the pockets of millions of Australians.

Qantas was planning to outsource maintenance work to overseas contractors as a cost-cutting measure. The Australian Manufacturing Workers Union claimed lowering of safety standards. Although Qantas denies that safety standards have slipped, a Qantas 747 in 1999 overshot a runway in Bangkok. This was Qantas' most serious accident since 1947. In April 2000, the undercarriage of a 747 collapsed at Rome airport.

Since deregulation, safety standards have been monitored by the Civil Aviation Safety Authority. CASA has been the subject of numerous complaints. In March 2001, a leaked internal CASA report found that CASA was not upholding safety laws.

Customers today are enjoying historically low prices. In the year 1945 a return airfare between Sydney and London took an average worker around 130 weeks to earn. In 1965, it took around 21 weeks. Until recently, a return ticket to Sydney London costs approximately two weeks pay for the average worker. Perhaps it is even lower, but how long that will last time will tell.

4. CONCLUSION

It is very clear that the 2011 financial year and coming future will be hard for private airlines. Competition in the world and mainly in Europe and on long-haul routes is getting tougher, especially on routes between Europe, US, Asia and Africa. The air traffic tax unpleasant raising in 2011 in some countries like in Germany and others in Europe is also the fact what will not help to airlines and their customers as well. The cost of aviation fuel is rising again to record heights. At the same time, political unrest, terrorist attacks, wars and environmental catastrophes like Island 2011 and Japan 2011 represent additional risks for private airlines. They must do nevertheless everything they can to keep above the water, so that all airlines can continue to grow sustainably and in order to retain the trust of their customers in the future.

Competition in the airlines may take the form of dramatic price cuts, but no corporation is prepared to lose profits. Instead, the leaders of airlines attempt to cut costs by slashing workers' wages and conditions, increasing the number of occupied seats per flight, cutting corners on maintenance and sacking workers.

A more rational system for a publicly owned and run airlines which has to use profitable routes to subsidise regional services, reduce environmental destruction and noise. At the end but still on the first place and most important is safety, it must ensure that high air safety standards are maintained.

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THE DEVELOPING MILITARY ROBOTICS

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Abstract: *Robots are widely used tools in remote sensing, and other fields. Based on theirs abilities robots are able to carry on tasks unbelievable fir human beings. Main problem proposed for solution by the author is to solve problems of automation of the flight of the UAV systems. In many air robot applications there is a need from the users to automatize flight of the aircraft increasing flight safety, and, quality of the control of the UAV systems. From among those available air robots this article deals with quadrotors. The closed loop control systems of the UAV being investigated is control of the vertical position of the UAV. The vertical motion will be controlled with LQR controller so as to provide flying and handling quality of the UAV.*

Keywords: *military robots, recce surface robots, air robot systems, CAD.*

1. INTRODUCTION

There is no doubt that number of robots designed by state-of-the technologies used for both military and non-military purposes is significantly increasing. Fields of possible applications of the robots and robot systems are as follows: investigation of the climate changes; air reconnaissance of flooding; elimination of consequences of the disasters; industrial catastrophes and theirs control; urban security applications; urban control of traffic of public transport; surface recce missions using ground robots; underwater applications; recce of dangerous areas; recce about safety and security items; solution of problems of defense of the critical infrastructure. Main purpose of the author is to design an optimal controller for the UAV being controlled along its vertical axes, i.e. vertical motion is controlled.

2. LITERATURE REVIEW

Mathematical models of the dynamical systems are outlined in [2,3,4,10]. They deal with analysis and design problems. Theoretical backgrounds of the automatic flight control systems are in [8], providing large scale of aircraft models, and giving examples for optimal control of aircraft. UAV systems are investigated in [1,5,6,12,13,]: there are many analysis and design examples applied to present latest results of robotics, mechatronics, and, sensorics. In [14] dynamic performances are summarized, and used in this paper. In [9] dynamic performances and stability analysis is shown for micro UAV: a complex task is made for deriving dynamical model of micro rotating UAV. Pokorádi in [11] deals with deterministic signals applied in control system analysis. Computer-aided design and analysis is supported by computer package MATLAB [3, 7].

3. DYNAMIC MODEL OF THE QUADRTOTORS

The quadrotor dynamics may be analyzed using Figure 1. [1,5,6,9,12,13]. Maneuvering along vertical axis is a common task, e.g. change height of the flight from the initial hovering position. The coordinate system **I** represent the system of inertia, the body-axis system centre is fixed in point **B**.

The rate of changes of the Euler-angles in the body-axis system may be derived as [12]:

$$\left[\dot{\varphi} \quad \dot{\theta} \quad \dot{\psi}\right]^T = \mathbf{M}^{-1}\left[\omega_{x_i} \quad \omega_{y_i} \quad \omega_{z_i}\right]^T = \mathbf{M}^{-1}\mathbf{A}\left[\omega_{x_b} \quad \omega_{y_b} \quad \omega_{z_b}\right]^T, \quad (3.1)$$

where: ϕ is bank angle; θ pitch angle; ψ yaw angle; ω_{x_i} angular rates of changes in the inertia system **I**, ω_{x_b} are angular rates of changes in the body-axis coordinate system. It is well-known that rotational matrices between two coordinate systems given above are as follows [12]:

$$\mathbf{M} = \begin{bmatrix} \frac{c\psi}{c\theta} & \frac{s\psi}{c\theta} & 0 \\ -s\psi & c\psi & 0 \\ 0 & 0 & 1 \end{bmatrix};$$

$$\mathbf{A} = \begin{bmatrix} c\psi c\theta & c\psi s\theta s\phi - s\psi c\phi & c\psi s\theta c\phi - s\psi s\phi \\ s\psi c\theta & s\psi s\theta s\phi + c\psi c\phi & s\psi s\theta c\phi - c\psi s\phi \\ -s\theta & c\theta s\phi & c\theta c\phi \end{bmatrix},$$

where: c – cos, s – sin.

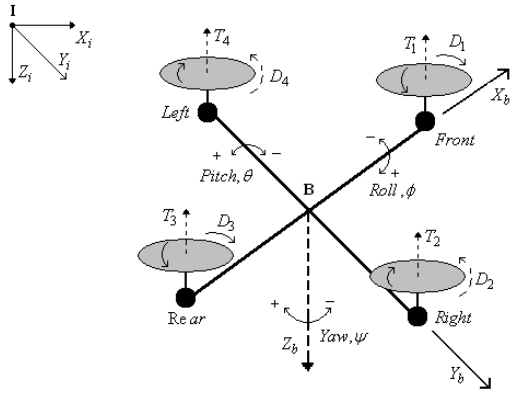

Figure 1. Quadrotor dynamics and kinematics.

For further investigations we will consider dynamics of the quadrotor in the body axis system, the following matrix equation must be defined:

$$\begin{bmatrix} \dot{x}_b & \dot{y}_b & \dot{z}_b \end{bmatrix}^T = \mathbf{A}^{-1} \begin{bmatrix} \dot{x}_i & \dot{y}_i & \dot{z}_i \end{bmatrix}^T, \quad (3.2)$$

where x_b, y_b, z_b are coordinates in the body-axis coordinate system, and x_i, y_i, z_i are the coordinates measured in the inertia system.

3.1 Equations of motion of the translational motion of the quadrotor. It is assumed that quadrotor has rigid and symmetric airframe and we will consider it with its mass concentrated in point B (see Figure 1.). Quadrotor owns rigid rotor blades, and finally, there is considered only motion along vertical axis of body-axis coordinate system Z_b.

The lift force generated by the i^{th} rotor blades is proportional to its squared rotational speed, i.e. we have [5, 12]:

$$T_i = C_1 \left(\frac{1 - 2\pi LCS}{P\alpha_i} + 2\pi \frac{\dot{z}_b - w_{z_b}}{P\alpha_i} \right), \quad (3.3)$$

where: $C_1 = k_t \rho A_p \alpha_i^2 R_p^2$; k_t is aerodynamic coefficient; ρ is air density; A_p is resulting area of the rotor blades; α_i is angular speed of the i^{th} rotor blades; R_p is radius of the rotor blades; L is a distance measured between centre point of the blades and point **B**; P is a setting angle of the rotor blades; w_{z_b} is a component vector of the atmospheric turbulence projected to vertical axis. It is obvious that: C=1, if i=1, or i=4; C= –1, if i=2, or i=3; $S = \omega_{y_b}$, if i=1, or i=3; $S = \omega_{x_b}$, if i=2, or i=4 [5,6,12].

The resulting force acting along longitudinal axis of the quadrotor may be derived as:

$$\mathbf{F}_{wI} = \mathbf{A}\begin{bmatrix} k_s(w_{x_b} - \dot{x}_b) & k_s(w_{y_b} - \dot{y}_b) & k_u(w_{z_b} - z_b) \end{bmatrix}^T, \quad (3.4)$$

where: k_s, k_u friction coefficients; w_{x_b} and w_{y_b} are components of the speed of the turbulent air along axis x–, and y–, respectively.

The quadrotor translational motion state equation may be derived as follows below:

$$\begin{bmatrix} \ddot{x}_i \\ \ddot{y}_i \\ \ddot{z}_i \end{bmatrix} = -\begin{bmatrix} \omega_{x_b} \\ \omega_{y_b} \\ \omega_{z_b} \end{bmatrix} \times \begin{bmatrix} \dot{x}_i \\ \dot{y}_i \\ \dot{z}_i \end{bmatrix} + \mathbf{g}\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} + \frac{F_{wI}}{m} - \frac{T_1 + T_2 + T_3 + T_4}{m} \mathbf{A} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, \quad (3.5)$$

where $\boldsymbol{g}$ is the gravitational acceleration and m is the mass of the UAV being investigated.

3.2 Equations of motion of the rotational motion of the quadrotor. It is well-known that drag moment of the rotor blades due to its rotational motion is proportional to the speed of its revolution, i.e. one can derive that:

$$D_i = C_2 \left(\frac{1 - 2\pi LCS}{P\alpha_i} + 2\pi \frac{\dot{z}_b - w_{z_b}}{P\alpha_i} \right), \quad (3.6)$$

where: $C_2 = k_d \rho A_p \alpha_i^2 R_p^3$; k_d is the moment

coefficient. The resulting reaction moment of the rotor blades may be derived using following equation:

$$I_{ct} = J_p\left(-\dot{\alpha}_1 + \dot{\alpha}_2 - \dot{\alpha}_3 + \dot{\alpha}_4\right), \quad (3.7)$$

where J_p is the moment of inertia of a single rotor blade.

The friction drag moment may be derived as follows below:

$$\mathbf{M}_f = k_r\left[\dot{\phi} \quad \dot{\theta} \quad \dot{\psi}\right]^T, \quad (3.8)$$

where: k_r is a friction coefficient. The resulting disturbances (e.g. gust) related to DC-motor rotors may be found using following formula [16]:

$$\tau_d = \left[\tau_{x_b} \quad \tau_{y_b} \quad \tau_{z_b}\right]^T. \quad (3.9)$$

The gyroscopic moment may be derived as:

$$\mathbf{M}_g = J_p\left[\dot{\theta}\alpha \quad \dot{\phi}\alpha \quad 0\right]^T, \quad (3.10)$$

where: $\alpha = -\alpha_1 + \alpha_2 - \alpha_3 + \alpha_4$.

Finally, using equations defined above, the state equation of the quadrotors spatial rotational motion may be derived as [5,6,12]:

$$\begin{bmatrix}\dot{\omega}_{x_b}\\ \dot{\omega}_{y_b}\\ \dot{\omega}_{z_b}\end{bmatrix} = -J^{-1}\omega \times J\begin{bmatrix}\omega_{x_b}\\ \omega_{y_b}\\ \omega_{z_b}\end{bmatrix} - J^{-1}\left(\mathbf{M}_f + \tau_d + \mathbf{M}_g\right) + \quad (3.11)$$
$$+J^{-1}\begin{bmatrix}L(T_4 - T_2)\\ L(T_1 - T_3)\\ D_1 - D_2 + D_3 - D_4 + I_{ct}\end{bmatrix}$$

where: $\omega = \begin{bmatrix}0 & -\omega_{z_b} & \omega_{y_b}\\ \omega_{z_b} & 0 & -\omega_{x_b}\\ -\omega_{y_b} & \omega_{x_b} & 0\end{bmatrix}$, $J = \begin{bmatrix}J_{xx} & 0 & 0\\ 0 & J_{yy} & 0\\ 0 & 0 & J_{zz}\end{bmatrix}$

is a main matrix of inertia; J_{xx}, J_{yy}, J_{zz} are moments of inertia related to axes X_b, Y_b, and Z_b, respectively.

3.3 Dynamics of the quadrotor DC-motor. DC motors (mainly brushless ones) are widely applied in propulsion systems of quadrotors. So, theirs equation – for small inductances – may be derived as [5,6,12]:

$$J_p\dot{\alpha}_i = G\tau_{m_i} - D_i, \quad (3.12)$$

where $\tau_{m_i} = \dfrac{k_i(V_i - \dfrac{k_v\alpha_i}{G})}{R}$ is the motor moment; k_i is a motor constant; k_v is a motor constant for rotation speed; V_i is a motor control voltage; R is a motor resistance; G is a constant transmission gain of the system "motor-rotor blade".

Let us find dynamics of the quadrotor in motion along vertical axis, for the initial conditions defined as:

$$\theta = 0^o; \phi = 0^o; \psi = 0^o; v_{x_{b_o}} = 0m/s; \quad (3.13)$$
$$y_{b_o} = 0m/s; v_{z_{b_o}} = 0m/s$$

Using equations (3.1)–(3.5), and considering initial conditions of (3.13) translational motion of the quadrotor along vertical axis may be derived as:

$$\ddot{z}_b = \frac{F_{mI}}{m} - \frac{T_1 + T_2 + T_3 + T_4}{m} + g, \quad (3.14)$$

or, in other manner

$$\ddot{z}_b + \frac{\dot{z}_b}{m} = g - \frac{T_1 + T_2 + T_3 + T_4}{m} = g - \frac{4T}{m}, \quad (3.15)$$

Lift generated by rotor blades may be derived as:

$$T = C_1\left(\frac{1}{P\alpha_i} + 2\pi\frac{\dot{z}_b}{P\alpha_i}\right), \quad (3.16)$$

where: $C_1 = k_t\rho A_p\,\alpha_i^2 R_p^2 = 4{,}15872\cdot 10^{-6}\,\alpha_i^2$.

Let us substitute equation (3.16) into equation (3.15), it yields to:

$$\ddot{z}_b + \frac{\dot{z}_b}{m} = g - \frac{4T}{m} = g - \frac{4}{m}C_1\left(\frac{1}{P\alpha_i} + 2\pi\frac{\dot{z}_b}{P\alpha_i}\right), \quad (3.17)$$

and rearranging equation (3.17), one may write:

$$\ddot{z}_b + \frac{\dot{z}_b}{m} + \frac{4}{m}C_1 2\pi\frac{\dot{z}_b}{P\alpha_i} = g - \frac{4}{m}C_1\frac{1}{P\alpha_i}, \quad (3.18)$$

and, finally, doing some mathematical arrangements, we get following formula:

$$\ddot{z}_b + \dot{z}_b\left(\frac{1}{m} + \frac{4}{m}C_1 2\pi\frac{1}{P\alpha_i}\right) = g - \frac{4}{m}C_1\frac{1}{P\alpha_i}. \quad (3.19)$$

Using hypothetical quadrotor data given in [16] following equation of motion may be derived:

$$\ddot{z}_b + \dot{z}_b\left(0{,}222568 + 153{,}0451369\cdot 10^{-6}\alpha_i\right) = \\ = 9{,}81 - 24{,}35789\cdot 10^{-6}\alpha_i \quad (3.20)$$

Let speed of rotation of DC-motors be the following: $\alpha_{i_o} = 1000 rev/\min$. Thus, equation (3.20) may be rewritten in the following manner:

$$\dot{v}_b + v_b 153{,}2677049 = \\ = 9{,}81 - 24{,}35789\Delta\alpha_i. \quad (3.21)$$

Using equation (3.21) transfer function of the UAV may be derived as [12]:

$$Y(s) = \frac{v_b(s)}{\Delta\alpha_i(s)} = -\frac{24{,}35789}{153{,}2677049 + s}. \quad (3.22)$$

For further investigations UAV model was analyzed in time domain, and in frequency domain. Results of the computer simulation may be seen in Figure 2., and Figure 3 [3, 7].

From Figure 2 it is evident that reaction of the quadrotor is fast. The impulse response function is derives, that the open loop UAV is the stable one.

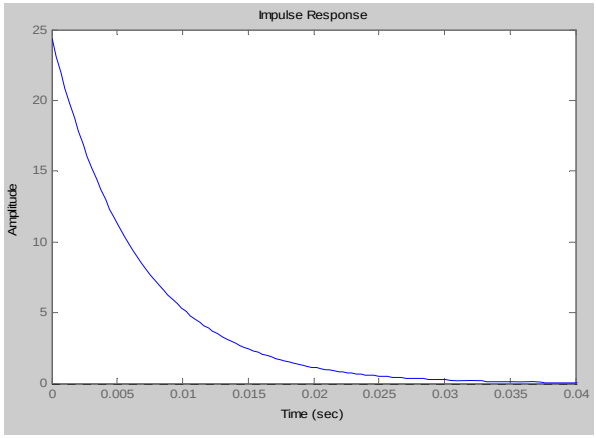

Figure 2a. Results of the Time Domain Transient Response.

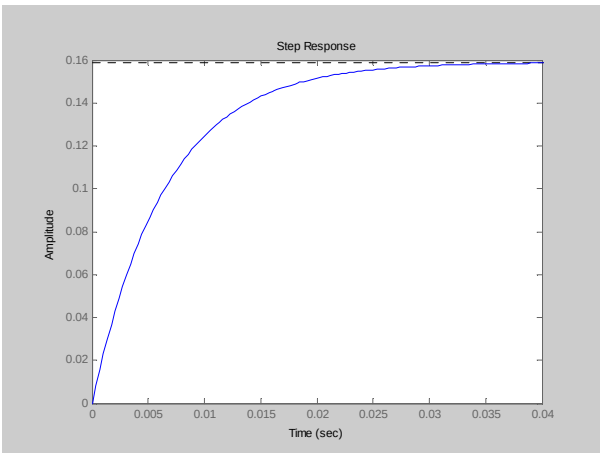

Figure 2b. Results of the Time Domain Transient Response.

Step response function shows that at the end of very fast response, the UAV will start to maneuver along vertical axis, and starts to ascend with constant speed of, say, approximately, 0,16 m/s. Step response function also predicts stable UAV behavior.

Figure 3. describes the frequency domain behavior of the UAV.

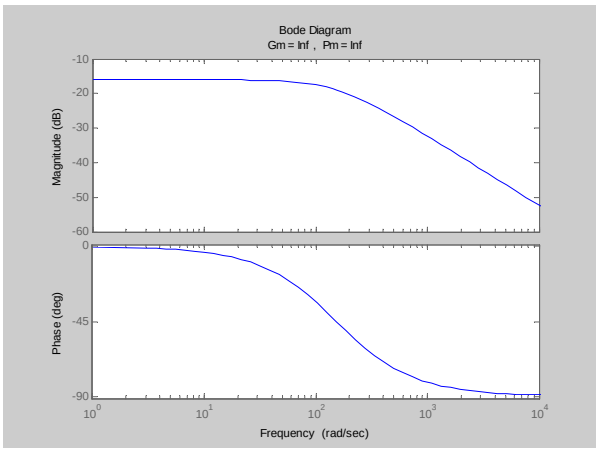

Figure 3. Bode Diagram of the UAV.

From Figure 3 it is evident that the quadrotor has low-pass behavior, in high frequency ranges it is cutting off signals.

4. LQ-BASED CONTROLLER SYNTHESIS FOR VERTICAL SPEED OF THE QUADROTOR

The linear, multi input, multi output (MIMO) system dynamics may be defined using state, and output equation given below [2, 4, 8, 12]:

$$\dot{\mathbf{x}} = \mathbf{Ax} + \mathbf{Bu}\,;\, \mathbf{y} = \mathbf{Cx} + \mathbf{Du}\,, \quad (4.1)$$

where x is state vector, **u** is the input vector, **y** is the output vector, **A** is the state matrix, **B** is the input matrix, **C** is the output matrix, and

finally, **D** is the direct feedforward matrix.

For MIMO control systems integral criteria to be minimized may be derived as [2, 4, 8]:

$$J = \frac{1}{2}\int_0^{\infty}\left(\mathbf{x}^{\mathrm{T}}\mathbf{Q}\,\mathbf{x} + \mathbf{u}^{\mathrm{T}}\mathbf{R}\,\mathbf{u}\right)dt \rightarrow \mathrm{Min}, \qquad (4.2)$$

where **Q** and **R** are positive semi-definite, and positive definite, diagonal weighting matrices, respectively.

The term $\mathbf{x}^{\mathrm{T}}\mathbf{Q}\,\mathbf{x}$ in equation (4.2) defines dynamic performances, while term $\mathbf{u}^{\mathrm{T}}\mathbf{R}\,\mathbf{u}$ describes costs. These terms are quadratic ones, because of following formulas:

$$\mathbf{x}^{\mathrm{T}}\mathbf{Q}\,\mathbf{x} = \begin{bmatrix} x_1 & \dots & x_n \end{bmatrix} \begin{bmatrix} q_1 & 0 & \dots & 0 & 0 \\ 0 & q_2 & \dots & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & \dots & q_{n-1} & 0 \\ 0 & 0 & \dots & 0 & q_n \end{bmatrix} \begin{bmatrix} x_1 \\ \dots \\ \dots \\ x_n \end{bmatrix} = \qquad (4.3)$$

$$= \begin{bmatrix} x_1 & \dots & x_n \end{bmatrix} \begin{bmatrix} q_1 x_1 \\ \dots \\ q_n x_n \end{bmatrix} = \sum_{i=1}^{n} q_i\, x_i^2(t)$$

and

$$\mathbf{u}^{\mathrm{T}}\mathbf{R}\,\mathbf{u} = \begin{bmatrix} u_1 & \dots & u_n \end{bmatrix} \begin{bmatrix} r_1 & 0 & \dots & 0 & 0 \\ 0 & r_2 & \dots & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & \dots & r_{n-1} & 0 \\ 0 & 0 & \dots & 0 & r_n \end{bmatrix} \begin{bmatrix} u_1 \\ \dots \\ \dots \\ u_n \end{bmatrix} = \qquad (4.4)$$

$$= \begin{bmatrix} u_1 & \dots & u_n \end{bmatrix} \begin{bmatrix} r_1 u_1 \\ \dots \\ \dots \\ r_n u_n \end{bmatrix} = \sum_{j=1}^{n} r_j\, u_j^2(t)$$

Using equations (4.3) and (4.4) it is easy to be seen that integral performance criteria minimizes integrals from squared functions of those $x_i^2(t)$ and $u_j^2(t)$.

4.1 The algebraic Ricatti equation (ARE). It is supposed that state equation of the dynamic system is given as follows:

$$\dot{\mathbf{x}} = \mathbf{A}\,\mathbf{x} + \mathbf{B}\ . \qquad (4.5)$$

The optimal control law is given as

$$\mathbf{u}^{\mathbf{o}}(t) = -\mathbf{K}\,\mathbf{x}(t), \qquad (4.6)$$

which minimizes integral criterion (4.2). The optimal control is solved for any initial condition of $\mathbf{x}(0)$, if static feedback gain matrix **K** is derived. Block diagram of the optimal control system is given in Figure 4. Let reference the signal be zero value one, i.e. $x_r(t) = 0$.

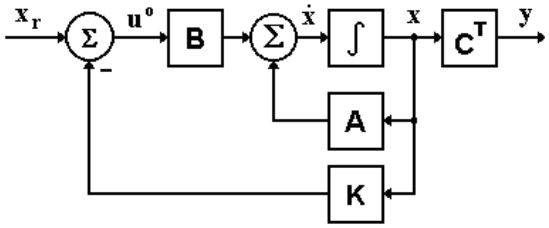

Figure 4. Block Diagram of the Optimal Control System.

Substituting equation (4.6) into equation (4.5) results in the following formula

$$\dot{\mathbf{x}} = \mathbf{A}\mathbf{x} - \mathbf{B}\mathbf{K}\mathbf{x} = (\mathbf{A} - \mathbf{B}\mathbf{K})\mathbf{x}\ . \qquad (4.7)$$

Supposing that matrix $(\mathbf{A} - \mathbf{B}\mathbf{K})$ has eigenvalues with negative real parts. Substituting equation (4.7) into equation (4.2) yields to:

$$J = \frac{1}{2}\int_0^{\infty}(\mathbf{x}^{\mathrm{T}}\mathbf{Q}\mathbf{x} + \mathbf{x}^{\mathrm{T}}\mathbf{K}^{\mathrm{T}}\mathbf{R}\mathbf{K}\mathbf{x})\,\mathrm{d}t = \qquad (4.8)$$

$$= \frac{1}{2}\int_0^{\infty}\mathbf{x}^{\mathrm{T}}(\mathbf{Q} + \mathbf{K}^{\mathrm{T}}\mathbf{R}\mathbf{K})\mathbf{x}\,\mathrm{d}t \rightarrow \mathrm{Min}$$

For minimization of the integral performance criterion (4.2) we will use second method of Ljapounov. It is supposed that for any state vector exists a positive definite Hermite-matrix, **P**, so that take place $\mathbf{P} = \mathbf{P}^{\mathrm{T}}$. For this particular case takes place following condition:

$$\mathbf{x}^{\mathrm{T}}(\mathbf{Q} + \mathbf{K}^{\mathrm{T}}\mathbf{R}\mathbf{K})\mathbf{x} = -\frac{\mathrm{d}}{\mathrm{d}t}(\mathbf{x}^{\mathrm{T}}\mathbf{P}\mathbf{x})\,. \qquad (4.9)$$

Taking derivative of matrix $\mathbf{x}^{\mathrm{T}}\mathbf{P}\,\mathbf{x}$, and considering equation (4.9) results in:

$$\mathbf{x}^{\mathrm{T}}(\mathbf{Q} + \mathbf{K}^{\mathrm{T}}\mathbf{R}\mathbf{K})\mathbf{x} = -\,\mathbf{x}^{\mathrm{T}}\mathbf{P}\mathbf{x} - \mathbf{x}^{\mathrm{T}}\mathbf{P}\mathbf{x} = \qquad (4.10)$$

$$= -\,\mathbf{x}^{\mathrm{T}}\left[(\mathbf{A} - \mathbf{B}\mathbf{K})^{\mathrm{T}}\mathbf{P} + \mathbf{P}(\mathbf{A} - \mathbf{B}\mathbf{K})\right]\mathbf{x}$$

Using second method of, if matrix $(\mathbf{A}-\mathbf{BK})$ has eigenvalues with negative real parts, than for positive definite matrix $\mathbf{Q}+\mathbf{K}^{\mathrm{T}}\mathbf{RK}$ exists positive definite matrix **P**, such that takes place following equation:

$$(\mathbf{A}-\mathbf{BK})^{\mathbf{T}}\mathbf{P}+\mathbf{P}(\mathbf{A}-\mathbf{BK})=-(\mathbf{Q}+\mathbf{K}^{\mathbf{T}}\mathbf{RK}) \quad (4.11)$$

Equation (4.11) is known as Ljapounov equation. The integral performance index may be derived as:

$$J=\frac{1}{2}\int_{\mathbf{0}}^{\infty}\mathbf{x}^{\mathrm{T}}(\mathbf{Q}+\mathbf{K}^{\mathrm{T}}\mathbf{RK})\mathbf{x}\,\mathrm{dt}=-\left[\mathbf{x}^{\mathrm{T}}\mathbf{Px}\right]_{\mathbf{0}}^{\infty}= \quad (4.12)$$

$$=-\mathbf{x}^{\mathrm{T}}(\infty)\mathbf{Px}(\infty)+\mathbf{x}^{\mathrm{T}}(0)\mathbf{Px}(0)$$

Supposing that all eigenvalues of matrix $\mathbf{A}-\mathbf{BK}$ have negative values, thus takes place that $\mathbf{x}(\infty)\to 0$. In this case equation (4.12) may be rewritten in the following manner:

$$\mathrm{J}=\mathbf{x}^{\mathbf{T}}(0)\mathbf{Px}(0). \quad (4.13)$$

From equation (4.13) it is easily may be seen that integral criteria (4.12) is a function of the initial conditions of **x**(0). It is known that weighting matrix **R** is positive definite, Hermite-matrix, i.e. takes places following equation:

$$\mathbf{R}=\mathbf{T}^{\mathbf{T}}\mathbf{T}, \quad (4.14)$$

where **T** is a non-singular (regular) matrix.

Considering equation (4.14) equation (4.11) may be rewritten as follows below:

$$(\mathbf{A}^{\mathrm{T}}-\mathbf{K}^{\mathrm{T}}\mathbf{B}^{\mathrm{T}})\mathbf{P}+\mathbf{P}(\mathbf{A}-\mathbf{BK})+ \quad (4.15)$$
$$+\mathbf{Q}+\mathbf{K}^{\mathrm{T}}\mathbf{T}^{\mathrm{T}}\mathbf{TK}=0$$

Rearranging equation (4.15) yields to the following formula:

$$\left(-\mathbf{K}^{\mathrm{T}}\mathbf{B}^{\mathrm{T}}\mathbf{P}-\mathbf{PBK}+\mathbf{K}^{\mathrm{T}}\mathbf{T}^{\mathrm{T}}\mathbf{TK}\right)+ \quad (4.16)$$
$$+\mathbf{Q}+\mathbf{A}^{\mathrm{T}}\mathbf{P}+\mathbf{PA}=0$$

It is known that $\mathbf{P}=\mathbf{P}^{\mathbf{T}}$, and $\mathbf{R}^{-1}=\mathbf{T}^{-1}(\mathbf{T}^{\mathbf{T}})^{-1}$, the term in brackets in equation (4.16), may be rewritten as follows:

$$\begin{aligned}&\mathbf{K}^{\mathrm{T}}\mathbf{T}^{\mathrm{T}}\mathbf{TK}-\mathbf{K}^{\mathrm{T}}\mathbf{B}^{\mathrm{T}}\mathbf{P}-\mathbf{PBK}=\\&=\mathbf{K}^{\mathrm{T}}\mathbf{T}^{\mathrm{T}}\mathbf{TK}-\mathbf{K}^{\mathrm{T}}\left[\mathbf{T}^{\mathrm{T}}\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\right]\mathbf{B}^{\mathrm{T}}\mathbf{P}-\mathbf{P}^{\mathrm{T}}\mathbf{BK}+\\&+\left(\mathbf{P}^{\mathrm{T}}-\mathbf{P}\right)\mathbf{BR}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}=\\&=\mathbf{K}^{\mathrm{T}}\mathbf{T}^{\mathrm{T}}\mathbf{TK}-\mathbf{K}^{\mathrm{T}}\mathbf{T}^{\mathrm{T}}\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}-\mathbf{P}^{\mathrm{T}}\mathbf{B}\left(\mathbf{T}^{-1}\mathbf{T}\right)\mathbf{K}+\\&+\mathbf{P}^{\mathrm{T}}\mathbf{B}\left[\mathbf{T}^{-1}\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\right]\mathbf{B}^{\mathrm{T}}\mathbf{P}-\mathbf{PBR}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}=\\&=\left[\mathbf{K}^{\mathrm{T}}\mathbf{T}^{\mathrm{T}}-\mathbf{P}^{\mathrm{T}}\mathbf{BT}^{-1}\right]\left[\mathbf{TK}-\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}\right]-\mathbf{PBR}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}=\\&=\left[\mathbf{TK}-\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}\right]^{\mathrm{T}}\left[\mathbf{TK}-\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}\right]-\mathbf{PBR}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}\end{aligned} \quad (4.17)$$

Thus, equation (4.16) may be derived as:

$$\begin{aligned}&\mathbf{A}^{\mathbf{T}}\mathbf{P}+\mathbf{PA}+\\&+\left[\mathbf{TK}-\left(\mathbf{T}^{\mathbf{T}}\right)^{-1}\mathbf{B}^{\mathbf{T}}\mathbf{P}\right]^{\mathbf{T}}\left[\mathbf{TK}-\left(\mathbf{T}^{\mathbf{T}}\right)^{-1}\mathbf{B}^{\mathbf{T}}\mathbf{P}\right]-\\&-\mathbf{PBR}^{-1}\mathbf{B}^{\mathbf{T}}\mathbf{P}+\mathbf{Q}=0\end{aligned} \quad (4.18)$$

Minimizing integral criteria (4.2), in other words, derivation of the optimal state feedback static gain matrix **K**, means mimization of the matrix product of

$$\mathbf{x}^{\mathrm{T}}\left[\mathbf{TK}-\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}\right]^{\mathrm{T}}\left[\mathbf{TK}-\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}\right]\mathbf{x}. \quad (4.19)$$

Since matrix defined by equation is a non-negative one, thus equation (4.18) takes a minimum if

$$\mathbf{TK}=\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}. \quad (4.20)$$

Let us find optimal static feedback gain matrix **K** from equation (4.20), thus we have:

$$\mathbf{K}^{\mathbf{o}}=\mathbf{T}^{-1}\left(\mathbf{T}^{\mathrm{T}}\right)^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}=\mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}. \quad (4.21)$$

The optimal control law is as follows below:

$$\mathbf{u}^{\mathbf{o}}(t)=-\mathbf{K}^{\mathbf{o}}\mathbf{x}(\mathrm{t})=-\mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{Px}(\mathrm{t}). \quad (4.22)$$

For derivation of matrix **P** there is often used method of algebraic Ricatti equation (ARE):

$$\mathbf{A}^{\mathrm{T}}\mathbf{P}+\mathbf{PA}-\mathbf{PBR}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}+\mathbf{Q}=0. \quad (4.23)$$

Solution of the LQR controller synthesis problem consists of following steps: using equation (4.23) positive definite cost matrix **P** must be derived; substituting matrix **P** into equation (4.22), what is optimal control law.

The optimal static feedback gain matrix **K** may be derived using MATLAB supplemented with Control System Toolbox. The built-in files of the proposed software may be used for solution of this problem are *lqr.m*, and *lqr2.m*.

4.2 Preliminary design of the Height Control System of the Quadrotor. Block diagram of the height control system of the UAV may be seen in Figure 5.

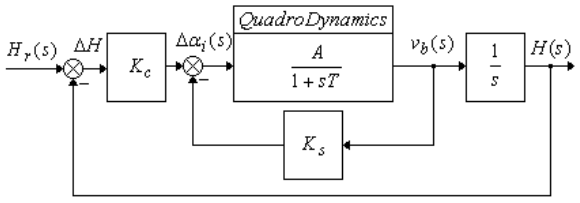

Figure 5. UAV Height Control System.

Using Figure 5. state equations of the UAV height control system of the quadrotor may be

derived as:

$$v_b(s)=\frac{A}{1+sT}\Delta\alpha_i(s)\rightarrow \rightarrow \dot{v}_b(t)=-\frac{v_b(t)}{T}+\frac{A}{T}\Delta\alpha_i(t) \quad , \tag{4.24}$$

$$H(s)=\frac{1}{s}v_b(s)\rightarrow \dot{H}(t)=v_b(t)\,, \tag{4.25}$$

or in matrix form:

$$\dot{\mathbf{x}}(t)=\begin{bmatrix}\dot{v}_b(t)\\ \dot{H}(t)\end{bmatrix}=\begin{bmatrix}-\frac{1}{T} & 0\\ 1 & 0\end{bmatrix}\begin{bmatrix}v_b(t)\\ H(t)\end{bmatrix}+\begin{bmatrix}A/T\\ 0\end{bmatrix}\Delta\alpha_i(t) \tag{4.26}$$

Results of the uncontrolled UAV transient response analysis may be seen in Figure 6.

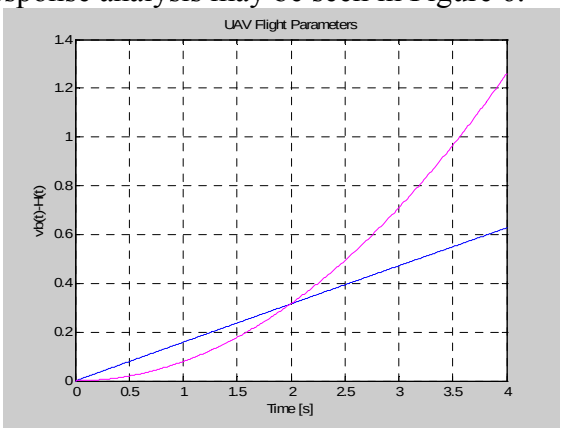

Figure 6. Uncontrolled UAV Step Responses
Vertical Speed Altitude

Control law of the closed loop control system may be found using Figure 5, and it is as follows below:

$$\mathbf{u}(t)=\Delta\alpha_i(t)=-H(t)K_c-v_b(t)K_s=-\mathbf{K}\mathbf{x}\,, \tag{4.27}$$

where: $\mathbf{x}=\begin{bmatrix}v_b & H\end{bmatrix}^T$ is the state vector, $\mathbf{K}=\begin{bmatrix}K_c & K_s\end{bmatrix}$ is the static feedback gain matrix.

Let find the optimal static feedback gain matrix, i.e. the optimal control law. For the first set of weighting matrices choose them by rule of unit weights, thus, we have:

$$\mathbf{Q}_1=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix};r_1=1\,. \tag{4.28}$$

In this case the static gain is as follows [3]:

$$\mathbf{K}_1=\begin{bmatrix}K_c & K_s\end{bmatrix}=\begin{bmatrix}3{,}6449 & 1\end{bmatrix}. \tag{4.29}$$

Results of the computer simulation of the closed loop control system for $H_r(t)=1(t)$ may be seen in Figure 7 [3, 7].

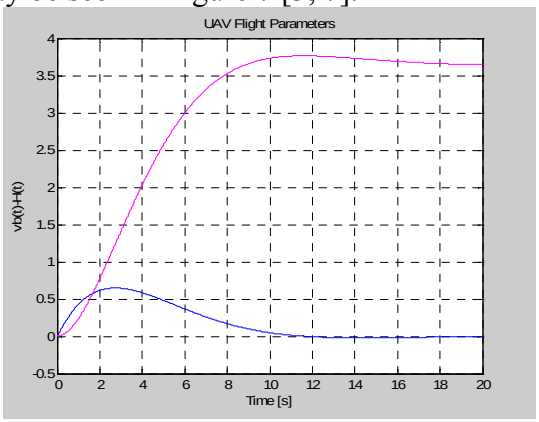

Figure 7. Controlled UAV Step Responses
Vertical Speed Altitude

Dynamic performances of the closed loop height control system designed by weights of (4.28) are as follows:

Eigenvalues	Damping ratio, ξ	Frequencies, [rad/s]
$-0{,}293\pm 0{,}27i$	0,735	0,399

From Figure 7 it may be seen that steady-state value of the height of the flight is $H(\infty)\approx 3{,}7m$, i.e. the reference signal yields to larger output from the system, and the closed loop control system dynamic performances are do not match those dynamic performances defined in [14]. However it is worth to mention that due to lack of complex set of dynamic performances for UAV automatic flight control systems, the standard [14] what is for aircraft piloted by human, was used instead. Let us change weighting matrices defined by equation (4.28) heuristically, to be as follows:

$$\mathbf{Q}_2=\begin{bmatrix}0{,}97 & 0\\ 0 & 1\end{bmatrix};r_2=0{,}000005\,. \tag{4.30}$$

Using weights (4.30) the static feedback gain matrix was found to be [3, 8]:

$$\mathbf{K}_2 = [K_c \quad K_s] = [446,7565 \quad 447,2136] . (4.31)$$

Results of the computer simulation of the closed loop control system for given weights of (4.30), and for given step function of $H_r(t) = 1(t)$, may be seen in Figure 8 [3, 7].

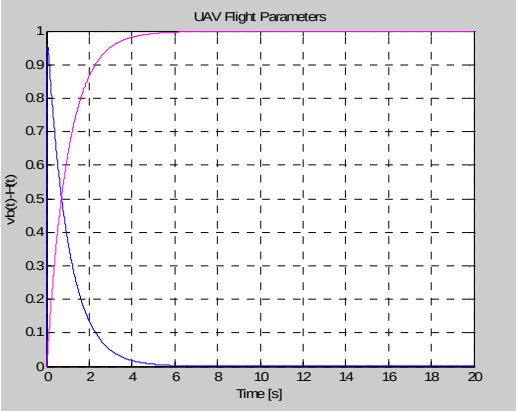

Figure 8. Controlled UAV Step Responses
Vertical Speed Altitude

Dynamic performances of the UAV closed loop height control system designed by weights of (4.30) are as follows:

Eigenvalues	Damping ratio, ξ	Frequencies, [rad/s]
-70	1	70
$-1,02$	1	1,02

From Figure 8. it may be seen that steady-state value of the height of the flight is $H(\infty) = 1m$.

In other words, the unit value reference input is followed with no static error, and the closed loop dynamic performances are those defined for aircraft as given in [14].

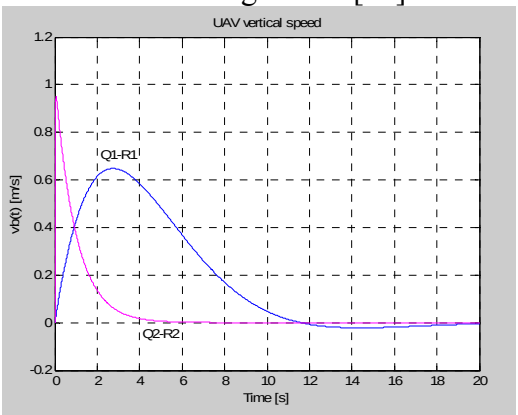

Figure 9-a. Controlled UAV Step Responses
Q1-R1 Q2-R2.

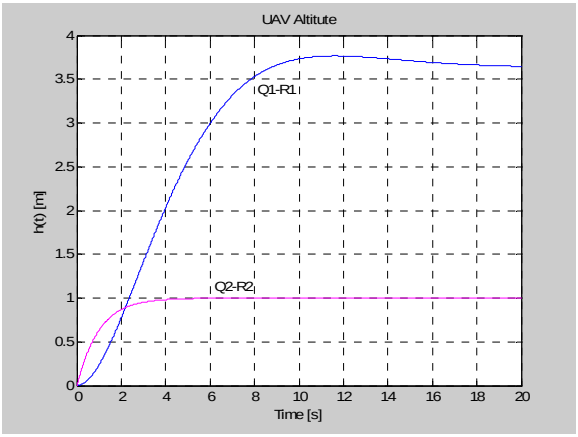

Figure 9-b. Controlled UAV Step Responses
Q1-R1 Q2-R2.

Results of the computer simulation of two designed systems for weights of (4.28), and (4.30), may be seen in Figure 9. From Figure 9. it is easily may be derived that heuristically set weighting matrices can derive namely that optimal control law, what will be able to provide dynamic performances of the closed loop altitude control system of the UAV [3, 7].

5. CONCLUSIONS

This paper deals with optimal control system design. The method propagated here is the LQR one, which is widely applied as preliminary design method for controller synthesis of UAVs.

The optimal control law synthesis is executed using heuristic setting of the weighting matrices in integral performance index. Dynamic performances were considered for those defined for piloted aircraft.

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HACCP - NEW TREND OF RISK MANAGEMENT IN AIR FORCE

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Abstract: *HACCP system can be considered as quality system that is used mainly in grocery industry and during food production. Its importance is constantly increasing and necessity of its implementation results from the law about food and Food code, when main goal is to secure optimal food production and minimizing of health risks. Presented article gives basic view about HACCP system, about way of its implementation in condition of catering establishment, about preparation of necessary documentation and about troubles that are connected with analyzing of various dangers as well as about costs that are necessary for program equipment of the service during establishing of HACCP system.*

Keywords: *hygiene safety, food quality, control points, risk.*

1. INTRODUCTION

System HACCP is implementated in various airports for example airport **Dalaman in Turkey** owns this system together with system of quality, environement and safety. In the airservices is this system HACCP necessary.

HACCP (hazard analysis and critical control points) means analysis of dangers and method of critical control points.

It is system that was developed during sixties in 20th century in USA for National aerial and cosmic agency (NASA) that needed to secure protection of every grocery and nutritional products before mechanical, toxic, chemical and physical contamination.

HACCP is a tool by which we recognize the risks connected with the production, storage, distribution and the preparation of food, beverages and seasonings and to which we define an inevitable measures to provide their hygienic safety and health harmlessness by usage of control points in which we can use the elements of management.

HACCP system is a more narrowly applied system of securing the quality of products and it is compatible with other systems, as e. g. quality system according to ISO 9001. [2]

The aim of HACCP is exclusively hygienic blamelessness and quality and health harmlessness of foods. Food producing enterprises aim to achieve a certificate for their system of quality and health harmlessness of foods. Food producing enterprises aiming to achieve a certificate for their system of quality according to ISO 9001 or ISO 9002, are bound to work out HACCP system for respective products, processes and phases of production simultaneously observing a certain progression of steps determining decisive points of this system. Introducing of some of the norms of ISO 9000 order need not necessarily mean that the quality system considered and solved with qualification all food security questions.

2. BASIC VIEW TO THE SYSTEM HACCP

From the Law about food and its amendments as well as according Food code of Slovakia it results commitment for every producers and persons, that manipulate with grocery or put grocery to the circulation, namely commitment to elaborate and establish to praxis „Proper production practice“ and „System for securing of grocery hygiene control HACCP“ with aim to secure optimalization for grocery, delicady and drinks production, for satisfying of nutrition need of human organism and for minimalization of health risks. [6] This system is usefull in all services on airport and in on board in airplane. It is world wide standard and it used air company for their services, that they offer in air halls. The main goal of this system is>

- to identify dangerous raw material and grocery from the view of alimental pathogens and toxic elements,
- to find if raw material and grocery are able to support reproduction of microbe,
- to identify possible sources of danger and place of contamination or input to the food chain,
- to state possibility, that microorganism in food will survive or will be reproduced during manipulation with grocery,
- o evaluate relevance and risk of danger as well as health relevance.[1]

HACCP can be used by any organization directly or indirectly involved in the food chain and pharmaceutical industry including:

- Farms, fisheries and dairies;
- Processors of meats, fish and feed;
- Manufacturers of bread and cereals, beverages, canned and frozen food ;
- Food service providers such as restaurants, fast food chains, hospitals and hotels and mobile caterers, catering company;
- Manufacturers of prescription and non-prescription drugs and remedies.

From the mentioned legislative it results responsibility for every businessman, institution and firm (business aviation) in area of grocery to make every neccessary measurements, by which he will be secured, that preparation, elaboration, production, packing, stocking, transport, distribution, manipulation and sale of the grocery, delicacy and drinks will be made by hygienic way. New system of production management due to the securing of healthy faultless products have to be elaborated of Food code of Slovakia „Principles of proper production practice“ and legislative of EU about grocery hygiene, that is internationaly marked as HACCP. In the business aviation is this support instrument useful for passangers in airplane and very important for food and drinks, that are consumed by board at air plane.

System contents following information:

- organizational scheme, with information about demands and responsibility of workers,
- hygienic regime and sanitary program, service plann with information about grocery flow,
- products and technological process description,
- analysis of possible risks and evaluation of their relevance,
- identification of critical control points,
- establishing of control system for risk handling in individual points,
- stating of corrective measurements and documentation establishing,
- stating of confirmation process and system verification. [1]

3. IMPORTANCE OF HACCP

Grocery contamination is very displeasing and it can have also mortal consequences. Contamination outbreak from grocery can damage business due to the loss of client confidence, that can lead to the loss of revenue, lawsuit and unemployment. Moreover legislative of Slovakia demands such system. Technical norm STN EN ISO 22 000 specify demands for management system of grocery safety, that is combination of generally recognized key elements for securing of grocery safety in whole grocery chain till the consumation, as for example: interactive communication, system

management, program for support and principles of HACCP.

Grocery safety is connected with risk presence in grocery during consumation. Since in every level of grocery chain the risk for grocery safety can raise, it is neccessary to apply sufficient control over it in whole grocery chain. Therefore grocery safety is secured by common afford of every concerned parties, participated in grocery chain. Such organizations of grocery chain are organizations from the point of feed producers and prime producers, through food producers, transport and stock service and subcontractor, till retail trade and catering establishment (including linking with organizations, as for example machines producers, stocking material, cleaning tools, supplementary elements and substances).

4. PROCESS DURING HACCP ESTABLISHING

1. **step: risk analyse,**
2. **step: stating of control points CP,**
3. **step: stating of critical limits,**
4. **step: stating of effective processes,**
5. **step:elaboration of corrective measurements,**
6. **step:stating of confirmation processes,**
7. **step: evidence, control and regular records actualization.**

HACCP consists from seven basic steps:

1. Risk analysis (to make team HACCP, description of output product, description of production process by the way of diagram, confirming of working place scheme, elaboration of risks list and control measurements). Description of product serves for risk analysis, as well as technological processes scheme and work of the HACCP team. [3]
2. Stating of critical points, in which it is possible to anticipate present risk in grocery, to remove it or to minimize it to the acceptable measure. Decision tree serves for deciding about the point in technological process, that is important from the view of product security and that is common control point.
3. Stating of critical limits in critical points. For every risk controlled in decision control point, that must be maintained with aim to risk anticipating, removing or minimizing to acceptable measure.
4. Stating of effective processes of following in critical control points (here there is stated, who will make it, when, and how often and by what way).
5. Elaboration of corrective measurements (by written way). It is stated corrective measurement for every discrepancy from critical limit with aim to prevent risk rising. At the same time there are stated also every necessary activities, that must responsible worker make and there is stated also the way of documentation for such activities.
6. Stating of confirmation processes, that HACCP system is working (audit, control of critical points, and control of measuring equipments).[5]
7. Elaboration of documents and records, that prove HACCP effectiveness – record about risk analysis, form of the HACCP plan, records from control points monitoring, records about performed corrective measurements, plan for HACCP checking and way of its recording.

HACCP is system that analyses risk and states measurements for its control by this way, that there will be secured safety and grocery health incorruptness. HACCP is orientated more to the prevention than to the

control of final product. HACCP is possible to apply in whole grocery chain from prime production to final consumption and its service can be influenced by scientific risk demonstration to the human health. Safety increasing and grocery health incorruptness and HACCP establishing can be very important convenience of the firms.

HACCP system it demands training of employees in the services, that are using HACCP for example catering service, restaurants, fast foods, air hall, buffets, coffee bars and other services. [5]

5. DOCUMENTATION OF HACCP SYSTEM

Direction of European Commission number 93/43/EEC about production hygiene for consumables is expressly stating what elaborated system should obtain. Documentation should obtain following records: [1]

- Service order;
- Determination of production activity and producer tasks;
- Construction of working team HACCP;
- Products description, meat and technological processes description;
- Construction of production process flow diagram;
- Construction of diagram during service;
- Analysis of possible risks danger and evaluation of their relevance;
- Control measurements;
- Stating of critical points (CP) ;
- Stating of critical points control (CCP) ;
- Stating of values for critical limits for every CP and CCP;
- Stating of corrective measurements for every CCP;
- Control system for risk handling at individual points;
- Stating of confirmation processes and system verification;
- Training of employees;
- Hygienic regime and sanitary program;
- Disposal solving for catering establishment with establishing of raw material flow and drawing of technological equipment;
- Service and sanitary program;
- Establishment of evidence and documentation .

Basic documentation for HACCP

1. Working processes.
2. Technics and technological processes.
3. Production process.
4. Norms for machines and equipments operating and reference to the technological equipment.
5. Hygienic regime.
6. Metrology program.
7. System project for control securing of grocery hygiene.
8. Other commands, directions and prescriptions according grocery producer decision.

Contribution of HACCP system for food producers:

- improving of transparency of food production process,
- systematic and regular work performance,
- gradual improvement in accord with clients demands,
- production control in area of prevention, that has influence to the production costs decreasing,
- rationalization of production working processes,
- increasing of food quality,
- increasing of employees work productivity.

Conveniences for food consumers:

- increasing of security during food consumption,
- higher protection before health and financial damages,

- higher level of satisfying of the consumers demands,
- lower risk for rising of the danger by contamination, infection etc.

6. CONCLUSION

HACCP has been used for testing of final products for confirming of food safety as preventive system of secure grocery production, that had universal application. Whole system had been built by this way, that it excluded or minimized risks to the maximal possible level, since such risks could cause infection, sickness or injuries. Today is HACCP system internationaly accepted system and it became international standard and tool for implementation of **System for food safety management according international norm ISO 22000.** HACCP is system, that it will be implementated in area of air force for business air, for airport hall, where are prepared food for passengers, on board in airplane. Its utilization in air force is wide-spectrum. This system is implementated in various airports for example airport **Dalaman in Turkey** owns this system together with system of quality, environement and safety. In the airservices is this system necessary. The main goal by implementation of this system HACCP is to create team of employees, that they are specific knowledges and skills for food processes. Team HACCP must to cooperate with experts of this system and to prepare records for implementation. Identification of potentially risks is very difficult process. Training of employess in the air services is important for system functioning. This system HACCP can bring some advatages for air company and their services, because the customers request quality and safety for foods today.

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6. DEVELOPMENTS IN THE FIELD OF UAS's

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THE COANDĂ VTOL-UAV AEROMECHANICAL ASPECTS

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Abstract. *The paper proposes a new concept of flight, including in the first phase of the flight, a vertical take-off, using the propulsion forces from an on-board rocket engine. The en-route phase of the flight, when moving horizontal, as the first part of the approach for landing, are conducted more similar with a rotary-wing flight. Also, the UAV sustentation comes from his aero dynamical shape. Especially designed to overcome the air resistance, the aerial vehicle has an appropriate design of the fuselage, which comply with a Coandă aerodynamic profile. Landing is assisted with the help of the same rocket engine, used for take-off. Up today, in our efforts to optimize the design of this VTOL-UAV, we made a first experimental model at a reduced scale. Moreover, aerodynamic researches have been conducted on it, in a wind tunnel, to enable optimal aerodynamic design of this new type UAV. Brief, the proposed aerial vehicle may be characterized as a mixture between a Coandă UAV and a reaction engine used only for vertical take-off and landing phase.*

Keywords: *rocket engine, Coandă fuselage, radial nozzle, flight vehicle.*

1. INTRODUCTION

The widespread aerial vehicles - planes to reach a destination point using the lift force that occurs on the wing's aerodynamic profile to the flow around them to high speed airflow. Flying an airplane consists of five distinct phases - the acceleration device runway, take-off, horizontal flight, lowering, braking on the runway. Addiction current speed lift force provided in the direction of increasing development of aviation and flight gear shift planes to jet propulsion. The result does not leave much to be expected - long runways, huge airports, catastrophic accidents, rescue systems, fuel consumption is high because the airplane propeller clock functions at all five phases of flight.

Another aircraft as well spread is helicopter; the lift force is created that all the aerodynamic profile of the blades flying in formation of eddy currents. Helicopter flight includes only three phases - takeoff, horizontal flight, helicopter descent. Increase flight speed is limited by resistance propeller blades at high speeds, motorization is excluded so reactive and propellers used. Fuel consumption is much higher compared with the plane, because the helicopter propeller works extensively in all the phases of flight, there are more catastrophic accidents. There are no rescue tool systems.

A new flight system used for travel aerospace are space ships "Columbia" (USA) and "Buran" (Russia), for multiple flights, includes four main phases: STOVL (Short Take-Off, Vertical Landing) with rocket launcher, ballistic flight path, aerodynamic brake, landing on a runway by aerodynamic braking (ship "Columbia") or by reaction engines (ship "Buran"). The advantage of the flight system, called "Shuttle" means the use of rocket pow-

ered propellers, with the period of active operation of the flight path only, use of air resistance for the landing, existing rescue systems. As a disadvantage we can consider a horizontal landing on a runway long and the impossibility of a "soft" vertical landing.

Nowadays there is a wide range of unmanned aircraft that rely on an airplane or on a helicopter scheme. These devices can provide tracking moving objects, environmental monitoring, fire and flood monitoring, tracking military personnel and groups of people, including visual tracking suspects and finding missing persons. Also the use of these unmanned devices requires favorable weather conditions similar to those required for flying airplanes or helicopters (wind speed, fog, visibility and lightning). The drawback of unmanned devices is impossibility to reach in the fast tracking speed and hang in the low speed tracking. All existing devices cannot be launched from underwater position; it cannot move in water and land on water.

To overcome the drawbacks outlined above are available to interested researchers for monitoring of ecosystem a vehicle that satisfies its sustentation and propulsion through an alternative based on the Coandă effect and reaction propulsion.

2. UNMANNED COANDĂ AIRCRAFT WITH REACTIVE PROPULSION

Below (Fig. 1) is a schematic diagram unmanned aircraft main propulsion Coandă reactive, which contains: Coandă fuselage (1), gas generator (4) which with a radial nozzle (2) forms the central rocket engine and four side rocket engines (3).

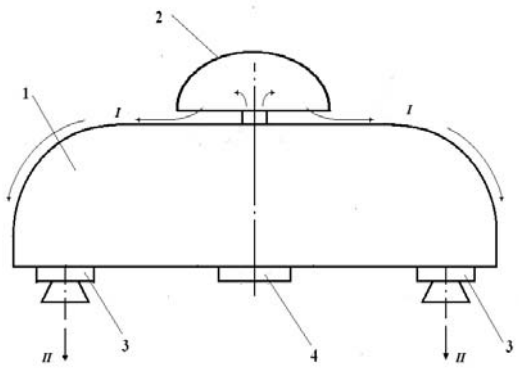

Fig. 1. Main scheme unmanned aircraft powered Coandă reactive: 1 - Coandă fuselage, 2 - radial nozzle, 3 - side rocket propellant, 4 - central rocket propellant; I - Central rocket thruster jet; II - lateral jet thruster rocket

Central rocket engine (4) produces gas that by nozzle radial (2) gets around a Coandă fuselage, causing the gas stream I. Because the supersonic Coandă jet *I*, creates a layer that significantly reduces the aerodynamic resistance of the fuselage. Supersonic jets *II* (Fig. 1) of the side rocket thrusters provide vertical take-off and guiding device on active flight path I (Fig.2). All these engines side decreases to zero speed landing providing soft landing of the last phase of flight (IV, fig. 2).

The main difference in the dynamics of the device Coandă jet flight unlike devices based on an airplane or helicopter is that movement in the horizontal direction occurs after inertial trajectory similar to ballistic missiles. The main purpose of the flight itself is done, horizontal displacement engines not started but to hang the device from the point of maximum altitude (3, fig.2) the free fall trajectory III, which may be with a different trajectory from the ballistic one.

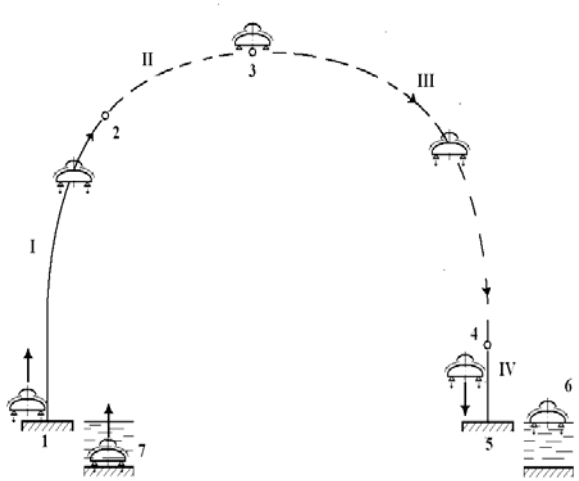

Fig. 2. Flight phases Coandă device with reactive propulsion: 1 - platform off; 2-point off the engine side; 4 - the point of maximum latitude; 5-landing platform; 6-landing on water; 7 - underwater home; I - active path; II, III - passive path; IV path braking.

Coandă jet device (Fig.1) is vertical launch and all engines starts or underwater position 7(fig. 2). Active path of the device is held up to the point 2, then engine side 3, stops. On passive path, device brakes due to aerodynamic shape and the Coandă effect. Reaching the point of landing 4, side engines are started providing a soft landing on the platform device 5, or on water surface 6 (fig. 2).

3. THE EXPERIMENTAL DEVICE COANDĂ JET

Experimental research conducted by most researchers [1,2] show that with increasing flow rate of radial nozzle, lift force developed by Coandă fuselage increased.

The Coandă device with radial convergent nozzle is shown in Fig. 3:

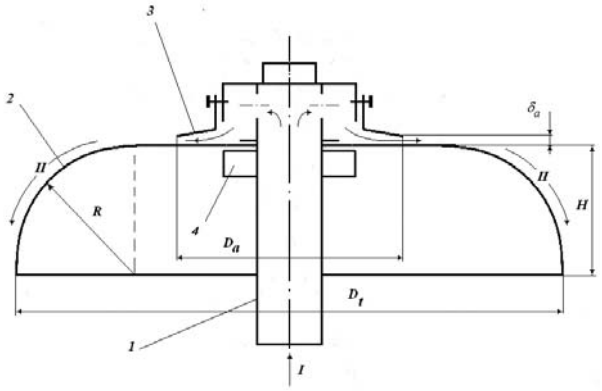

Fig.3. The Coandă device with convergent nozzle: 1-feeder; 2- Coandă fuselage; 3-convergent nozzle; 4-fixing nut; *I*-air intake; *II*-jet attachment; D_t , *H*-Coandă fuselage diameter and height; *R*-radius of curvature of the Coandă fuselage; D_a -radial nozzles diameter; δ_a- radial slot nozzle

The feeder 1 (fig. 3) is a central piece where the Coandă profile is fixed 2, with nut 4. Coandă fuselage radius *R*= 70 mm is equal to its height *H*. Nozzle 3 is screwed on top of base allowing slot nozzle size changes $\delta_a = 0.5 – 5.5$ mm. Nozzle position fix 3 is made with two diametrically located mounting screws. Compressed air tamp down by center channel base 1, and is targeted by the cross holes of the base in radial convergent nozzle 3, which accelerates and flows on being attached to the exterior profile of the plates 2, creating lift force in the axial direction.

Velocity converging gas nozzle ranges accordingly the supply pressure and the flow accordingly the slot and fixed diameter nozzle pressure.

Depending on the flow of gas in the convergent nozzle outlet section, being that subsonic (Mach number *Ma* <1) or transonic (Mach number *Ma* = 1).

In the subsonic regime speed gas flow nozzle is determined by applying Saint-Venant formula [1]:

$$\upsilon = \sqrt{\frac{2k}{k-1} \cdot \frac{P_0}{\rho_0} \left[1 - \left(\frac{P_{at}}{P_0} \right)^{\frac{k-1}{k}} \right]}, \ m/s \qquad (1)$$

where:

$p_0 = p + p_{atm}$ - absolute pressure supply, Pa

p- manometer pressure supply

p_{atm}- atmospheric pressure

$p_0 = \frac{p_0}{R \cdot T_0}$, kg/m^3 - density air supply

R=287 J/(kg ·K) - air gas constant

T=273.12+t_0,K - air temperature

$t_o{}^oC$ - air temperature

Air mass flow rate using the *Saint-Venant* formula for subsonic gas flow through holes and nozzles will be:

$$\dot{m} = \rho_0 \cdot \upsilon \cdot S, \text{ kg/s} \quad (2)$$

where:

S= S_a = π D_a δ_a, sectional area of exit, D_a, m– radial nozzles diameter; δ_a, m– radial nozzles slot.

If the total gas pressure p_0 is higher than pressure of the surroundings p_{at} in which flow occurs $\left(\frac{2}{k+1}\right)^{\frac{k}{k-1}}$ = 1.72 time, in the convergent nozzle exit section transonic flow regime is installed with *Mach* number M_a = 1,with critical thermodynamic parameters, then air mass flow is determined by the formula:

$$\dot{m} = \rho_{cr} \cdot a_{cr} \cdot S_{cr}, \text{kg/s} \quad (3)$$

where: ρ_{cr} and a_{cr} are the critical parameters determine by the initial parameters (P_0, ρ_0, T_0) and adiabatic exponent (k) of gas.

Critical velocity is given by:

$$\upsilon_{cr} = a_{cr} = \sqrt{\frac{P_0}{\rho_0} \cdot \frac{2k}{k+1}}, \text{ m/s} \quad (4)$$

Critical air density:

$$\rho_{cr} = \rho \cdot_0 \left(\frac{2}{k+1}\right)^{\frac{1}{k-1}}, \text{m/s} \quad (5)$$

Construction model provided 5 different diameters converging nozzles, with dimensions of respectively D_a = 70, 90, 130, 150 and 170 mm, with a D_t = 280 mm diameter Coandă fuselage that, consecutively, ensure changes ratio D_a/D_t =0.25; 0.32; 0.46; 0.54 and 0.61.

4. RESULTS AND DISCUSSION

Experimental tests conducted in the Laboratory of Aerodynamics the Department of Fluid Mechanics, Hydraulic and Pneumatic Machines and Drives, Technical University "Gheorghe Asachi" from Iasi, aimed at measuring the static pressure on the Coandă device experimental prototype of scale achieved. Since the capacity of the laboratory compressed air supply is up to 1.5 m^3/min, experimental tests were performed for flow of 25 l/sec being tested several configurations of exhaust air nozzles (nozzles 70, 90, 130, 150 and 170 mm). Airflow measurement is made with a diaphragm flow meter connected to a differential manometer measuring range 0÷1500 mm H_2O.

The fourteen static pressure plugs are located from 10 to 10 mm, from the neighborhood feeder and ending at the bottom of the Coandă fuselage of experimental prototype, small scale developed (Fig. 4)

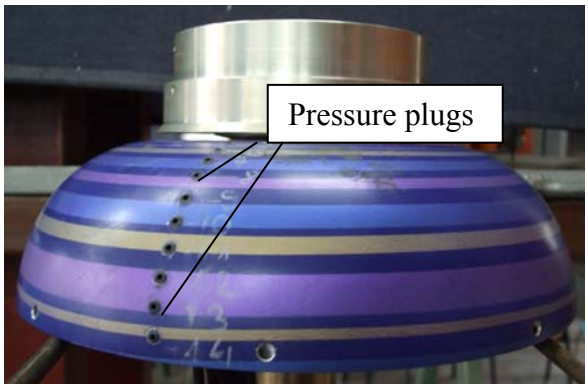

Fig. 4. Pressure plugs on the Coandă fuselage

The value of pressure drop measured on active element flow meter with diaphragm was Δp=1334 mm H_2O which corresponds to a rate Q= 25 l/s.

In terms of fluid flow attached to the main body of experimental prototype small-scale developed, has been noticed that large diameter discs (D_a=150 mm and D_a=170 mm) ensures conditions for the separation of fluid flow in the lower housing, while for smaller diameter discs separation is achieved in the maximum curvature of the case.

In Fig. 5 is presented the static pressure distribution compared for the six nozzle diameters considered, while three slot nozzle size, δ_a =1.5; 2.5 and 5.5 mm.

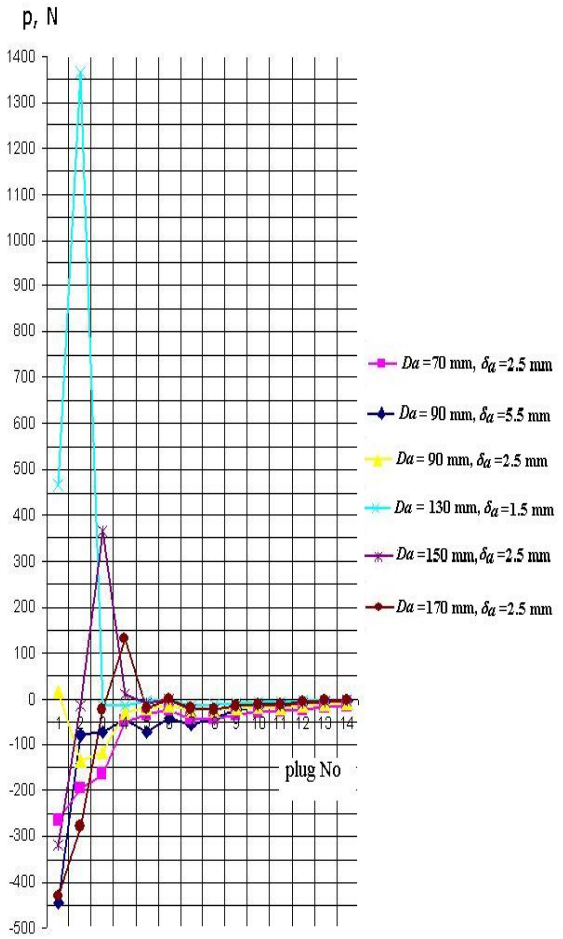

Fig. 5. Variation of static pressure on a generator of Coandă fuselage

There is a better behavior in terms of static pressure distribution, to nozzles with smaller diameters to large diameters D_a = 130, 150 and 170 mm. Radial flow separation occurs on the surface of Coandă fuselage.

Below Figures 6 and 7 are graphs that dependent lift forces R_z are shown determined by processing data [2], depending on nozzle diameter radial Da report to Coandă fuselage diameter D_t.

As shown in Figure 6, there is an optimal value for D_a/D_t where aerodynamic lift force maximum and namely is.

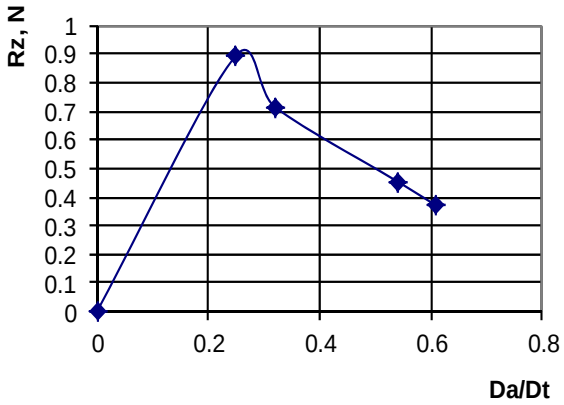

Fig.6. Aerodynamic lift force depending on the diameter ratio D_a / D_t (slot nozzle δ_a=2.5 mm)

With increasing flow velocity of the radial jet, also increases the aerodynamic lift force (Fig.7).

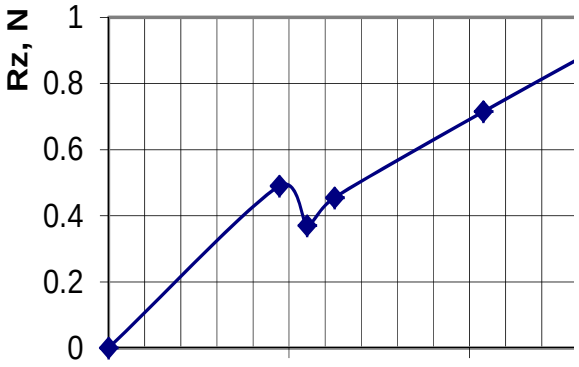

Fig.7. Aerodynamic lift force R_z depending on air velocity υ to the exit of radial nozzle

Data processing method of least squares allowed approximation equations for the dependence of aerodynamic lift force depending on the diameter ratio D_a/D_t and in speed according to radial jet flow:

$$R_Z = 19.767\left(\frac{D_a}{D_t}\right)^3 - 24.568\left(\frac{D_a}{D_t}\right)^2 + \\ +82.655\left(\frac{D_a}{D_t}\right) + 0.0036 \quad (6)$$

$$R_z = 0.0004 \cdot \upsilon^3 - 0.0092 \cdot \upsilon^2 + \\ + 0.1182 \cdot \upsilon + 0.0052 \quad (7)$$

Formulas 6 and 7 allow choosing the radial nozzle geometrical parameters:

D_a - radial nozzles diameter;

δ_a - radial nozzles slit.

In Tab.1 and Tab.2, are presented the experimental data collected from the dependence of aerodynamic lift force of diameter ratio D_a/D_t and speed υ.

Tab.1 Experimental data for the air velocity

Nozzle diameter D_a [mm]	Nozzle slot δ_a [mm]	Diameter ratio D_a / D_t	Velocity υ [m/s]
170	2.5	0.61	5.5
150	2.5	0.54	6.26
130	1.5	0.16	12.0
90	2.5	0.32	10.38
90	5.5	0.32	4.73
70	2.5	0.25	13.38

Tab.2 Experimental data for the lift force

Nozzle diameter D_a [mm]	Nozzle slot δ_a [mm]	Diameter ratio D_a / D_t	Lift force R_z [N]
170	2.5	0.61	0.370
150	2.5	0.54	0.455
130	1.5	0.16	0.705
90	2.5	0.32	0.715
90	5.5	0.32	0.490
70	2.5	0.25	0.896

CONCLUSIONS

It was proposed a new concept of flight, including in the first phase of the flight, a vertical take-off, using the propulsion forces from an on-board rocket engine.

An aerial vehicle characterized as a mixture between a Coandă UAV and a reaction engine used only for vertical take-off and landing phase it was described.

For optimizing the design of this VTOL-UAV, it was made a first experimental model at a small scale.

The aerodynamic researches have been conducted on it, in a wind tunnel.

The results of aerodynamic researches allowed determination of aerodynamic lift force depending on radial nozzles diameter, its slot and flow velocity at nozzles exit.

Nozzle diameter ratio was established to the Coandă fuselage diameter, where is the maximum aerodynamic lift force.

The numerical approximation analytical relations were obtained to calculate the aerodynamic lift force depending on the radial speed jet and geometric parameters of the aircraft.

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UAV SYSTEMS IN SUPPORT OF LAW ENFORCEMENT FORCES

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Abstract: *The world in which we live can often be dangerous. Then, law enforcement officials must use the best technologies to protect us, but many times they don't have the budget to buy such advanced equipment. The UAV is the best airborne platform for surveying areas in which unpleasant things might occur. Instead of using an expensive helicopter or airplane, or sending human beings into a potentially dangerous situation, you can use a UAV platform to capture video evidence you need. Due to its silent flight and small dimensions, compared with a normal aircraft, UAV won't disturb the scene being surveyed. Having video, low light or FLIR cameras on board, you get the picture that your organization need, without exposing your people. The expenses are also at a fraction level from those inferred by a conventional manned aircraft mission. The response plan of the street cops in uniform to a call is based on their experience and information acquired from various sources and on scene observations. In such situations they may benefit also from the live images obtained with the help of a non-expensive eye in the sky. Strategies and decisions based on accurate information in hostage taking act or barricaded subject can save lives and prevents injuries. With a UAV help you may have a big picture instead of visual limited recording from the ground level. Also, once the event and activities are recorded, you have valuable information available for review as evidence or as an authentic training tool.*

Key words: *UAV, support, law enforcement, scene observations, cop missions*

1. INTRODUCTION

When they are dealing with a dangerous situation, police officers are needed more information before get involved. In this way the operation of the planned intervention will be more responsible planned, more efficient and less risky. Normally this information is gathered by police on the spot. These policemen are exposed to dangers in the environment in which they operate. To avoid this situation, if conditions permit, one may use the support aircraft and helicopters. Usually, large organizations have such means but they are available in limited numbers and require qualified pilots to high operating costs. Under these conditions UAVs may be an alternative to conduct surveillance and reconnaissance activities.

Easy to transport to the venue of the operation they can perform aerial survey of the area using a video camera or thermal imager. UAV enables the police to see the roof or behind buildings regardless of surface configuration. They can also be maintained for a long time over an area to help the command and control mission.

UAVs can carry sensors to detect dangerous chemicals or drugs; may monitor areas inaccessible for extended periods.

Operating costs are much lower compared with those of helicopters; their use is much more advantageous for the support of smaller formations of police.

2. POSSIBLE MISSIONS

UAVs may be used as a means of support, with unique potential for a wide range of

missions from the police portfolio. Its ability to provide a "view from above", from multiple angles of a fixed or a moving target provides the opportunity to supply a larger amount of information that allow a more accurate analysis of a operational situation and take the most appropriate decisions to resolve.

We will examine tasks that could be successfully achieved in these devices.

2.1 Patrol neighborhoods

Persistent presence of a UAV over a densely populated suburbs may reduce crime. Patrol will be most effective if they will fly both day and night, so avoiding the usual routes and flight after pre-flight programs. The observation of a target from the air at altitudes of 150 ÷ 250 m at a speed of 100 km / h, allows a 10 times greater visibility than a land patrols.

Street crime, looting, robberies, car thefts, etc. may be detected directly from the air. Based on information received may be made a intervention plan of the ground forces. Reduction in crime makes cities safer living environments for residents and gives them back their confidence in widely accepted social values.

UAV capability to maintain for a long time over targets allows coordination of the intervention forces and warning of the dangers that threaten them. In this way reduced the risks police team members are subjected carrying out missions.

In addition to the helicopters, UAVs can fly without being detected by ground. Also there is no risk of serious injury or death to crew members, given the low-altitude flight in an area with high density of obstacles on the ground.

Fig 1 – UAV VTOL for survey

Purpose: Detecting criminal activities and stop them.

Objectives:

- Protection of the integrity and life of citizens.
- Protection of property.

Methods:

- continuous shooting by day and night, in low visibility conditions;
- infrared film;
- high resolution pictures.

Activities monitored:

- theft;
- robberies;
- murder;
- taking of hostages;
- prostitution;
- road accidents;
- car chase escaping control;
- disturbing public;
- trafficking in drugs and other banned substances;
- trafficking;
- illegal commercial activities.

Land Characteristics: “urban 3D relief” is composed of buildings and streets. The cities are blocks with heights ranging between 10 ÷ 25 m on the roof of which are GSM antennas increasing the overall height of 30 m. The small green spaces around the blocks are planted with flowers and shrubs to 3 m high. The rest of the spaces are arranged as parking.

Access roads have widths ranging from 2 m in the historic centers of cities up to 20 m on the boulevards. On their side are rows of trees and lighting columns 5 to 10 m high. Above

the streets are suspended overhead wires to power electric vehicles for urban transport (4 m height). There may well be large parks with lawns dotted with works of art, with lanes 2 to 3 m wide and flanked by ornamental trees with heights between 1.5 ÷ 5 m or clumps of forest with trees of above 7 m.

In some areas are central markets where can be organize demonstrations and other cultural events.

On the main roads traffic is high, decreasing on the access streets in residential areas and became fragmented on alleys between blocks. In smaller towns the traffic is lower except the transit routes of national or international routes.

Cities are located on flat surfaces or on a range of hills or on the slopes of a mountain. Cities on the plain are built with spaces between buildings, wide streets with large parks. The old cities are crowded with narrow and winding streets. Cities on the mountain are built on inclined slopes with buildings stuck together, with open space close to zero, with narrow and winding streets, that have a height slope.

At the outskirts are industrial zones with halls between 5 to 7 m high and access roads for transporting goods. The halls are surrounded by large surface areas for vehicle parking and storage of goods.

Climate / weather: urban settlements are scattered throughout the area of the country so that we meet the entire range of temperatures (-35 ÷ 450 ^{0}C) and weather. The lowland areas are subjected to persistent winds (15 ÷ 35 km / h), the storms (over 70 km / h) or tornadoes, which fell trees and tear roofs bring or down the power grid. In the winter blizzards are affected them, sometimes leading to blocking traffic. Rain, heavy at times (25 ÷ 45 l/m^2), may even lead to stopping the traffic by flooding the streets. In the summer fall torrential rains with lightning and hail.

In general the blocks reduce the wind speed but produce swirls in their neighborhood. Large asphalt surfaces and facades of buildings radiate heat so the temperature is a few degrees higher in summer within localities, may exceed 40 ^{0}C.

Scenarios

Scenario 1 - A small UAV platform will be launched by members of a patrol. It recovered in the locations that will not endanger the integrity of others, making the operation with its own resources, without special arrangements. Air vehicle will travel on a pre-flight path, surveying from air urban area of 1x1 km. He will fly to a height between 250 ÷ 300 m. To capture the details will be lowered to a height of 100 m. He will transmit images in real time to the ground patrol, around the buildings, on the streets, within parks. If suspicious activity is detected they are located and the vehicle will float above, supervising permanently those involved. If they move to a motor vehicle will be pursued by the UAV. Based on information received from the air patrol will decide where and when intervention and may ask for support if necessary.

Scenario 2 - An UAV Platform launched from a mobile unit will fly at heights of 500 ÷ 800 m with speeds of 80 to 100 km / h on a path of "combing" surveying strips of 6x6 km. To capture the details will fall to 300 m. The images are transmitted to a command center. . Recovery will take place in an area on the outskirts, with their own means, on undeveloped land. Upon detection of suspicious activity, these will be located and land patrols will be moved to those areas. Until the arrival of ground units UAV will run hovering over the target or will follow ground moving target. Upon arrival directly to the

patrol will provide tactical information. After that they will resume patrolling the predetermined trajectory.

Scenario 3 - A UAV platform launched from a mobile unit will patrol an area up to 10x10 km at heights of 800 ÷ 1000 m on a stationary trajectory. It will transmit images to a command center along with other sensors on the ground. When suspicious activity is reported, an operator in the center will moved the platform to the area indicated. If you need to be lowered to a height of 300 m. UAV will perform hovering over the area by providing basic information to evaluate the situation and prepare intervention scenario. The arrival of ground patrols, will resume its patrolling on the old path. If you have followed a suspicious car and locate the UAV will be followed throughout its route allowing permanent location. If it is a car moving at high speed to avoid being stopped by officers on the ground it will be followed by surveillance UAV, thus being able to block intersections so as not to cause serious accidents. UAVs can also accompany an ambulance carrying a serious case to allow land units clear the traffic. Such a UAV could transmit control centers about traffic jams, traffic flows that can be leverage for intersections directing or diverting traffic detours.

2.2. Traffic monitoring

Traffic monitoring is currently a chain of terrestrial sensors scattered along a road. Each sensor has the ability to monitor a small portion of the road transmitting images to a traffic monitoring center. Analysis of information received from a relatively large number of such fixed sensors allows creation of an image on the traffic density (number of vehicles per km), the main flow direction of their movement and detection areas which such streams disruption occurred. In general the result is a big error margin is achieved after a long time to process raw data. Most times it is necessary to gather additional information by a ground observer moving in a given area. Rapidity of its movement will be slowed by traffic jams so that an assessment of the situation will be much slower, response time will be much higher, the situation will get worse and the chances of survival of victims of road accidents will diminish considerably .

If the same information would be taken from a UAV moving at a sufficient height and with a higher speed than the vehicles on the road, it would allow real-time visualization of a much longer road sections, conclusions can be drawn immediately by a ground observer who can instantly assess the situation and prepare a intervention plan that would lead to speedy resolution of the situation. If road events occur they can be quickly located and evaluated given the short time the UAV can reach the place of their occurrence, because he flies in a straight line, the shortest path, unimpeded by obstacles and speed. Moving terrestrial means to rescue victims from accidents can be directed to detours, less crowded, that response time be as short as possible.

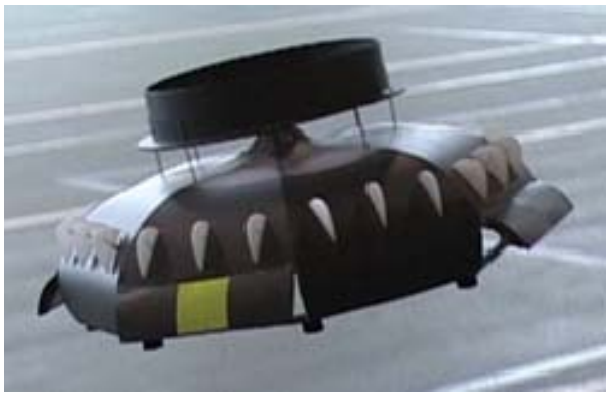

Fig 2 - UAV VTOL for traffic monitoring

Purpose:

- Ease traffic.
- Increase traffic safety.
- Saving the life of people involved in accidents.

Objectives:

- Establish traffic flows in order to fluidize them.
- Detection and removal of traffic jams.
- Finding and identifying those who violate road regulations.
- Location of the accident and obtain information quickly, immediately after production.
- Research site accidents.

- Monitoring land vehicles transporting accident victims to hospital, to clear the route.

Methods:

- continuous shooting by day and night, in low visibility conditions;
- infrared film;
- high resolution pictures;
- travel speed measurement radar method;

Activities monitored:

- violating rules of conduct road;
- production of road traffic accidents;
- roadblocks;
- heavy traffic;
- identification of traffic flows.

Land Characteristics : Roads crossing plains and plateaus, follow the thread of water, the winding hills or mountains, crossing water courses or precipice. They are built at elevations ranging from sea level to over 1 km.

Roads cross grassy plains or fields planted with crops, wooded areas, or goals alpine, following rock slopes or strain on the bottom of deep valleys. They are often flanked by rows of trees (3 to 6 m).

Climate / weather: roads. cover the whole country so that they meet along the whole temperature range (-35 ÷ 450 C) and weather. The lowland areas are subjected to persistent winds, the storms and tornadoes. In the winter blizzards are blocked. Throughout their fall precipitation, sometimes heavy rainfall can lead to stopping the circulation. Summer torrential rains occurring with lightning and hail.

Scenarios

Scenario 1 - A UAV platform will run patrols consisting of surveillance of a portion of road 100 km in length. The launch will made from mobile units on the ground and the recovery by its own means, on undeveloped land. Air vehicle will travel at speeds 80 to 100 km / h, following the path of the road and slightly to one side of it. Video images will be transmitted to mobile crews or to route traffic monitoring center. Simultaneously, it may record the vehicle speed along with recognition of the speeding vehicle on the section of road monitored. Upon detection traffic jams will be located, and UAV execute hovering above the busy intersection providing data to the ground crew by on vehicle flows on emerging directions. Upon detection of a traffic accident, the air vehicle will fly for collecting information about vehicles involved, the losses recorded, the status of the persons involved. Based on these images will be able to analyze the production of accident and the guilt of those involved. When transporting the injured persons to the nearest health facility, the ambulance will be tracked from air, in order to remove bottlenecks on the route.

Scenario 2 - small UAV platforms will be launched by members of mobile patrols in the hand. They will act at a distance of 1 ÷ 2 km from the launch site. They will provide patrol video witch will intervene to punish drivers out of traffic and unruly. When blocking an intersection, the ground crew in charge of directing circulation will receive information about the directions that recorded the main streams of traffic and queue length on each direction beginning at the intersection. If traveling to a traffic accident on a road blocked traffic the mobile crew will gather the first in formations by sending an UAV. The investigation at the crash site from the ground crew will be able to analyze aerial filming production to determine how the accident, location and fixation of trace evidence for their submission to court.

2.3. State Border Patrol

The need to secure the frontiers demands new technologies to strengthen the capacity of border guards to prevent, detect and apprehend smugglers, terrorists and those attempting to illegally cross the border.

UAV is the "eye in the sky" which was lacking until now. This new technology will complement the presence detection and information gathering systems, now existing, and will work integrated with them.

Video images from the UAV will be transmitted in real time to ground patrols.

UAVs will be even more effective in remote border areas, where access is difficult and staff safety is jeopardized while the infrastructure is difficult or impossible to build.

Also simultaneous transmission of information in a unique coordination center will lead to increased mobility of ground patrols.

Interception and retention of groups of illegal immigrants eliminates the economic crimes they might commit in the country as: trafficking in drugs, weapons, living beings, undeclared work.

Confiscation of illegal transportation of goods leads to increased revenue from the state budget.

Terrorist groups can be stopped at the border as being defended people's lives.

Decrease or even eradicate drug trafficking and other hallucinogenic substances leads to maintaining the health of the population and reducing mortality.

Preventing leakage outside the country of strategic metals lead to enhancement of defense, sovereignty and national independence.

Interception of traffic with works of art has the effect of strengthening the people's national identity.

Fig 3 - Combine UAV-UAS for border patrol

Purpose:

- Detecting and stopping criminal activities taking place on the border - both in the border strip and a certain depth within the national territory (30 km).

Objectives:

- To protect life.
- Protection of national economy.

Methods:

- continuous shooting by day and night, in low visibility conditions;
- infrared film;
- high-resolution photos.

Criminal activities:

- Smuggling weapons, drugs, counterfeit goods, stolen goods;
- illegal border crossing;
- trafficking.**Land Characteristics**: The land border crosses most diverse landforms: alluvial flat or steep cliffs, vast plains or slightly wavy, more or less hilly terrain, steep mountain walls, cut by deep valleys.

The meadow area is spread over large pieces hardwood forests relatively of tall trees (3 ÷ 8m). Along the shores are formed, in the dry season, small beaches (5 to 30m).

Vegetation in the plateau region is composed of steppe grasses interspersed with small shrubs (0.5 ÷ 2 m) and isolated trees. Rarely encountered of small groups of forest formed from relatively high trees (2 to 4m).

The vast mountain areas are covered by dense forests of tall trees (6 ÷ 8m), interrupted

by small grassy and dense meadows. Alpine areas are covered by dense vegetation of dwarf shrubs (0.3 ÷ 1 m) or tangled grass (0.1 ÷ 0.3 m) was strewn with boulders and of small rocks (0.2 ÷ 0.5 m) .

Climate / weather: Conditions will be depending on the area. The mediteranian influenced climate in SE, the harsh climate in the mountain areas of N. Since the prevailing winds of moderate intensity (15 ÷ 25 km / h) in areas with persistent, cold and violent winds (40 ÷ 80 km / h) which occur in winter storms. Annual precipitation is in the form of rain and snow, which can be quiet or as heavy falls (25 ÷ 50 l/m^2). In the summer heavy rainfall is accompanied by lightning and hail. Sometimes summer design storm and even tornadoes. Lows down to-10 ^{0}C in the SE while the mountains to -25 ÷ 30 ^{0}C. Summer temperatures are recorded the 30 ÷ 35 ^{0}C in S and E.

Scenarios

Scenario 1 - UAV platform will run patrols consisting of surveillance of areas in the form of strips of 10x100 km. The launch will be on patrol vehicles fitted with catapults and recovery will be done by landing UAV, using of it himself, in undeveloped areas. The flight will be performed at altitudes ranging between 600 ÷1500 m above the ground. The flight path will be set up so that it can be under surveillance as long a time a certain area of land. Platform for identifying people and vehicles will come down to 500 m. In the data transmission distances beyond LOS (Line of Site) the ground relay networks is a useful presence, that can also provide command and control of UAVs. Data is transmitted to a regional command center and the ground mobile units. Command Center will conduct mobile crews.

Scenario 2 - small UAV platforms will be launched from the hand by mobile patrol units. They will do reconnaissance on a radius of up to 4 miles around the patrol. The platforms will rise to a height of 300 ÷ 500 m above the ground from where they will transmit images in real time to the patrol commander. When illegal activities where detected they will float above the ground providing tactical information. Recovery will be done in-house, in undeveloped areas.

Scenario 3 - UAV platforms will make the standby flight over a territory. During this time they will do air-to a 10x60 km area. At the onset of the presence detection sensors placed on the ground they will automatically be routed over the territory from intruders raped running research area by "combing", the detection and identification of beings from the ground. After execution of the mission will resume patrolling the old area or will be moved to another area. Images will be transmitted at the regional command center and during the intervention patrol commander, too. During the intervention UAV's command may be entrusted to chief patrol. In this case it is necessary that terrestrial communications network to transmit data and to exercise UAV's command and control. The platform will provide real-time image.

2.4 Actions special intervention forces (SWAT)

Live of the fighters in the special forces are submitted at risk during each intervention. To avoid threats that are lurking behind a grove of trees, a wall or a building, the solution is the observation from the air, from an aerial platform, which provides so-called "view over the hill. "

Helicopters should be lifted in the air with a certain time before the onset of the operation

due to preparations for the flight duration and can be easily detected due to noise and large size. Instead UAV can be launched immediately on the ground, operating undercover, and in addition, much lower cost.

After a reconnaissance made before the mission beginning, topography will be much better known, so that intervention will be more accurate planning, eliminating many of the risks. Air surveillance of the action enables information the team members about the dangers that occur over time.

Using UAVs reduce hazards for members of SWAT troops and provide a high degree of success of the missions.

Purpose: Gathering of tactical information.

Objectives:

- Stop the criminal activities.
- Protect life.

Methods:

- continuous shooting by day and night, in low visibility conditions;
- infrared film;
- high resolution pictures.

Activities monitored:

- theft;
- taking of hostages;
- trafficking of arms and explosives;
- terrorism;
- trafficking in drugs and other banned substances;
- trafficking;
- illegal commercial activities.

Land Characteristics. The action mostly takes place inside buildings or inside some isolated farms. Sometimes monitored activity occurs on the roof of a tall building (30 m). Sometimes it can take place in a suburb with luxury properties surrounded by high fences that do not allow for the courtyard.

Illegal activities can take place in port, on a boat. Sometimes the ship is moored, sometimes is roadstead.

Terrorist threats can occur offshore platforms located at sea (60 ÷ 200 nm).

Goods or hostages may be carried in motor vehicles traveling on roads or rough terrain.

Climate / weather: The objectives can be located anywhere within the country, so that at the time of intervention can meet the full range of climatic and weather conditions specific to our country.

Scenarios

Scenario 1 - A very small UAV platforms launched by special forces rises along the walls of tall buildings spying through the windows. They remain in homes hovering at the window where they detected suspicious activity or fixes of walls where it transmit real time images and sound on the ground. Launch is made from hand and recovery in the same way.

Scenario 2 - small UAV platforms are launched by hand by the intervention units. They fly over the target at heights between 150 ÷ 200 m and can fall to 50 m. They will fly over the target on stationary trajectories collecting information about the topography, the presence of people and activities. They will be maintained above the target after penetration of the intervention teams providing tactical information. Recovery is taking place in areas where there aren't endangered others.

Scenario 3 - UAV platforms are launched from land or sea mobile units. They are moving at high speed (150 ÷ 200 km / h) over a target where it made hovering at heights of 300 ÷ 500 m above the round, gathering information about goals and activities and sending them to intervention team. At the start of operations will provide tactical information. On completion of the operation will be recovered by landing unprepared zones or recovered with special means on ships.

3. CONCLUSIONS

1. Small UAVs are a vehicle of aerial surveillance as effective as conventional piloted aircraft. They can be used to support the mission of maintaining public order throughout the national territory.

2. For the police, UAVs are required to perform work surveillance, reconnaissance, information gathering and tracking fixed and mobile targets, which are essential components in the performance of specific tasks aimed at protection of life and property.

2. When choosing from the diversity of existing UAVs, the best for police needs are

those that can be easily transported in mobile units and do not require ground facilities for launch and recovery.

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ATTACK OF THE DRONES: UNMANNED AERIAL VEHICLES AS AN INSTRUMENT OF WAR

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OVERVIEW

On December 14th and 15th, 2009, the Center for Technology and National SecurityPolicy hosted a conference addressing the topic of "Unmanned Aerial Vehicles (UAV) as an Instrument of War."[1 2] A part of the Transforming National Security Seminar series, this conference brought together distinguished panelists and expert speakers from the domestic and international, civilian and military, academic and private sector arenas. Focusing on the explosive rise of remotely-piloted vehicles in the skies above Afghanistan, Iraq, and Pakistan, several panelists addressed the current roles and missions, modern designs, and future capabilities of this unique platform. In addition to these discussions on the "hard" engineering behind these different aircraft, the conference also looked at some of the tougher issues facing UAV manufacturers, unmanned operators in the U.S. Air Force, and the American society in general. For example, what is this robotics revolution we are living through and what does it mean for the U.S. military? How is waging war without warriors affecting our traditional soldier ethos? Is the rise of "joystick jockeys" a sign that war is no longer a risky life-and-death battle but more of a detached form of entertainment? Are these machines even legal or ethical according to international standards? Based on the conference report, speaker presentations, and independent research, this paper focuses primarily on the aforementioned "soft" challenges associated with operating unmanned systems. After providing a brief general history of American UAVs, this article will highlight the role of unmanned aircraft in the robotic revolution of the 21st Century as well as their impact on the U.S. armed forces and the international legal system as a whole.[3]

A BRIEF HISTORY OF UAVS

After the surrender of Japan on August 14, 1945, General Henry "Hap" Arnold, General of the U.S. Air Force (USAF), declared: "We have just won a war with a lot of heroes flying around in planes. The next war may be fought by airplanes with no men in them at all."[4] While the Korean War did not see the use of unmanned aircraft in combat, surveillance versions of such remotely-piloted planes have been a part of the American arsenal since the Vietnam War. Hunter-killer platforms like General Atomics Aeronautical Systems' MQ-1 Predator (which made its unarmed debut in the Balkans in 1995) and MQ-9 Reaper have been omnipresent in the "Global War on Terror" since 2004. Declared to be "the only game in town" by Leon Panetta, Director of the Central Intelligence Agency (CIA), it is clear to all observers that the age of unmanned warfare has arrived.[5] Widely equated to the Ford Model-T or the Wright Flyer, current generations of unmanned systems are

considered bulky and unrefined while their successors are likely to be deadlier, faster, sleeker, and smaller.

Long considered the "bastard step-child" of the U.S. military, drones were originally produced by the Radioplane Company in 1944 for anti-aircraft target practice. In the 1950s, after the U-2/Gary Powers spy plane incident, Norman Sakamoto decided to equip the platforms with cameras and helped create the Ryan Firebee. Soon over 1,000 Firebees were flying surveillance missions above Vietnam.[6] Grounded after the war, unmanned drones were not used extensively again until the 1991 Gulf War and *Operation Desert Storm*. In addition to being the first widespread use of UAVs since Vietnam, the Gulf War also saw the most varied use of unmanned platforms, both in style and in service operation with the U.S. Army, Marine Corps, and Navy all operating Israeli-built RQ-2 Pioneer drones.[7] When fighting broke out in the Balkans in the early 1990s, then-CIA Director James Woolsey was desperate for surveillance footage for his spies. After receiving significant pushback from the U.S. Air Force, Woolsey contacted Abe Karem, an Israeli expatriate and former UAV designer for the Defense Advanced Research Projects Agency (DARPA). Karem's stripped-down platform, the Gnat 750, had a relatively lackluster performance in the Balkans but evolved into the MQ-1 Predator, an unmanned aircraft American troops on the ground cannot imagine living without.[8] With at least twelve drone variants in operation, there are currently eighteen different missions – not all of them military – that use remotely-piloted aircraft.[9] A mix of upgraded systems, converted manned vehicles, and brand new designs, these platforms are used to assist forest firefighters, stalk and kill terrorists, protect the skies above national/international events like the 2012 Olympics in London, and monitor the U.S.-Mexico border.

Despite the term "unmanned," maintaining these vehicles is more labor-intensive than manned operations, causing a large cultural shift in the U.S. Air Force as more unmanned operators were trained in 2010 than traditional pilots. In an effort to increase the ranks of drone operators from 800 today to 1,400 by 2012 and to reduce the stigma of the UAV community within the service, the USAF institutionalized a remotely-piloted aircraft (RPA) undergraduate training course and an associated career field (18XX) last year.[10] Accompanying this internal service change is a larger societal detachment from war and combat. With no war bonds, no victory gardens, no military drafts, and no formal declarations of war, scholars worry that the military option will become the first choice of politicians to resolve international conflicts. And while saving human lives is always an admirable goal, if casualties are completely removed from the equation, negating any kind of risk, some have even speculated that we will enter an age of perpetual conflict. Only time will tell how the rise of the machines will impact U.S. foreign policy but it is clear that the brave new world of the 21st Century is a predominantly unmanned one.

THE ROBOTICS REVOLUTION

Should anyone doubt they are living in the midst of a robotics revolution all they have to do is look at the numbers. For instance, when coalition forces invaded Iraq in 2003, there were only a handful of unmanned drones in the U.S. inventory; today there are over 7,000. Likewise, there were no robotic ground vehicles during the invasion but the popularity of the roadside bomb has led to the creation of over 12,000 unmanned ground systems. Every single service of the U.S. armed forces operates at least one kind of drone variant and over 44 countries possess unmanned aerial platforms, though only the United States, Great Britain, and Israel currently fly hunter-killer UAVs like the MQ-9 Reaper. However, these aircraft are no longer only the property of nation-states. In the 2006 Lebanon War, for example, the political/paramilitary organization Hezbollah flew drones across the Israeli border. This empowerment of the small group against the state is just one of three main trends experts see in the current weapons transformation.

Unlike other technologies, there is no first-leader advantage in the robotics revolution. The United States will likely spend the maximum amount on development while every other interested party, be it a nation-state, terrorist organization, or private company, will spend the minimum amount on exploitation. Unmanned platforms can cost anywhere from $1,000 to $4.5 million to $35 million allowing anyone with a computer and a credit card to acquire their own personal surveillance aircraft. While this wide accessibility certainly has privacy implications for the larger community, in the military realm, it highlights the second main trend of the revolution – the elimination of the power of the suicide bomber. With Do-It-Yourself drones purchased off the Internet, one can be deadly but not suicidal. A determined insurgent can take out a government building, a military convoy, or an individual Humvee without killing themselves in the process.

The third main trend concerning unmanned technology is one of the most basic challenges any dominant leader would face, criticism. Not everyone is excited by the rise of unmanned capabilities which is leading to new sparks of conflict and tension in already tenuous relationships. This frustration may come from a country that desperately wants to acquire its own drones or an international organization that feels this technology is illegal and unethical. No matter the cause of the apprehension, the reality is these platforms are most likely to be used in the world's hot spots, like Pakistan's Federally Administered Tribal Areas, making their use even more contentious. Couple this fact with the open knowledge that some of these platforms are being flown by a civilian organization whose operating procedures are murky at best and one sees the dangerous precedent that is being set.[11]

On top of the sheer numbers of platforms and their various owners is the overwhelming amount of information these planes are transmitting home. For instance, in 2008, drones flew for 800,000 hours, a 2,300% increase from the number of hours flown from 2003 to 2007.[12] Full-motion video footage from these flight hours stream back to ground control stations around the U.S. to be analyzed, processed, and if necessary, acted upon. In 2009, the U.S. Air Force alone collected 250,000 hours of video. If an analyst sat down to watch all of that footage it would take him 28 years to get through it.[13] With the coming arrival of new high-tech video Gorgon Stare sensors, these data feeds will increase tenfold, dramatically exacerbating the problem.[14] As many presenters noted at the conference, unless some kind of prioritization scale is created within the mission structure, the Air Force will simply drown in all of this data.

Despite the impressive number of unmanned systems in the field and the data streams coming in from the feeds, the real revolution comes not from the technology itself but the way these capabilities are changing the way we interact with the world around us. While some roboticists eagerly look forward to an age where man and intelligent machine coexist peacefully, other scholars believe that true autonomy is impossible and that automation should simply enhance and leverage existing human assets and skills, not replace them. Whatever one's personal feelings about the future of artificial intelligence, it is clear the current robotics revolution is changing the definitions of what it means to be human and what it means to be a warrior.

A VIEW FROM THE INSIDE

Despite the fact that all five services of the U.S. armed forces operate some version of unmanned aircraft, the majority of the platforms belong to the U.S. Air Force. Originally outspent in development by both the U.S. Army and the U.S. Navy, the USAF recognized the utility of unmanned aircraft during the Balkan conflict and formed its first UAV squadron at Creech Air Force Base (AFB), Nevada in July 1995.[15] There are now four reconnaissance squadrons and one attack squadron operating in the plains outside of Las Vegas and there are UAV training and maintenance facilities in Arizona, New Mexico, and New York. Since 2007, the U.S. Air Force has been operating in a "surge" mode, deploying 100% of its unmanned aircraft while, by comparison, the U.S. Army has only been flying 30% of its fleet. This discrepancy and the increasing numbers of flight hours UAV pilots put up each year would suggest an embrace of the Air Force's unmanned mission but the reality is something quite different. While the men who fly the drones recognize the importance of their mission and welcome the new technology, there is a perceptible rift between the old guard of traditional fighter pilots and the Air Force's senior leadership over the future of force.

Since its creation in 1949, the identity of the Air Force has always been associated with the aerial dogfights of the fighter pilot, but the reality is that less than half of one percent of the force actually fly fighter jets.[16] This out-of-balance perception is one of the main hurdles facing Chief of Staff General Norton Schwartz as he prepares the Air Force for the conflicts of the 21st Century. Though numerous challenges face the USAF, from aging planes to poor personnel retention, the largest battle is over the place unmanned aircraft have in the service's mission repertoire. The first non-fighter pilot to become Air Force Chief of Staff, General Schwartz recognizes the robotic reality of the new millennium and knows the Air Force needs to adapt to remain relevant. While many fighter aviators dismiss the demands of operating UAVs and mock the skills of the pilots, General Schwartz is determined to change the current 'leper colony' mentality to one that sees a viable future in remotely-operated vehicles. To do this, the Air Force created a UAV-specific career field that will operate at the tactical and strategic levels, as well as the operational one. Starting in 2010, the USAF will send 10% of its undergraduate pilots directly to unmanned training. A four-week fundamentals course at Randolph AFB in Texas will be followed by months of hands-on training at Creech. Roughly 100 new pilots will head down this track each year, slowly increasing the ranks of UAV handlers.[17] This process of adjusting current attitudes towards UAVs will be long and arduous and will likely change only when unmanned pilots are in positions of higher authority. However, it will be hard for unmanned operators to advance to these positions as long as fighter pilots still receive valorous awards and all drone "pilots" receive are thank you notes.[18]

In addition to challenging the traditional fighter pilot ethos of the U.S. Air Force, the explosion of military UAVs in theater is creating a role reversal among the top brass and the lower ranks of America's aerial defenders. With an increasing number of young decision-makers with less in-the-field experience, the U.S. military is seeing the emergence of the 'Strategic Corporal.' Likewise, the easy accessibility of UAV video feeds is creating the position of the 'Tactical General', the senior micromanager from afar. In numerous articles on the subject, Dr. Peter W. Singer, Director of the 21st Century Defense Initiative at the Brookings Institution, references a conversation he had with a four-star general who spent two hours watching Predator footage. As the events on the screen unfolded, he decided this particular area of interest was indeed a legitimate target and even decided which ordnance size he wanted to use.[19] While increasing one's knowledge of the battlefield is not necessarily a bad thing, for those two hours, the general was doing the work of a captain. While other men and women were capable making the same kinds

of decisions, there was no one who could step in and do the work of a four-star general. If senior leaders continue to insert themselves into lower-level decision-making and rail against the creation of a UAV career path, the younger generations of U.S. airmen will never acquire the combat experience and confidence they need to rise through the ranks themselves. This discrepancy could leave the Air Force even more unbalanced and unprepared for the next potential conflict.

WAGING WAR WITHOUT WARRIORS

In his recent book, Wired for War: The Robotics Revolution and Conflict in the Twenty-First Century, Dr. Singer writes: "Avoidance of war has been a traditional tenet of [American] foreign policy. Yet we have been at war for most of our nation's history and many of our greatest heroes are warriors." He goes on to suggest that our fascination with war exists because it brings out "the most powerful emotions that define what it is to be human. Bravery, honor, love, leadership, pity, selflessness, comradeship, commitment, charity, sacrifice, hate, fear, and loss all find their definitive expressions in the fires of war."[20] Of all of these emotions, the one most strongly associated with war is fear. Very few people take to war naturally and are inclined, when faced with potentially mortal danger, to run in the opposite direction. What makes servicemen and women different is that they show courage under fire. When everyone else is running away, they charge forward defending their country, protecting innocent lives, and restoring order. It is that spirit of selflessness that makes them heroes. But what happens if you take fear out of the equation? What would occur if a UAV operator was simply monitoring the progress of ground robots, not human soldiers? Could war lose its meaning? Would the lack of political risk make it the first option for politicians? Is it possible that war could become an ever-present, societal mainstay? How dearly do we hold our "unalienable rights" – life, liberty, and the pursuit of happiness – if we aren't willing to die defending them?

The idea of "no-fear" warfare is a difficult subject that scholars are just beginning to address. There certainly are benefits to robotic warfare – no concern for self-preservation, no feelings towards the enemy, no motivation besides a set of programmed instructions – but the number of concerns are just as many. What kind of people would be attracted to a world of "no-fear" warfare? What skills, training, and leadership would be needed to make this military successful?[21] What would decide victory in this kind of environment? More importantly, what would happen to our warrior class and their brave heroics on behalf of the country?

As one of the speakers at the UAV conference suggested, what makes us human is the fact that we tell stories and then act upon the lessons from those stories. We recognize a warrior culture and ethos that comes from maintaining one's integrity and character in difficult, often life-threatening, situations. In a "fear less" environment where there is no more self-sacrifice there is also no more courage under fire. With robots we may lose fewer lives but we also lose the morality story of the returning hero. Since survival is programmed into our psyches, we look to these heroes for a reason. Relying on memories to honor those who have gone before and their personal sacrifices, we often define our own sense of humanity and responsibility through their individual actions. However, while these stories instruct our sense of self, they also shape the opinions of others, including the enemy. To them, our

reliance on technology, particularly UAVs, is a sign of both our arrogance and cowardice.[22] With current and, most likely, future fighting occurring in a part of the world that prizes bravery, courage, honor, and masculinity above all else, relying on technological advantages will result in extended, stalemated conflicts. Trapped in a "virtueless" war of our own making that requires neither courage nor heroism, we would lose the very emotions and stories that define who we are as humans.[23] Although some roboticists look forward to a future of androids walking the planet, their enthusiasm begs the question: just because you can make it, should you really bring it to life? And if you bring it to life, how do you control it?

THE LEGALITY AND ETHICS OF UAVS

Almost every single aspect of operating unmanned aircraft is fraught with intense debate but one of the most contentious areas of concern revolves around the legality and ethics of deploying such aircraft into combat and non-combat zones. Drones were issued into the airspace above the battlefield so quickly that only now is their military context being questioned according to international regulations. While USAF RPAs are considered an extension of the general military, "subject to the laws of armed conflict within a military chain of command subservient to civilian oversight," many analysts agree that these frameworks – the Geneva Conventions and the Law of Armed Conflict – were not designed with this autonomous capability in mind.[24] As one scholar noted, "the current protocols are so old that if they were people, they would qualify for Medicare."[25] As legal experts struggle to place these autonomous machines into a formal protocol, the place they turn most often for guidance is science fiction, particularly *I, Robot* and the "Three Laws of Robotics" by Isaac Asimov.

First introduced to the world in Asimov's short story, "Runaround," published in 1942, the "Three Laws of Robotics" are as follows:

1) A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2) A robot must obey any orders given to it by human beings, except where such orders conflict with the first law.
3) A robot must protect its own existence as long as such protection does not conflict with the first or second laws.[26]

Though these three laws may seem like a decent guide for restricting robotic behavior, the truth is they are fiction. They were created as plot devices for Asimov's stories, most of which focus on a breakdown in the rules and the resulting chaos. As such, there is no current technology that can translate these laws into binary code and program them into a computer chip or robot. Lastly, the U.S. military specifically wants robots that can kill humans, can act independently from human handlers, and don't care about their own lives.[27] When the robots we are concerned about are designed to violate these very protocols, what good are the laws as guidance?

Further complicating the above conclusion is the fact that there are currently two different operational unmanned programs in the United States, one run by the U.S. military and one handled by the CIA. As noted above, legal experts agree that the unmanned operations conducted by the U.S. military are done in the traditional context of conflict and are therefore subject to the Law of Armed Conflict, ultimately legalizing the program. While some may question the ethicality of using drones in combat, they are considered lawful weapons. They may just be used in unlawful or illegitimate ways.

The second drone program is operated by the Central Intelligence Agency which flies unmanned vehicles from bases in Afghanistan and Pakistan and operates them from their headquarters in Langley, Virginia. Most legal analysts agree that this program, conducted under a cloak of secrecy by a civilian agency that often outsources its missions to contractors in a country with which we are not

at war, is illegal and results in targeted killings/assassinations – acts banned in the intelligence community by Executive Orders 11905, 12036, and 12333.

Targeted killings are defined as the use of lethal force against a state with the intent to kill individually-selected persons not in the custody of the state targeting them. While the Obama Administration claims U.S targeting practices comply with all applicable laws – foreign and domestic – the dramatic increase in air strikes authorized by the 44th U.S. President has some international organizations crying foul.[28] For example, in 2010, the CIA alone carried out 118 strikes (at $1 million a piece) while there were 33 total strikes authorized in 2008 – an increase of nearly 360%.[29] While some analysts speculate the increase in air strikes reflects the administration's frustration with the Inter-Services Intelligence (ISI) Directorate's suspect relationship with militants like the Haqqani network, the truth is President Obama initially allowed the Pakistani government to select some of its own targets, a decision many analysts fear led to deadly political reprisals and personal vendettas.[30]

While those familiar with the CIA's program admit there is a well-established protocol for selecting targets, no one is entirely sure what oversight actually occurs. Who operates the UAVs – civilian employees, private contractors, or military personnel – determines some of the legality of the program. As some legal experts have said, who pushes the button doesn't necessarily matter but the rules they follow do. What those rules are at the CIA is anybody's guess since the agency often declines "to comment on a program [it] refuses to acknowledge publicly."[31] How the targets are selected also determines if the strikes are following appropriate protocols. While the military creates a list of "high value targets" based on two verifiable human sources and other substantial evidence, there is no such public guide for how targets end up in the CIA's crosshairs. For instance, out of the 581 militants killed in CIA drone strikes last year, only two were on the most-wanted list.[32] Even the military's list is starting to expand from known terrorists to drug traffickers, albeit bad guys but not ones directly involved with the "War on Terror." This blurring of the lines between legitimate combatant target and politically-motivated removal could have serious implications for the U.S. intelligence community. If U.S. drone strikes begin to attack a wider variety of targets, it is quite possible that civilian UAV operators working in the United States will be considered unlawful combatants – civilians that take up arms – by our enemies and the CIA's Langley headquarters would become a legitimate target. Since the U.S. has been flying unmanned aircraft in uncontested airspace, policymakers have chosen not to worry about some of these thornier issues but the reality is we no longer have a monopoly on this technology. We may have the most aircraft in sheer numbers and in platform variety but drone-on-drone combat is very possible in the next battle of the 21st Century. We need to prepare for that eventuality, and all of the problems associated with it, now rather than later.

POLICY CHALLENGES

Counter-terrorism operations have employed surveillance UAVs since 2001 and armed RPAs since 2004. Since 2009, the Obama Administration has almost quadrupled the number of air strikes – lethal operations – raising critical questions for policymakers:

Who approves the target list and the actual target selected for neutralization?

Are the "pilots" of the UAVs unlawful or lawful combatants?

Do precision UAV strikes reduce civilian casualties?

Are they effective in decapitating and otherwise destroying, disrupting, and dismantling Al Qaeda and the Taliban?

What is the impact on relations with Pakistan (sovereignty)?

How does killing from a stand-off distance affect the moral and legal questions of surrender of the enemy?

What is the intelligence cost of killing an insurgent instead of capturing and detaining him instead?

Is the U.S. Constitutional system of checks and balances adequately preserved by the Presidential findings and Executive Orders that form the basis for these strikes?

What targets in the U.S. become fair game for an adversary's counter-attacks? [33]

These and other perplexing questions will haunt this and future administrations as we wrestle to find the means necessary to prosecute a war on terror consistent with our national values. However, it is equally important to remember that, to some degree, it is the military's job to make war unfair and to our advantage.[34] Unmanned systems live on the edge of this double-edged sword – what may be legally fair is perceived as ethically unfair. As technological innovation races ahead and provides us with additional capabilities to prosecute this war while keeping our soldiers safe, it is incumbent that the policy debate keeps pace.

CONCLUSION

Unmanned aerial vehicles are exciting, new instruments of war that have proven their worth throughout the wars in Afghanistan and Iraq. They are a low-cost, big impact weapon that creates results disproportionate to the sacrifice, saving the lives of American servicemen and women.[35] But using them against our enemies is a tactic, not a strategy. And history has shown us that having a comprehensive strategy is much more important than a good tactic. For example, at the end of World War I, Britain and France had more armored tanks than Germany but still believed in the power of the cavalry and posted tanks to the rear of their divisions. It was a defeated Germany that retooled its strategy, created the blitzkrieg, and overran much of Europe in just a matter of months.[36] American policymakers need to work with academics, ethicists, roboticists, strategists, and UAV operators to create a robust national robotics strategy. Utilizing this vast field of knowledge would not only allow these leaders to create a legal framework for the use, research, and development of autonomous systems but would also address the widening science, technology, mathematics, and education (STEM) gap between the United States and the rest of the world. There is no first-leader advantage in a robotics revolution but that should not prevent the U.S. from negotiating a path and a place for these new weapons in international treaties and national arsenals.

However, though the future looks increasingly unmanned, policymakers should not be too quick to favor the machine over the individual. Viewing technology as a panacea to end all evil in the world devalues not only our selves but our unique set of skills. One cannot negotiate with a UAV, a drone cannot feel empathy and a remotely-piloted platform cannot be a brave and conquering hero. With younger generations that are increasingly less literate, with weaker powers of concentration, and an inability to conduct deep analysis, we risk further detaching ourselves from the

meaning of "war" at a time when the battle is increasingly an existential one.[37]

War is a terrible human constant; robots save lives and are "fucking cool."[38] It seems like a non-issue. But if the definition of a warrior is courage is the face of fear, what happens when conflict loses that fear? How often will troops be committed when leaders know they won't have to suffer a single casualty? When insurgents on the ground get a hold of this technology and use it against us, what then? War is already destructive but technology has become more lethal as we look for new ways to end wars cleaner and faster. However, the drone is an advanced piece of technology that is tied to a fallible human operator who makes mistakes. Even if the aircraft was fully autonomous, there could be a glitch in the programming. Mistakes will happen and we need to be prepared to respond accordingly. While unmanned aerial vehicles will continue to raise tough cultural, ethical, legal, and societal questions, we need to start answering them now, not after some catastrophe shows us how inhuman we have truly become.

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[1] This conference was a part of an unclassified, "not for attribution" series sponsored by the Office of the Under Secretary of Defense for Policy. The event was held at Fort Lesley J. McNair and was attended by 145 participants, with more than 290 total registrants.

[2] Unmanned aerial vehicles (UAV), unmanned systems, remotely-piloted aircraft (RPA), and remotely-operated platforms, as well as various subsets of these phrases, are all terms used in the current lexicon to refer to these semi-autonomous weapons systems and as such, the authors of this paper have tried to use each reference equally throughout the paper.

[3] Electronic copies of the "Unmanned Aerial Vehicles as an Instrument of War" conference report and speaker presentations are available online at: http://www.ndu.edu/CTNSP/index.cfm?secID=21&pageID=2&type=section.

[4] Quote read to the author by Colonel Pete "Gunz" Gersten, Commander of the 432nd Air and Air Expeditionary Wing at Creech Air Force Base, Nevada. Mockenhaupt, Brian. "We've Seen the Future, and It's Unmanned." *Esquire*. November 2009. Available online at: http://www.esquire.com/features/unmanned-aircraft-1109.

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[16] This figure is a rough approximation by the authors. Despite numerous Google searches and calls to the Air Force Personnel Center, it was not possible to find a specific figure for the number of fighter pilots within the active U.S. Air Force. According to the AFPC's Program on Air Force Demographics, out of 330,159 active Air Force personnel, 13,725 members are pilots (4% of the total force). Evenly split among all eleven pilot categories, there would be approximately 1,248 fighter pilots (0.3% of the total force). However, the fact that all fighter pilots are officers, of which there are 65,515, means this percentage of the total force is probably much smaller.

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AN OVERVIEW ON THE CONCEPT OF UAV SURVIVABILITY

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Abstract: *UAV's are becoming more and more active in the modern battlefield; there is no question about it, these types of aircraft are in the proliferation state because of the low costs and relatively good life/cost benefits. To address the modern problem of UAV's a word comes to mind that is survivability. Survivability is the ability of the UAV platform to perform ingress, fly over the target area (including weapon release and guidance) and egress while being subjected to threats. It is nearly impossible to address the survivability of only one subsystem, the aspect has to be treated as a hole, although most modern studies are concentrating on the susceptibility of the unnamed aircraft. Susceptibility and vulnerability reduction are key factors in the further development o of UAV's. The paper discusses the necessary steps for implementing the survivability concept for modern UAV.*

Keywords: UAV - Unmanned Aerial Vehicle, UAS - Unmanned Aircraft System

SURVIVABILITY AN OVERVIEW

UAV's are becoming more and more active in the modern battlefield; there is no question about it these types of aircraft are in the proliferation because of the low costs and relatively good life/cost benefits. To address the modern problem of UAV's a word comes to mind that is survivability. Survivability is the ability of the UAV platform to perform ingress, fly over the target area (including weapon release and guidance) and egress while being subjected to threats. It is nearly impossible to address the survivability of only one subsystem the aspect has to be treated as a hole, although most modern studies are concentrating on the susceptibility of the unamend aircraft. Susceptibility and vulnerability reduction are key factors in the further development o of UAV's.

TERMS SPECIFIC TO UA SURVIVABILITY

Survivability. The capability of an aircraft to avoid or withstand a man-made hostile environment

Susceptibility. The inability of an aircraft to avoid the threats in a man-made hostile environment

Vulnerability. The inability of an aircraft to withstand a man-made hostile environment.

Expendable. The UAV is minimally survivable. Loss of the UA has minimal cost and operational impact; the UA can be quickly replaced or is not critical to operational success.

Survivable. The UAV is highly survivable. Loss of the UA will have a significant cost and/or operational impact.

1. UAV SURVIVABILITY IN COMBAT

UAV's are not a new concept they have been used since 1944 the TDR-1 assault drone that were guided by a pilot in the loop using television to drop bombs on Japanese positions in the Pacific, they lost 3 units out of 50 during the first 2 months of service due to hostile fire.

During the Vietnam War, the AQM-34 was used to collect reconnaissance data. Limited data from 1964-1989 show UAS combat loss rates of 3.9/year during the Vietnam conflict (1964-69), 4.5/year in the Bekka Valley conflict (1981-82) and 1/year over the period of the Angolan Border War (1983-87).

More accurate data set include non-combat losses so that we can differentiate between when the UAV is subjected to direct fire and when it is a case of subsystems failures. Therefore for the period of 1991-2003, which covers the major conflicts Desert Storm (1991), Allied Force (1999) and OEF and OIF (2001-2003), over that 13-year period 185 UA losses were recorded, an average of 14.2 per year. Considering the specific periods of major conflict; 20 RQ-2 Pioneer UA were lost in Desert Storm over a period of less than a year, 18 were combat losses and two were non-combat losses. In Operation Allied Force in Kosovo, 45 UA of various types were lost. Of the 45 losses, 26 were combat and 19 were non-combat. Data available from OEF and OIF over the period of 2001-2003 show a substantial decrease in UA loss rates, with an average of 2.0 combat losses and 2.7 non-combat losses per year over the three-year period.

UAV threats have evolved since there creation, but most of them still remain military jets, and SAM's, while most recent conflicts attribute UAV loses to small arms, air defense artillery and unspecified ground fire, any number of modern tactical, strategic, technological and political factors will continue to affect the threats of UAV's in the future.

Latest threats for unnamed areal systems are not lethal systems but based on electronic warfare or information warfare techniques, that affect they electronic systems and subsystems such as communication, data links, GPS systems. All of these techniques can impale or render the UAV useless.

2. SURVIVABILITY AS A SYSTEMS DESIGN DISCIPLINE

Modern military require that UAV mission take place in "a man-made hostile threat environment. In order for the mission to succeed survivability must be considered but not as an improvement for existent system but as a design feature embedded early on in the design on the UAV to limit the cost of survivability.

The problem of low cost and large numbers versus high cost less numbers and less vulnerable is an onwards debate, if we were to look at manned system's the human life of the pilot would considered the deciding factor and a high survivability would be a priority. But that is not the case for unnamed systems however the mission success there deciding factor, to meet that requirement in a potential hostile environment survivability has to be met, and it has to be taken into account since the design process. However designing such a system requires many more subsystems such as range, payload, cost these will take precedent over the survivability feature.

This aspect may also be true if a large number of expendable assets are available to perform the mission. If one or more of the assets are destroyed, the mission can still accomplished at lower life-cycle cost. A more critical mission in a higher threat environment increases the importance of survivability design features. If few assets are available, completing the mission the first time and with a single vehicle may be imperative. It is important to weigh all the factors in determining how "survivable" a UAS must be to fulfill its specified functional capability.

Considering the survivability from the start of the design process one can make design trade-offs and minimize the potential cost and performance impacts. Changing some aspects later on in the design cycle will come with some performance and cost penalties. An example to prove this point is to band together critically components and shielding them from small arms fire, and from onboard fire. Considering all the faces of the design early on will decrease the overall life-cost cost.

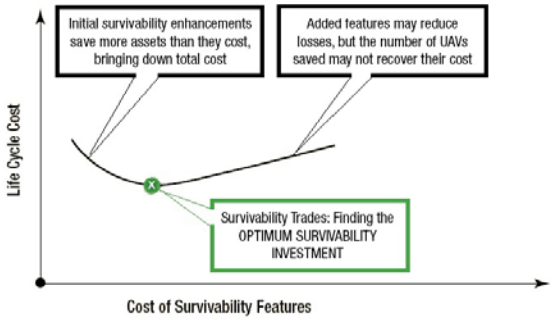

Figure 1. Cost/life ratio

3. UNMANNED AIRCRAFT SYSTEM SURVIVABILITY CONSIDERATION

No matter the class of the UAV they all share the same components: one or more aircraft, a system for command and control of the aircraft and associated payloads, payload(s) and a means of disseminating the information obtained by the payload.

3.1. Aircraft

Because of their wide range of sizes and performances a standard survivability approach is close to impossible. Therefor passive susceptibility reduction measures, such as visual and acoustic signature reduction, may be the only way to increase the survivability of small aircraft due to their limited size. Larger aircraft can support the introduction of active susceptibility reduction measures such as flares, chaff, other decoys, and/or traditional aircraft vulnerability reduction design concepts. The cost and intended purpose of the unmanned aircraft system will inform the decision to invest in the survivability of the aircraft.

3.2. Command and Control System

UAS's have a command and control system for preprogramming the flight and/or direct remote piloting. The command and control system consists of uplink and downlink communications that can be encrypted, navigation equipment and Global Positioning System, applications software to control the aircraft and the payload. The UAV ground station may vary between an laptop to a fixed plant installation within the country of origin, and of course the physical treat to the ground station varies according to this factors.

The uplink transmits command and control information from the ground station to the UAV while the downlink provides health and status information from the UA to the operator. Information for the control of the payload can also be transmitted in the downlink. Generally, these communications channels emit continuously, thereby allowing radio direction finding techniques to be employed against the ground station and its UAV. Depending upon the UAS, the command and control links may be interleaved with the payload (i.e., information dissemination) data link or there may be two separate links.

Vulnerability in the data links is jamming and intrusion by hostile forces. Jamming may degrade the ability of the system to transmit signals between the ground station and the UAV, especially if the antenna on the UA is omni-directional, vice steerable. UAV operating within radio line of sight from their control stations are more likely to use an omni-directional antenna approach, while UA operating through communication satellites are more likely to employ a steerable dish antenna with a relatively narrow beam. Unintentional jamming from friendly or neutral communications emitters may also degrade the UA's capabilities. Hostile forces may intrude into either the C2 or the data link in order to take over the UA or degrade the UA control or payload data reception so that it cannot carry out its intended mission.

Navigation equipment, most likely GPS, and mission management software provide the UAV the capability to fly a given route and execute its intended mission. We have to take in account that GPS is the propriety of UAS and access to it can be easily limited, also GPS jamming is also a vulnerability that has to be Taken into account, leaving the UAV grounded or worst.

The mission management software can also be affected through several means either before or after the aircraft is launched. Viruses, Trojan horses, and other hostile software agents can infect the UAS' software and keep the system from fulfilling its mission.

3.3. Payloads

The mission payloads vary according to the UAV type, with the overwhelming majority of UAV payloads being imaging payloads; therefore this discussion will be limited to imaging payload survivability. Payloads can be either external, as in a ball or pod that hangs from the aircraft, or internal. In smaller, less expensive UAS, locating the payload internally does not dramatically decrease vulnerability. Payloads are generally not specifically targeted in the smaller aircraft because it is just as easy to destroy or degrade the UAV itself.

Although payloads are not subjected to physical treats do their small sizes, they are most likely to be affected by collateral damage, however the payload is the point of UAV's mission any damage to this subsystem will render the UAV useless.

3.4. Dissemination Means

The normal way of an UAV to disseminate information is via data links. Depending upon the system, information may be processed onboard the aircraft or transmitted to the ground for processing. In either case, the communications channel is susceptible to detection, radio direction finding, intercept, and electronic attack efforts. If the UA is transmitting a live video feed, the communication channel is likely to be wideband and continually emitting.

Encryption of the data links would reduce the possibility of successful intercept and exploitation. Depending upon the UAV system, the dissemination data links and the command and control links may share the same frequencies and be interwoven through multiplexing schemes.

The data links and the transit and receive equipment associated with the dissemination of information are susceptible and vulnerable to the same efforts that threaten the command and control links. The dissemination data links on larger aircraft should be encrypted, as they are more likely to be relaying data that are of interest to higher echelons. Conversely, handheld/small and tactical UA may not require encryption devices because it is harder to intercept their dissemination signals (closer to the ground station and flying at lower altitudes) and because the information they collect and disseminate is highly perishable.

4. SURVIVABILITY CLASSIFICATIONS

If we are to consider the survivability of the airframe it is more logical to divide the UAV's in 3 categories (small, medium and large) based on the size, operational altitude and speed. These categories will help consider the type of threat that they are susceptible and also their operating environment so that survivability can be applied. Although categories are useful this should not be taken into account has a deciding factor, studies for individual UAV is key, for they are unique in their design and missions.

Small. UAV with a MTOW weight less than 225 kg, a wingspan of 6 meters or less and that operate at altitudes below 3,000 meters and 185 km/h. They are generally used for tactical reconnaissance. Examples include the Raven, Dragon Eye, Pioneer and Shadow.

Medium. UAV with a MTOW weight between 225 and 2250 kg, a 6-18 meters wingspan and generally operate at altitudes of 3,000-10,000 meters and below 460 km/h. They are generally used for tactical or operational reconnaissance, they can be equipped to for supplies drop offs. Examples include the Predator and Fire Scout UAV

Large. UA with a MTOW weight above 2250 kg, wingspan longer than 18 meters and that operate above 9,000 meters and over 460 km/h. Used for operational or strategic reconnaissance, these types of UAV have long endurance and also can be outfitted with weapons. Examples include the Global Hawk, Euro Hawk and also Taranis.

5. THREATS BY SURVIVABILITY CLASSIFICATION

For the real assessment of UAV threat the system has to be treated as a one that includes ground stations and data link as well as the aircraft itself. The wide varieties of weapons have to be taken into account such as energy weapons (DEW) and nuclear, biological and chemical. Table 1 shows a basic of the threats that UAV have to face on the modern battlefield.

Table 1. Survivability classification lethal threat matrix

Survivability Category	Ground Fire	Air Defense Artillery	Shoulder Launched Missiles	RF Missiles	Air-to-Air Missiles	Laser	NBC
Small	✓					✓	✓
Medium	✓	✓	✓	✓		✓	
Large – Low Altitude	✓	✓	✓	✓	✓	✓	
Large – High Altitude				✓	✓		

Table 2. Survivability classification non-lethal threat matrix

Survivability Category	Jamming	Deception	Meaconing	Intrusion and Exploitation
Small	✓	✓		
Medium	✓	✓	✓	✓
Large – Low Altitude	✓	✓	✓	✓
Large – High Altitude	✓	✓	✓	✓

6. SURVIVABILITY EFFECTIVENESS

The decision sub-criteria identified for evaluating survivability effectiveness are as follows: (1) Situational awareness; (2) Stand-off range; (3) Signature reduction; and (4) Countermeasures.

6.1. Situational Awareness:

The overall information is shared over a network enabled system that is self-synchronized to enhance survivability. The extent of awareness is calculated by an assessment program that includes the following: (1) Systems integrated in the network; (2) Degree-of-communication across systems; and (3) Criticality of the data in enhancing survivability. The system gives a score depending on the above factors which is measured an a degree of situational awareness, although the score may vary in a short period of time the total an average score is kept.

6.2. Stand- Off Range:

Stand-off range is the distance that a system can effectively operate while still being beyond the effective range of hostile threats. Greater standoff ranges provide increased survivability

6.3. Signature:

Signature reduction enhances survivability by limiting the capability of the adversary to detect the system and follow offensive action. The type of signatures and the way adopted to address survivability is as follows:

Visual: This signature is governed by physical size of the system (VTUAV), where survivability is enhanced by smaller designs. UAVs are classified as micro, small, medium, and large based on its maximum takeoff weight, wingspan, operating altitude, and speed. The size difference is significant between the variant classifications, but does vary within the classifications.

Acoustic: The main contributors to noise are the propeller, and motors. The acoustic signature is estimated based on an assessment matrix which includes the following: (1) Type of motors - electric, turbine, diesel, solar-powered and futuristic technologies; (2) Location - external or internal; (3) Tip shape and speed - lower tip speeds and non-squared tip shapes provides low acoustic signatures; and (4) Tail propeller configuration -NOTAR anti-torque system reduces acoustic signature. The system in consideration is allocated scores based on these parameters. The total score is a measure of the acoustic signature.

Thermal: The major source of heat is the propulsion subsystem of the UAV. The thermal signature is estimated based on an assessment matrix which includes the following: (1) Mufflers that reduce heat from engine exhaust; (2) Heat-absorbing materials; and (3)

Cold air mixing that reduces heat from the engine exhaust. Air friction creates heat on the leading edges of an aircraft. The system in consideration is allocated scores based on these parameters. The total score is a measure of the thermal signature.

6.4. Countermeasures:

Active countermeasures such as warning sensors (radar, laser, and missile), jammers (radar and infrared), and chaff and flare dispensers enhance survivability by countering the threat of missile fire. Contribution to survivability from a system's countermeasures is measured by the number of defensive systems in the payload design and their effectiveness in countering the threat identified in the operational environment.

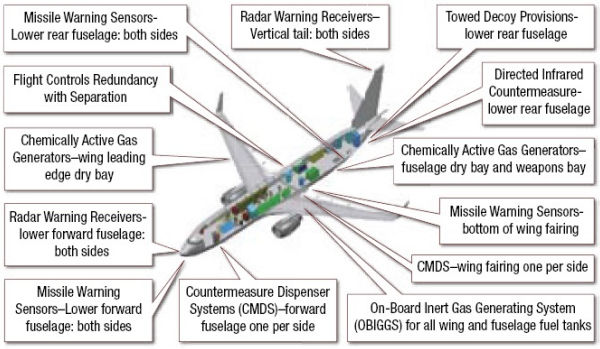

Figure 2. Types of countermeasures

CONCLUSIONS

UAVs present major challenges if they are to survive as an independent system. It is necessary to implement better procedures that require new and innovative technologies, with better and safer capabilities in the automation and optimization of mission planning in unstructured environments within the entire flight envelope. It is also necessary to accommodate subsystem/component failure modes without major performance degradation (the maximal takeoff weight and the aerodynamics of small vehicles are very sensitive to all the additional equipment's) or loss of vehicle and to perform extreme maneuvers without violating stability limits.

The future work regarding the swarm problem opens new avenues of research where the intelligent control community can contribute significantly in terms of smart coordination / cooperation technologies.

We believe it would be very important to continue work on this study with reference to specific situations, especially military actions, under different conditions from the above study. The primary characteristic is represented by the existence of hostile environment. In this case in the same airspace there will operate aircrafts (including UAVs) from both conflicting sides, which will not be cooperate with each other to achieve the separation minima, but they will even try to postpone or even collide with the enemy aircraft. This situation is more complex as in the same airspace is shared with operating civil aircrafts from some operators that are neutral to the conflict.

The survivability concept has been presented as a new view on the way to designing future UAV's, although implementing the survivability on existing systems is not always recommended because of the cost/life beneficiary, this remains to be established for the individual UAV's already existing on the market.

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LUAV'S ARE THE RIGHT APPROACH FOR SURVEILLANCE CIVIL MISSIONS

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Abstract: Surveillance missions are among the most needed ones in monitoring the environment and in modern disaster management mechanisms emergency situations. Environmental monitoring is part of the management of reserved areas and nature parks. In pre-disasters situations, environmental emergency organizations need the most possible information brought right from the center of the ground evolving processes. The information a LUAV (Light Unmanned Aerial Vehicle) can get or measure through its sensors is various. In a flight above the endangered area, one may get visual, IR and/or thermal images, take air samples and measure toxic emissions or radioactivity levels. For people dealing with a HAZMAT operation, having accurate and most complete information can be a matter of life and death situation. Also, whether a disaster occurs naturally or caused by manmade event, a quick response is then critical for all the implied actors. Being able to quickly get an overview of the extent of injuries, damage, existing and potential hazards along with a live map of the access and exit points allows you to prioritize resources in order to start effectively managing the disaster site. All the information obtained without jeopardizing people plays an important role in modern disaster management and helps organizations identify and prevent further disaster risks.

***Keywords**: Light Unmanned Aerial Vehicle, environmental monitoring, disaster management*

1. INTRODUCTION

In civil sector, since the military has demonstrated reliability and usefulness of the UAVs, the Unmanned Aerial Vehicles have already outlined many potential uses[1]:

Thus, for the interior administration, the UAVs have shown their value for actions such as monitoring the occurrence of emergency/dangerous situations and monitoring their evolution, maintaining public order, border security, coastal protection and monitoring traffic.

In the fight against fires in large areas (forests, grasslands) the UAVs have shown their value for early detection of fires - in areas far from human settlements, as in forests or in hights, early detection of other major accidents, finding survivors in inaccessible areas (for example, in the mountains or flooded areas).

In the energy sector, UAVs began to be used for monitoring the infrastructure and pipelines for oil and gas distribution and for monitoring the distribution networks for electricity.

In agriculture, or in wood harvesting and fishing, UAVs are being used on an increasingly wide scale for monitoring natural environment, spreading of chemicals in agriculture, or for natural resource monitoring, in order to optimize their use, as for protection of fish ponds.

In applications of land surface observation and remote measurements of the environmental parameters, UAVs are appreciated for mission as climate monitoring, aerial photography, maps and cadastral surveys for the construction of bridges and roads in inaccessible areas, monitoring the occurrence of seismic events, aerial archeology.

In Fig. 1 may be seen a faster trend of growth for the civil sector, compared with the military one. As a result, it's just a matter of time before research and development of civil applications where UAVs are more numerous, will surpass those of the military

Fig. 1 – The estimated evolution of the European military and civil UAV markets [2]

2. LUAVS IN MODERN DISASTER MANAGEMENT MECHANISMS EMERGENCY SITUATIONS

In situations marked by natural disasters caused by man-made event, it is essential that the response of those who must act in such critical situations to be a quick one. This may help especially the injured and at risk persons.

Using a light UAV, which can be launched from nearby the disaster scene, or from a command center, will allow, firstly, to obtain in a short time an extended picture of the degree of destruction and damage, and will allow warnings on existing and potential hazards.

Also, with the help of the LUAV, it may be created a live map of access and exit points. This allows prioritizing resources in order to start effectively managing the disaster site.

LUAV may be equipped with a high resolution camera, high definition video camera, a high resolution black and white low light camera or a camera, high resolution IR camera. All cameras may provide live feed so that on-ground personnel will see the disaster scene as being on-site. Also, the images obtained, they may be recorded for a thorough examination and review.

Thus, with a LUAV, it may be obtained assistance of quality in providing summaries on the current situation. Decisions on what to do are based on the analysis of what happened, with information obtained with a high probability.

This emergency situation is managed effectively and human and material resources that are allocated to redress the situation may arrive in time to all those who really need them.

3. NON-INTRUSIVE SURVEILLANCE OF THE ENVIRONMENT

Natural ecosystems have a wide distribution not only spatial, but also a wide range time variability, which makes their monitoring difficult. Since ecological systems are functional systems with complex organization, generally, the structural modifications are visible either from one year to another, and only in case of major environmental accidents, or if developing on short term.

Monitoring system which must be created aimed at identifying and quantifying the state variables that characterize the structure and functions of ecosystems. Also the monitoring system should emphasis the internal and external factors that could threaten their ecological integrity of the ecosystems.

The goals set for such a monitoring system are: aerial surveillance of the protected areas, in order to help their conservation and preservation of the biological diversity. As a result it may be controlled - without the direct presence of man - different ecosystems in severe environmental conditions, such as, for example, those existing in nature reserves. [3]

Starting precisely from non-involvement in the environment, it was necessary to design an aerial vehicle that is based on an alternative propulsion system, which should not alter the environmental parameters monitored.

4. MEDIAS - A NON-POLLUTING LUAV, MEANT TO MONITOR THE ENVIRONMENTAL PARAMETERS

As far as the UAV with the above mentioned destination is concerned, there are a number of special design restrictions resulting

from the limited field of activity where it has to be used.

The environmental monitoring project described in this paper mainly focused on interaction with the environment. The authors carefully considered its environmentally-friendly dimension. Consequently, the design specifications required that the vehicle should have the lowest possible impact on the environment. For an UAV meant to monitor the parameters of the natural environment, the main restriction is to be non-polluting, in order not alter the environmental parameters which have to be measured, in any way.

Engine and propulsion. This first design feature is at the same time a design restriction requires solutions which involve particular aerial vehicle propulsion. In short, the design task is to have a non polluting propulsion. Our solution was an electric engine driving a propeller.

Speed and autonomy. Other secondary UAV characteristics connected to the task of performing scientific research missions are:

1. They do not need a high cruise speed; this is due to the fact that the vehicle carrying mobile sensors should also be able to keep the same aerial position for a long time in order to perform certain tasks of monitoring natural environmental parameters;
2. Since it has been assumed that the cruise speed would be low, the duration of the mission / the autonomy should be - on the contrary – higher, amounting to several hours (up to 24 hours or more);
3. Since mission autonomy should be relatively high for a small LUAV (less than 150 kg) – "Light UAV-category", this implies that the propulsion system must to be highly efficient. At the same time, the fuel tank and/or the onboard power source should provide increased autonomy.

Taking into account these characteristics, we searched for solutions to increase the efficiency of the propulsion.

As a first solution, we adopted a ducted propeller due to its superior efficiency.

Afterwards, we vertically redirected the exhausted air currents in order to add some reactive force to the sustentation. The Coanda Effect seemed to be a suitable solution, because it was able to vertically redirect the exhausted jets from the propeller duct, adding more air masses from the vicinity of the vehicle in the same process. All these additional effects were achieved only by reusing the energy of the air entrained by the propeller.

Size/dimensions of the vehicle and payload. As far as the dimensions and weight of the vehicle are concerned, there are more constraints. First, we need a payload of at least 3-5 kg, but we also have to keep the overall size under a minimal value (taking into consideration the deploying demands).

If the mission requires more or heavier sensors and equipment, we shall add an extra inflatable chamber inside the UAV filled with helium, making it a type of a balloon of no more than 1..1.5 m in diameter.

Final design. The MEDIAS project is a VTOL UAV with a hybrid design.

Because of the restrictions imposed on this aerial vehicle, the solution which was finally chosen is characterized by the fact that the UAV shall use the Coandă Effect (I) and an electrically driven propeller (II); alongside these features, optional conversion and use of solar energy will compete at improving and increasing the UAV's mission autonomy. The helium optionally added inflatable chamber (III) will also increase the functionality of the MEDIAS-LUAV.

The specific contribution of each device to the propulsion and sustentation of MEDIAS

aerial vehicle is shown in the next scheme (Fig. 2)

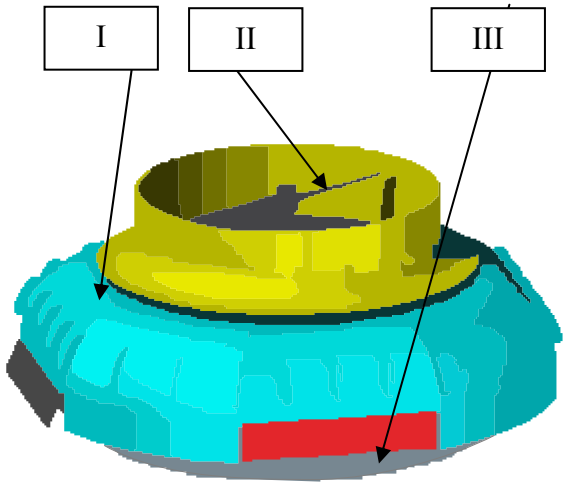

Fig. 2 - The specific contribution of each device to the propulsion & sustentation of MEDIAS-LUAV [4]

The first tasks for the experimental model within the project will be either photo- or video- recordings with scientific purpose or real time monitoring of the nature reserves and of the areas found within the range of the remote control.

Besides the measurement of environmental parameters, the MEDIAS-LUAV described previously will be able to carry out a large variety of missions such as:

- Wildlife inventory and species conservation, especially in mountains or wetlands,
- Forestry or fishery inspection,
- Forest and crop disease management,
- Forest and crop fire detection and firefighting management,
- Monitoring of natural disasters (water flows, avalanches, oil spill tracking) etc...

5. CONCLUSIONS

1. When studying the environment, those LUAVs, that have a suitable structure designed in a such manner as to not pollute by themselves, are an appropriate solution. MEDIAS-year LUAV is an example of non-polluting aerial vehicle, meant to monitor the environmental parameters and, at the same time, having the lowest possible impact on the environment.

2. The vehicle will have an innovative design being a hybrid between the following three devices:

I. An air vehicle - propelled by air jets;

II. An air platform - which ensures its sustentation by using a propeller;

III. An aerostat - which contributes to the improvement of some of the flight parameters.

3. The MEDIAS project has a notable characteristic: it uses the well-known, yet not so much studied, Coandă Effect, in order to sustain, propel and steer the vehicle.

This effect seems to be more promising than those used nowadays, regarding the energetic efficiency supplied.

4. MEDIAS-LUAV project is also an interdisciplinary one, environmental sciences specialists joining their efforts together with engineering sciences ones.

6. ACKNOWLEDGEMENTS

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ASPECTS REGARDING THE CONCEPT, DEVELOPMENTAND USE OF MODERN UAVS

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***Abstract**: UAVs, constitutes an important branch of aerospace, UAVs sites because construction and operating costs incomparably smaller than the well-known aircraft will be used increasingly over the coming decades. . The armed interference must be done based on some highly accurate information that must be gathered without endangering the human lives. The armed interference must be done based on some highly accurate information that must be gathered without endangering the human lives. This is the role the unmanned air vehicles (UAVs) presently play; they can perform both the function of surveillance, information gathering, data storage and their transmission to the ground stations, and the function of interference, when needed.*

***Keywords:** UAV systems (UAS), theater of operations, conflict zone, intelligence.*

1. INTRODUCTION

Unmanned aircraft in the general sense is the vector actually and equipment that are located on its board. Together executing specific tasks which were built and designed.

The unmanned air vehicles (UAV) have reached an unprecedented level of development and distribution and in the next two decades they will probably take the lead on the battlefield. From a strategic point of view, USA have issued a long term development plan since 1997, which they have subsequently upgraded, thus we can now speak about a UAVs hierarchy depending on the destination, action area, intervention means within the battlefield and the conventional echelon that operates them.

If in the first Gulf war a single UAV had been used, eight years later their number reached three vehicles used by the allied forces in Iraq, especially for aerial research and surveillance {7}. Initially, in Afghanistan there have also been used three UAVs, the essential difference being that there the first RQ-1 Predator had been used, having been engaged in battle missions, together with data gathering or surveillance missions.

RQ-1 Predator Unmanned Air Vehicle

The purpose of this paper is to review the unmanned air vehicles, the status of the technological development in the field (especially in the European Union country members) and to present the role and importance of UAVs within the current theaters of operations, as well as the capabilities this type of airplane may have, through the comparison between the strategic mission and the current technological level.

UAV: A powered vehicle that does not carry a human operator, can be operated autonomously or remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic or semi-ballistic vehicles, cruise missiles, artillery projectiles, torpedoes, mines, satellites, and unattended sensors (with no form of propulsion) are not considered unmanned vehicles. Unmanned vehicles are the primary component of unmanned

systems.

NASA tehnology

UAV is contiunes field expansion in both constructive solutions and the tasks that can be fulfilled by them, whether using UAVs to the top sites were military excusiv currently have a wide use in civilian areas. UAV sites today know a great variety of shapes, sizes, configurations and construction characteristics.

The main reasons to use this type of aircraft is reduced construction and operating cost compared with older sisters with human pilot.

Note that air vectors satisfying simple missions do not require specialized training of human operators on the ground, but the situation changes in UAV sites that have a high degree of complexity of construction and equipment on board, it is necessary both to a specialized training of human operators as well as a logistics training. Another important indication is that missiles are not part of the UAV category sites for simple reason that they can be reused after the mission although they may be (self) guided.

2.CLASSIFICATION UAV SITES

The most important criteria for the classification of unmanned aircraft:

a. in terms of weight:

Category	Weight	Sample
Micro	Sub 5 kg	Dragon Eye
Mini	5 – 50 kg	RPO Midget
Light	50 – 200 kg	Raven
Medium	200 – 2000 kg	A-160
Heavy	> 2000 kg	Global Hawk

b. in terms of andurance and range of:

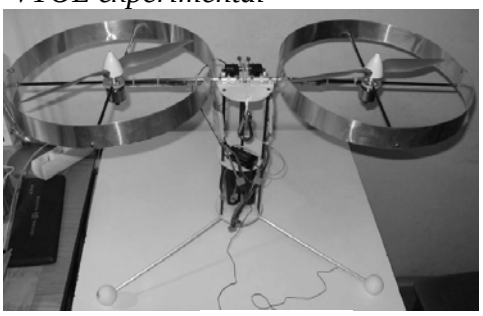
- andurance / low range: up to 1 hours (short mission) and the range under 100 km
- andurance / medium range: between 1 and 5 o'clock and range between 100 and 1500 km
- andurance / high range: 5 to 24 hours and range between 100 and 250 km
- andurance / veryhigh range: over 24 hours and the range between 250 and 22000 km

c. in terms of altitude at which it operates:

- Low altitude - up to 1000 m,
- Average altitude - between 1000 and 10000 m
- High altitude - more than 10,000 m

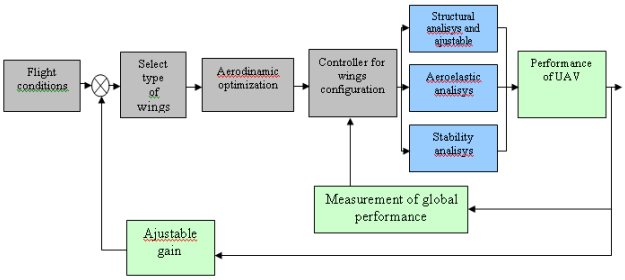
3.TYPES OF UAVS

Category micro unmanned aerial vehicle MAV VTOL experimental



MAV VTOL

The final goal is microUAV experimental audio-video surveillance enclosed large perimeters. Quiet diesel engine provides the air carrier near the zones of interest.



Model UAV

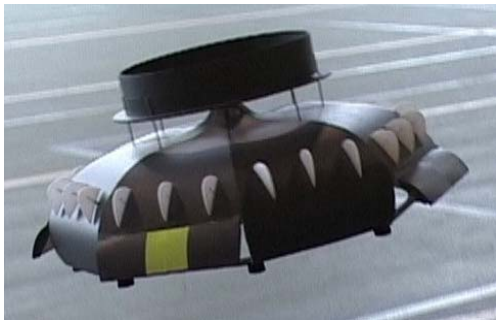
The limitations imposed by the concept of morphing described below for optimized wing complies with the conform limits of the execution mechanism. The main differences between optimized wing shape and deformed wing shape are the following:

• Reorient the wing sections in the deformable space occupied by the mechanisms and therefore loss of this area of wings;

• Failure of the mechanism to provide an optimal structure to a good aerodynamic shape with curved lines between control points;

• Limitation of the mechanism in changing the profile for low-speed flight.

In 2006, Jean-Louis Naudin made and tested his first UAV (GFS-UAV model N-01A). This one, propelled by an electric engine, was using the Coandă effect to take off vertically, fly, hover and land vertically (VTOL).



J.-L. Naudin's first GFS-UAV (N-01A)

The design of the GFS-UAV N-01A was based on the Geoff Hatton' flying saucer from GFS Project limited. In the next year, Jean-Louis Naudin freely published the full plan of the GFS-UAV N-01A and a detailed tutorial to help UAV fans to replicate his GFS UAV.[**Error! Reference source not found.**]

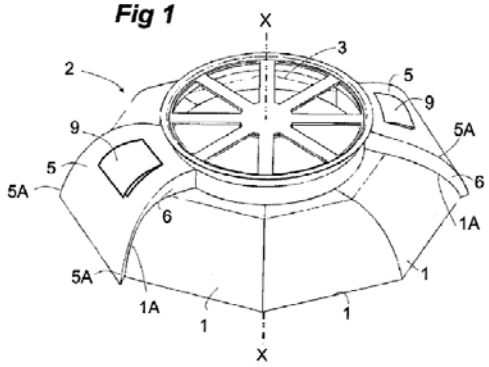
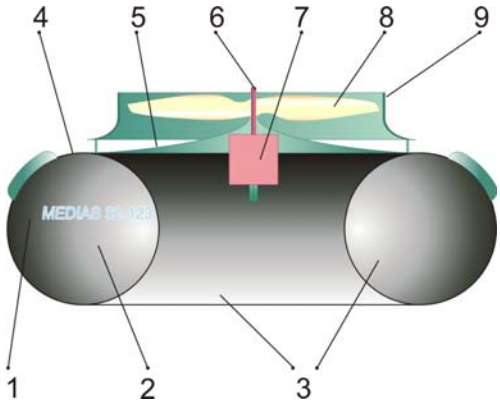


Fig. 1 Geoff Hatton's 2007-UAV model

In 2007 Geoffrey Hatton presented an optimized control for his family of Coandă UAVs, this time improving the airflow over the outer surface, especially in open air, when it may be disturbed by a lateral wind. [**Error! Reference source not found.**]

In 2008, in Romania, an academic consortium, with researchers from Galaţi, Iaşi and Bacău universities, coordinated by the author, obtained, for the researches on Coandă effect, a national grant from CNMP, (contract no. 32-123), for the surveillance and protection

of the natural environment, using a Coandă UAV.



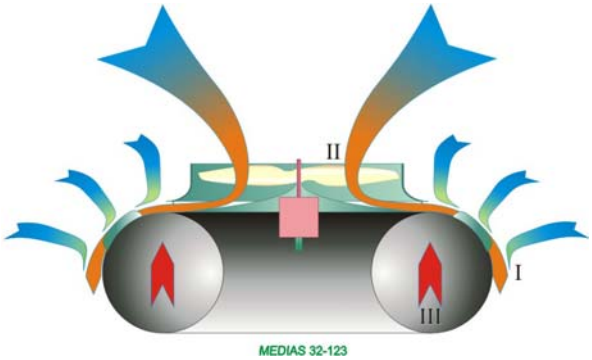
MEDIAS components **Error! Reference source not found.**

1 - curved upper surface; 2 - steering flaps; 3 - toroidal He chamber; 4 - counter-rotating fins; 5 - inner exhaust profiled cap; 6 - propeller's shaft; 7 - electrical motor and batteries; 8 - propeller; 9 – propeller duct

According the contract, this new UAV, named MEDIAS, had to be in the same time a modern and a nonpolluting aerial vehicle, easy to maneuver and safe to the environment and people.

As a main characteristic, MEDIAS with his adequate shape, uses the Coandă Effect (I) for lift and maneuverability. An air flow created by an electrically driven propeller (II) flows over the upper surfaces of a curved radial canopy and changes the pressure field above and under the vehicle, creating more lift and improving the stability of the flight.

A toroidal Helium optionally added inflatable chamber (III) is increasing the buoyancy and functionality of the MEDIAS VTOL UAV design and is increasing also the UAV's mission autonomy.



The sustentation and propulsion components of MEDIAS UAV

This high propulsion efficiency will be obtained because, besides using Coandă effect, the vehicle has an innovative design, MEDIAS being a hybrid between the following:

I. An aerial vehicle - propelled and steered by Coandă effect and vertical air jets,
II. An aerial platform - which ensures its sustentation by using a propeller, preferably ducted, for a greater efficiency,
III. An aerostat - preferably filled with Helium - which improves some of the flight parameters.

However, the Coandă effect, as physical phenomenon used for sustentation, should allow it to lift and carry a significant weight compared to its estimated energetic consumption.

For an increase in efficiency, the electrical driven propeller itself was mounted in a central duct. In this particular arrangement, also the air volumes entrained by the Coandă effect became several times multiplied.

UAVs are designed and manufactured depending on their mission and they may perform one of the following roles [5, 6, 11]:

- **surveillance** representing a monitoring process of the humans', objects' or processes' behavior, to be compared to the expected or required norms (for example, detecting some nuclear, biological or chemical activities or phenomena);
- **intelligence** considered to be a military branch of knowledge, which concentrates upon the gathering, analysis, protection and the dissemination of the information about the enemy, field and weather in the military operations area or within the area of interest;

1 History of Unmanned Aerial Vehicles - www.vectorsite.net
2 The Role and Importance of UAV Within the Actual Theaters of Operations NICULAE MARIN, ELENA MARIN, AFASES 2010 BRASOV
3 Civil Aviation Authority - CAP 658, Model Aircraft: A Guide to Safe Flying, United Kingdom, June 2003;
4 Policy for Unmanned Aerial Vehicle (UAV) certification, EASA-AMENDAMENT (NPA) No 16/2005;
5 Civil Aviation Authority of New Zealand, January 2007;
6 Pahonie R., Cîrciu I., Boşcoianu M.- „AN ANALYSIS OF DIFFERENT ROTARY WING MICRO AIR VEHICLES SOLUTIONS"- Metalurgia Internațional No.7 Special
7 Geoffrey Hatton, Simon McIntosh, GFS Projects Ltd., *Craft having flow-producing rotor and gyroscopic stability*, UK Patent Office no. GB 2,424,405 /23.03.2005

- **reconnaissance** having the purpose of inspecting or scanning an area to gather information;
- **communications,** in which case they can perform units connecting missions, including the connection to the higher command structures;
- **insertion** for the load delivery within specific target areas. For military purposes, we can talk about weapons airdropping (not necessarily lethal) and that could also include electronic war actions and target destruction actions. The electronic war actions may have two features: the attack against the enemy, for the electromagnetic jamming or by high energy weapons bombing of the convoys, and the protection of their own and allied communications, equipments or objectives;
- **target** represented by a UAV that can be used to simulate a fighter aircraft or a missile in the following purposes:
  - operators' training, in this case being considered as a **practice target**;
  - the imitation of any kind of a person, object, phenomenon to mislead the enemy surveillance devices or the enemy report, in this case the UAV being used as **bait.**

References:

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INTRODUCTION MORPHING TECHNOLOGY IN UNMANNED AIRCRAFT VEHICLES (UAV)

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Abstract: *The intent of this paper is to review the origin, history and the morphing UAV types and principles of automatic command and control system based on the concept. While the mentioned UAVs have high enabling capabilities, they are limited to a single-role mission or application specific tasks.*
Keywords: *morphing, flying wing, UAV*

1. INTRODUCTION. BIO-MECHANICAL ASPECTS OF FLYING WING

Researchers have long recognized that birds were able to change their body position in flight in order to perform specific maneuvers or adjust their aerodynamic profile to suit flight condition. This orientation adaptive body shape has been termed 'morphing' in specific literature. The words 'transform' and 'morphing' are actually forms of the word 'metamorphosis', which derives from the Greek 'meta' (change), and 'morpheme' (form). That is the description of the capability to change shape or geometry of their bodies and wings for both a heightened maneuverability and a stable flight within multiple environmental conditions. Darwinist selection played a crucial role in refining the wings. The type of habitat the animal lives and how flying exploits this habitat are closely related to body size, wing shape, flight style and power of flight (Fig. 1).

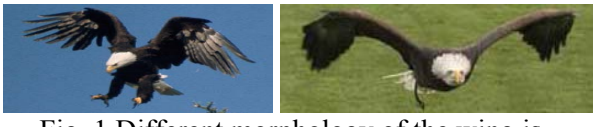


Fig. 1 Different morphology of the wing is required for various flight activities (birds: 8,000 species, 2…12000 g; bats: 800 species, 3…1400 g)

This ability has always been respected and often duplicated by aviation engineers, to the extent that it was technologically possible. Nevertheless observations of birds have inspired in numerous cases the technological progress in aircraft design and development.

For instance Figure 2 shows the types of wings of four different birds. Wings with low elongation (6.8) such as pheasant wing, usually allows rapid and slow take-off, but not useful for gliding. The wings with 9.3 elongation (eagle wings) are usually longer and have feathers, which are adjusted as a type of control surface for more precise handling. Wings for waders, with an elongation ratio of 12.5 are useful for higher speeds and sliding, but not for a quick take-off, because a large amount of energy is needed to train such long wings. 13.8 lengthening wings of seagulls, are usually useful for close sliding surfaces, such as sea and land to take advantage of air currents in order to preserve energy.

Fig. 2 Types of wings depending on the elongation

Birds and bats are capable of changing their wingspan and lower bearing surface, herein

increasing the speed of advance. The rope can be modified wing and the wing twist can be transformed in order to change the aerodynamic performance.

Senses. Flying creatures and machines have to be able to detect and to sense the atmosphere around their state and their structural position and configuration in order to conduct the flight in a given environment. Examples of types of data to be collected are: air speed, altitude, air pressure, position against other objects, beside their wing' position and shape at any given time. This capability may require highly specialized sensors aboard the aircraft, such as gyroscopes and angular orientation devices to capture air pressure along the wing.

Birds are capable to make use of these senses, such as seeing, hearing, smell, but must rely also on some special sensor systems: cross-location for bats, linear and angular acceleration for birds, very sensitive mechanoreceptors that allow insects to feel the approach of potential predators. As suggested in recent research, the birds are able to feel the Earth's magnetic field, provided valuable information for navigation.

Processing. Input signals from the eyes, ears, and specialty sensor systems are to be integrated and processed in the brain or the flight computer. Processes to be performed include specialized algorithms for flight stability, guidance, navigation, and control. Flight stability is probably the most important of the above mentioned functions, because without stability is impossible to remain in flight, and lack of stability in flight could lead to tragic results. The aircraft' flight stability algorithms are executed at processing speeds and top priority. Orientation is the function that determines the current position in space with the highest possible accuracy.

On the other hand, navigation is comparing information obtained at the crossing points with known geographical positioning in order to compute the "best" way ahead for the flight to reach the desired destination. The control functions perform the navigation guidance and generate commands to steer the drive along the calculated rate. In biological flight, these commands are electrical impulses from the brain that stimulates the muscles and organs. At the aircraft, orders are also electrical signals activating the electrical or hydraulic motors.

Operation. Flying morphing requires specialized structures and actuators to alter the position of the intended structures. Natural biological flight requires dedicated and specialized skeletal muscles to perform the corresponding figures of aerial acrobatics.

Skeletal mechanism provides a geometric relation between the inner and outer bone expansion. Such a mechanism allows the birds to go through a variety of positions using a single movement, each position being stable and allowing a unique capability within the flight envelope. Specialization of this skeletal mechanism for in-flight morphing which determines the required movement is produced by means of subsystems. Each of these subsystems requires specialized components to allow changes in flight. The way in which the subsystems interact is paramount for a contribution to airworthiness. Sensory signals should provide useful information for stability, guidance and navigation, not forgetting the sufficient computing capacity for speed and feed-back. Computing function should have information about the actuator configuration and the output signals in order to give the appropriate command to achieve flight stability and to successfully execute any desired motion in flight. Finally, action must have the dynamic range, the magnitudes of force and torque to make the necessary changes in body shape and position in time.

2. MORPHING CONCEPT

A morphing aircraft is generally defined as an aircraft whose shape is changed during flight to optimize performances. Types of changes include scale, chord, volume, bearing surface, the thickness profile, elongation and planform. Morphing could also be applied to command and control area in order to remove the hinges. Morphing can be used as a control element by changing the shape of the aircraft in order to change the dynamics of flight.

Wrights developed the idea to change the airplane's aerodynamic features by modifying the shape of the wings, using the techniques of structural deformation. Another method is a variable dihedral angle for aircraft's stability with the change of wingspan.

The morphing technology is not limited to crew-operated aircraft, developing a new generation of UAVs that in conjunction with the advanced technology materials has led to renewed interest for radical configurations of morphing. Current research focuses on changing wing configuration, namely: scale, thickness, planform, which showed that a morphing wing without classical surfaces lead to improved performance, herein extending the aircraft's

2.1 1D Change. The one-dimensional change of wingspan is represented in Fig. 3. By making a major variation in the size scale of a small section of wing, wing aspect ratio can be optimized for various flight missions. In addition, differential span change between wingtips can generate a roll moment, potentially replacing the aircraft ailerons.

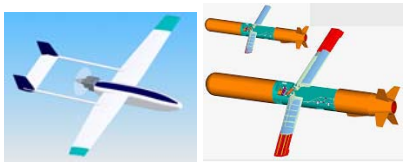


Fig. 3. Change span of UAV, 1D change.

2.2 Concept of Morphing Buckle-Wing – 3D Morphing

Fig. 4. DARPA Morphing

- The UAV (3D Morphing, Fig. 4) has the capacity to change the configuration of its wings from a single one in two wings glued to the extremities

2.3 Morphing Wing Concept Generation (NASA). There are aircraft with wings that have the capacity to change the shape of the planform during the flight with a 200% elongation, a 50 % wing area, and with 20° the wing sweep. The concept of morphing by DARPA was further developed in the Phase II program called MAS (Morphing Aircraft Structures). The 'wing folding' concept developed by Lockheed Martin allows variations on the span, aspect ratio cord's angle and effective sweep angle (Fig. 5).

Fig. 5 Morphing by Lockheed Martin MAS & NextGen Aeronautics

2.4. Total Morphing concepts for UAV. The aircraft with the total morphing are flying vehicles that change their shape in order to accomplish the stated mission without the use of conventional control surfaces or seams for flight control (Fig. 6). The aircraft built with morphing technology promise the distinct advantages of being able to fly many types of missions, to perform radically new manoeuvres not possible with conventional control surfaces, to be more fuel efficient, and to provide a reduced radar signature. The key concept is full integration of the control shape of wing structure with a truly intelligent structure. The design of these vehicles must take full account of the aerodynamic loads and must carefully consider the power requirements for shaping control to ensure an overall performance benefit.

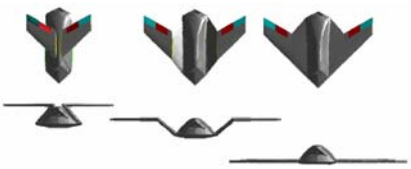


Fig. 6. Planform changes - Lockheed Martin 'Folding Wing' concept.

Morphing aircraft is an ideal aircraft with the ability to modify the external form for extreme performance requirements of the tasks (Fig. 7).

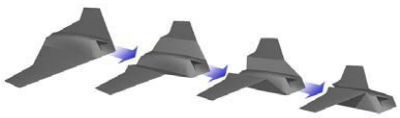


Fig. 7. DARPA Morphing aircraft

Case of Flexible Wing (Inflatable Wing). This wing inflates during flight (University of Kentucky) and it is reinforced under the action of UVs during the ascension made with the help of a balloon. Researchers from Dover had a similar approach (Fig. 8), with wings powered by

piezoelectric means. The wing is inflated and deflated, according to the needs of control during the flight and is able to change shape tips, such as NACA profiles (NACA 8318 and 0018).

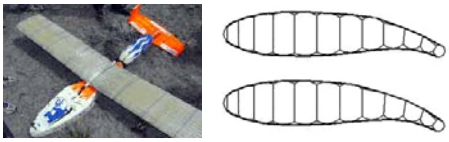


Fig. 8. Inflatable wing

Another interesting morphing UAV concept comes from 1950, involving the idea of inflating and deflating wing for storage and transport. The idea came from the auto casings produced by GoodYear which created "Inflatoplane", a plane for rescuing the pilots dropped-in behind the enemy lines.

Morphing for rotary wing (RW). Using the latest piezoelectric technology, European Aeronautic Defense and Space Company (EADS) has been able to successfully reduce the noise of helicopter blades by 20%, while reducing vibration in the cockpit by 90%. This allows a smooth and comfortable flight for the crew and passengers. They have accomplished this by incorporating multiple piezoelectric amplifiers, which measure actively and reduce vibrations caused by blade at high speeds. Board of flight of the blade has 2-3 actuators able to modify the geometry with 10 degrees. The actuators are controlled through fiber optics by the control block mounted above the rotor hub. Actuator reacts so quickly that each flap on each blade can be opened and closed 30-40 times in a rotation when the rotor has 400 rpm (rotations at cruising speed). Piezoceramic actuators are suitable for this application because they are able to move very quickly against high forces on short lengths. Any other approach would be unlikely and impractical.

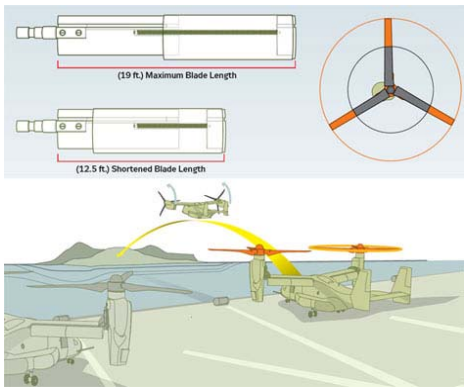


Fig. 9. V-22 Osprey rotor morphing

The blades of the RW aircraft have also been modified by increasing the length through centrifugal forces, based on the methods developed by State University of Penn. This would be ideal for a vehicle which needs the available power to lift higher.

3. FUTURE DEVELOPMENTS IN THE FIELD OF MORPHING UAV

NASA Dryden Flight Research Center is promoting the idea of morphing structures that will improve various aspects of flight. It is believed that a morphing structure could bring a reduction in noise, an increase in fuel efficiency, improved safety and handling, lower approach and landing speeds, better adaptability to short tracks, and extensive versatility.

Fig. 10. Morphing technology envisaged by NASA

Another research trend is credited to Hypercomp NextGen, Fig. 11, which performed substantial changes in plan, form and surface.

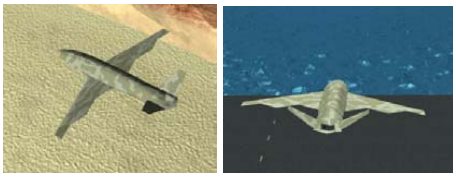


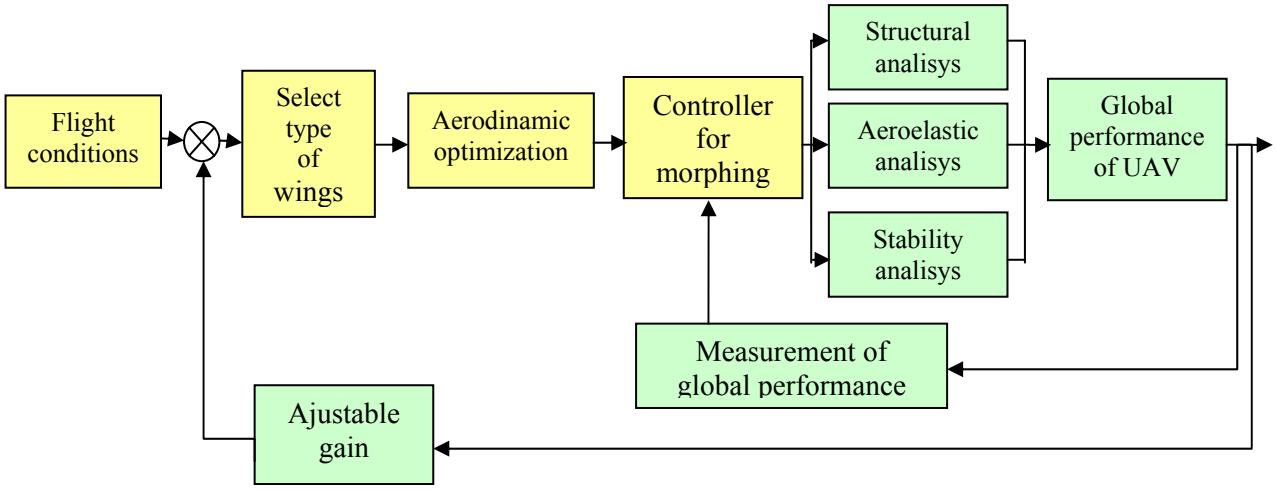
Fig. 11. NextGen Morphing design

The latest research has been performed on UAVs, preferred for experiments due to their reduced scale. Advanced composite materials improve design approach, and as a result they allow development of new structures and actuators, lighter and reliable.

Composite materials are very important in the aviation industry because of differences they make related to weight, strength and flexibility. Memory materials are being researched, but they appeared to be very promising, with their ability to change shape by means of electrical signal or temperature variation. Bending the material is preferable because it provides better aerodynamic avoiding turbulent flows. However, smart

materials still have a long way to become trusted ones.

4. PROPOSAL FOR A MODERN UAV STRUCTURE



Limitations to the concept of morphing

The limitations imposed by the concept of morphing described below for optimized wing complies with the conform limits of the execution mechanism. The main differences between optimized wing shape and deformed wing shape are the following:

• Reorient the wing sections in the deformable space occupied by the mechanisms and therefore loss of this area of wings;

• Failure of the mechanism to provide an optimal structure to a good aerodynamic shape with curved lines between control points;

• Limitation of the mechanism in changing the profile for low-speed flight.

Structural Transformation

Structural morphing or control surface for aerodynamic components could provide significant performance improvements. For instance, changing the shape reduces the drag during various stages of flight. Variable geometry for trailing edge has an extremely strong influence on the wing pressure distribution.

It not only controls the local rear load on the wing but also the flow around the profile that obviously leads to controllability with significant effect on flight characteristics, even applied to only a few degrees. This is known as "Variable Camber", a technique that can be used to adjust the wing characteristics with differentiated cross-section for the whole scale in different circumstances and, therefore, be used to reduce drag and the loads on the wing (weight) in order to reduce fuel consumption and emissions.

A variety of approaches have been investigated to achieve change in structural shape. These range from use in accordance with the mechanism to the bi-stable concepts, which are a form of behavior that occur eg in structural or non-symmetric composite laminates.

Post-buckling has also been used successfully to increase the performance of piezoelectric actuators used to control a wing and to allow optimization of design variables profiles. Structural buckling leads to a reduction of structural stiffness, therefore, a reduction of the driving force to produce a given shift.

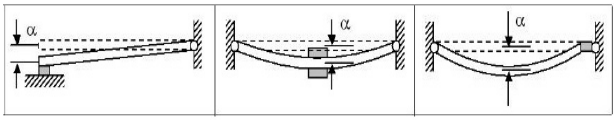


Fig. 12. Comparisons of amplitude for piezo-actuators, linear actuators respectively (left), the composite beam (middle), and buckling of composite (right)

5. CONCLUSIONS

Dedicated special missions require exceptional maneuverability of the UAV. Morphing solutions are analyzed and compared according to a global indicator focused on controllability, aggressive handling, but reduced manufacturing costs are important in selecting the most suitable morphing strategy.

The concept of modularity is well adapted to the proposed concept of semi-flexibility for flying wing with high elongation ratio. Inertial sensors used to measure the response characteristics of flight maneuvers together with qualitative analysis lead to improved overall performance of the flying wing aerodynamics.

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UAV CONTROLLER SYNTHESIS USING LQ–BASED DESIGN METHODS

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Abstract: *The LQ (Linear Quadratic) based design methods are powerful tools for control system controllers' synthesis and they are applied since many decades for control system design purposes. The model-based LQ methods may be divided into two different methods. First of them is the LQR (Linear Quadratic Regulator) method. This design method supposes available for the measurements state variables of the control system. This problem is the so-called "full state feedback" problem. The second LQ design method is the LQG (Linear Quadratic Gaussian) one. This method allows consideration of the influence of internal and external stochastic disturbances affecting motion of the aircraft. The purpose of the author is to summarize the theoretical backgrounds of design methods listed above and to show design examples for solution of LQR and LQG model-based design methods applied to synthesize controller for the Unmanned Aerial Vehicle (UAV) system.*

Keywords: *military robots, recce surface robots, air robot systems, CAD.*

1. INTRODUCTION

LQ based design methods are widely applied for optimal control of aircraft. The LQR method allows determining optimal control law minimizing pre-defined integral performance criteria. The LQG design method allows consideration of simultaneous external and internal disturbances affecting motion of the aircraft.

Modern control systems are analyzed in [1, 3, 4, 5, 6, 10, 11, 13, 14]. LQR design problem in the focus of attention of references of [1, 2, 3, 4, 10, 11, 13, 14]. The LQG design method is outlined with applications in [5, 6, 13]. A special attention must be paid to applications of the proposed LQR and LQG methods applied in design of the automatic flight control systems [8, 9]. Pokorádi in [12] gave full-scale description of derivation of dynamic systems' mathematical models, and signals applied for system analysis purposes.

Computer aided analysis and design of the dynamical systems are supported by computer packages like MATLAB® supplemented with appropriate toolboxes applied at our Department of Military Robotics, at Zrínyi Miklós National Defense University [2, 7].

2. THE LQR DESIGN PROBLEM FORMULATION

Dynamics of the LTI system may be defined using the following state and output equations [1, 3, 4, 5, 6, 8, 9, 11]:

$$\dot{\mathbf{x}}=\mathbf{Ax}+\mathbf{Bu},\ \mathbf{y}=\mathbf{Cx}+\mathbf{Du}. \qquad (2.1)$$

The block diagram of the closed loop system – for $\mathbf{D}=0$ – built by equations (2.1) may be seen in Figure 1.

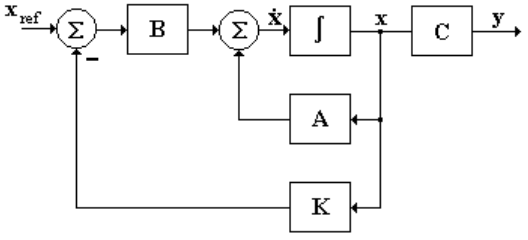

Figure 1. Block Diagram of the Control System

Optimal control law may be determined evaluating the following integral performance criteria [3, 4, 5, 8, 10, 13, 14]:

$$J = \frac{1}{2}\int_0^{\infty}\left(\mathbf{x}^{\mathrm{T}}\mathbf{Q}\mathbf{x}+\mathbf{u}^{\mathrm{T}}\mathbf{R}\mathbf{u} \right) dt \to Min\,. \qquad (2.2)$$

In cost function of equation (2.2) main design parameters are weights of $\mathbf{Q}\geq 0$ and weights of $\mathbf{R}>0$. If weighting matrix $\mathbf{Q}$ is very large relative to weighting matrix $\mathbf{R}$ one may get a closed loop system response with large overshoots. If weighting matrix $\mathbf{R}$ is chosen to be very large relative to $\mathbf{Q}$ control system has smaller actuators, electric motors, amplifier gains and other devices. During controller synthesis weighting matrices may be derived using the so-called inverse square rule.

The LQ optimal control problem may be solved using wide variety of techniques. Let us consider method of Euler-Lagrange equations, Hamilton-Jacobi-Bellman theory and Pontriagin's minimum principle. Firstly, let us define the so-called Hamiltonian matrix to as follows below [1, 2, 3, 4, 8, 11, 13, 14]:

$$\mathbf{H}(\mathbf{x},\lambda,t) = \frac{1}{2}\left(\mathbf{x}^{\mathrm{T}}\mathbf{Q}\mathbf{x}^{\mathrm{T}} + \mathbf{u}^{\mathrm{T}}\mathbf{R}\mathbf{u}^{\mathrm{T}} \right) + \lambda^{\mathrm{T}}\left(\mathbf{A}\mathbf{x}+\mathbf{B}\mathbf{u} \right), \qquad (2.3)$$

where $\boldsymbol{\lambda}$ is the Lagrange multiplier.

It is well-known that Pontriagin's minimum principle states that optimal state and control trajectories must satisfy the following equations [10, 11, 13, 14]:

$$\frac{\partial\,\mathbf{H}}{\partial\lambda} = \dot{\mathbf{x}};\frac{\partial\,\mathbf{H}}{\partial\,\mathbf{x}} = -\dot{\lambda};\frac{\partial\,\mathbf{H}}{\partial\,\mathbf{u}} = 0\,. \qquad (2.4)$$

Using rules for differentiation of matrices and vectors equations (2.4) may be rewritten in the following manner

$$\dot{\mathbf{x}} = \mathbf{A}\mathbf{x}+\mathbf{B}\mathbf{u},\ \mathbf{x}(0) = \mathbf{x}_{\mathrm{O}}\,, \qquad (2.5)$$

$$-\dot{\lambda} = \mathbf{Q}\mathbf{x} + \mathbf{A}^{\mathrm{T}}\lambda,\ \lambda(T) = 0\,, \qquad (2.6)$$

$$\mathbf{u}^{O} = -\mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\lambda\,. \qquad (2.7)$$

Equation (2.7) defines the optimal control law. The coupled equations (2.5), (2.6) and (2.7) may be regarded as the 'two point boundary value problem' (TPBWP). Substituting equation of control law (2.7) into state equation (2.5) results in following formula [1, 2, 3, 4, 8, 11, 13, 14]:

$$\begin{bmatrix}\dot{\mathbf{x}}\\ \dot{\lambda}\end{bmatrix} = \begin{bmatrix}\mathbf{A} & -\mathbf{B}\mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\\ -\mathbf{Q} & -\mathbf{A}^{\mathrm{T}}\end{bmatrix}\begin{bmatrix}\mathbf{x}\\ \lambda\end{bmatrix} \hat{=}\, \mathbf{H}\begin{bmatrix}\mathbf{x}\\ \lambda\end{bmatrix}. \qquad (2.8)$$

Let us make the following substitution in equation (2.8):

$$\boldsymbol{\lambda}=\mathbf{P}\mathbf{x}, \qquad (2.9)$$

where $\mathbf{P}$ is the so-called cost matrix.

Differentiating equation (2.9) with respect to time, and considering equations (2.5) and (2.7) following equation may be derived:

$$\frac{d\lambda}{dt} = \frac{d\mathbf{P}}{dt}\mathbf{x} + \mathbf{P}\frac{d\mathbf{x}}{dt} = \frac{d\mathbf{P}}{dt}\mathbf{x} + \mathbf{P}\mathbf{A}\mathbf{x} - \mathbf{P}\mathbf{B}\mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}\mathbf{x} = -\mathbf{Q}\mathbf{x} - \mathbf{A}^{\mathrm{T}}\mathbf{P}\mathbf{x}\,. \qquad (2.10)$$

The sufficient condition for optimal control is that $\mathbf{P}$ must satisfy the following Ricatti differential equation [11, 13, 14]:

$$-\frac{d\mathbf{P}}{dt} = \mathbf{A}^{\mathrm{T}}\mathbf{P} + \mathbf{P}\mathbf{A} + \mathbf{Q} - \mathbf{P}\mathbf{B}\mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P},\ \mathbf{P}(\mathrm{T}) = 0 \qquad (2.11)$$

Solution of the optimal controller synthesis problem using Ricatti-equation in control theory is regarded as the finite time problem. This solution results in the linear time varying controller of the feedback [1, 2, 3, 4]:

$$\mathbf{u}^{\circ}(t) = -\mathbf{K}(t)\mathbf{x}(t),\ \mathbf{K}(t) = \mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}(t)\,. \qquad (2.12)$$

Equation (2.11) is a nonlinear, first order differential equation, which has to be solved backwards in time [1, 2, 3, 4]. During solution of the infinite time LQR problem it is considered that $\mathrm{T}\to\infty$.

It is obvious that under mild conditions cost matrix $\mathbf{P}$ may be considered as constant and, solution of Ricatti-equation results in the asymptotically stable closed loop control system.

In this particular case, equation (2.11) may be rewritten as:

$$\mathbf{A}^{\mathrm{T}}\mathbf{P} + \mathbf{P}\mathbf{A} + \mathbf{Q} - \mathbf{P}\mathbf{B}\mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P} = 0\,, \qquad (2.13)$$

And, optimal control vector may be derived as:

$$\mathbf{u}^{\circ}(\mathrm{t}) = -\mathbf{K}\mathbf{x}(t),\ \mathbf{K} = \mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}\,. \qquad (2.14)$$

Equation (2.13) is known as algebraic Ricatti equation (ARE). Conditions defined by equations (2.13) and (2.14) are necessary and sufficient for existence of the optimal controller, which will asymptotically stabilize the control system.

The steps of optimal control law synthesis includes following two steps:

1, solution of the ARE - equation (2.13) - in order to find the constant cost matrix $\mathbf{P}$,

2, substituting cost matrix $\mathbf{P}$ into equation (2.14).

The resulting feedback gain matrix **K** is an optimal for the given set of weightings of those matrices of **Q** and **R** of the performance integral criteria [1, 2, 3, 4, 8, 11, 13, 14].

3. OPTIMAL CONTROL LAW SYNTHESIS USING LQG DESIGN METHOD

The LQ based control law synthesis problem is solved in the time domain (LQR problem) and in the frequency domain (LQG problem). The LQR problem is for the determination of the optimal control law when all state variables are available for measurement. This case is rarely may be met in the practice. The more realistic case is the LQG problem, which is representation of the output feedback problem.

During solution of the LQG controller synthesis problem there is considered the disturbed state-space model of the plant as given below [1, 2, 3]:

$$\dot{\mathbf{x}} = \mathbf{A}\mathbf{x} + \mathbf{B}\mathbf{u} + \mathbf{\Gamma}\mathbf{w},\ \mathbf{y} = \mathbf{C}\mathbf{x} + \upsilon \qquad (3.1)$$

In equation (3.1), **x** is state vector, **u** is the control vector, **y** is the vector of measured outputs, **w** is the random plant disturbance, and υ is the random sensor noise. Both disturbances are uncorrelated, Gaussian stationary random processes with zero-mean values. Finally, $\mathbf{\Gamma}$ is the input matrix for the external disturbance of **w**. Covariances of the random processes are listed below [5, 6, 13]:

$$\begin{aligned} E\left\{\mathbf{w}\mathbf{w}^T\right\} &= \mathbf{Q}_0 \geq 0 \\ E\left\{\upsilon\upsilon^T\right\} &= \mathbf{R}_0 > 0 \\ E\left\{\mathbf{w}\upsilon^T\right\} &= 0 \end{aligned}, \qquad (3.2)$$

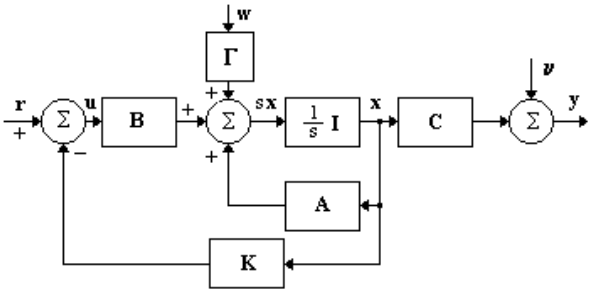

Figure 2. Block Diagram of the Dynamic System

Block diagram of the dynamic system defined by equation (3.1) may be seen in Fig. 2.

From Figure 1 the optimal control law – for **r** = 0 - may be derived as follows below:

$$\mathbf{u} = -\mathbf{K}\mathbf{x}. \qquad (3.3)$$

The optimal state feedback gain matrix is as given below

$$\mathbf{K} = \mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P}. \qquad (3.4)$$

The positive definite cost` matrix **P** may be found solving the algebraic Ricatti-equation [1, 2, 3, 4, 7, 8, 11, 13, 14]:

$$\mathbf{A}^{\mathrm{T}}\mathbf{P} + \mathbf{P}\mathbf{A} - \mathbf{P}\mathbf{B}\mathbf{R}^{-1}\mathbf{B}^{\mathrm{T}}\mathbf{P} + \mathbf{Q} = 0. \qquad (3.5)$$

The synthesis of the LQG controller may be achieved using the so-called separation principle.

The derived control law will minimize the following average integral 'cost' function, i.e.

$$J = \lim_{T\to\infty} E\left\{\int_0^T \left(\mathbf{x}^{\mathrm{T}}\mathbf{Q}\mathbf{x} + \mathbf{u}^T\mathbf{R}\,\mathbf{u}\right)dt\right\} \to Min. \qquad (3.6)$$

Using the separation principle the control law synthesis problem may be solved in two separate stages.

Firstly, the so-called deterministic cost is minimized solving the reduced-matrix Ricatti equation. The Kalman-filter state equation may be derived as given below [1, 2, 3, 4, 7, 8, 11, 13, 14]:

$$\dot{\hat{\mathbf{x}}} = \mathbf{A}\hat{\mathbf{x}} + \mathbf{B}\mathbf{u} + \mathbf{L}\left(\mathbf{y} - \mathbf{C}\hat{\mathbf{x}}\right). \qquad (3.7)$$

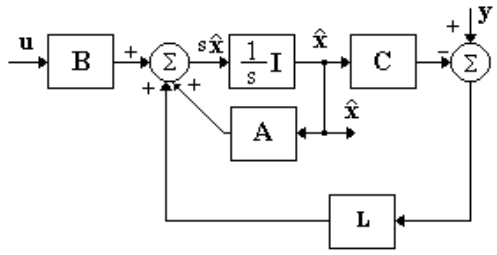

Figure 3. Block Diagram of the State Observer

The block diagram of the state observer – Kalman-filter – derived by equation (3.7) may be seen in Figure 3.

The input of the state observer are **u** and **y**, the output is the estimate $\hat{\mathbf{x}}$. The static gain of the optimal state observer **L** may be found by equation given below

$$\mathbf{L} = \mathbf{\Sigma C}^{\mathrm{T}} \mathbf{R}_{\mathrm{o}}^{-1}. \qquad (3.8)$$

In equation (3.8) **L** is the Kalman-filter static gain, **Σ** is a positive definite cost matrix and, $\mathbf{R_o}, \mathbf{Q_o}$ is the set of weighting matrices of the state and the input vectors, respectively.

The cost matrix **Σ** may be derived solving the following equation [2, 3, 4, 8, 11, 13, 14]:

$$\mathbf{A\Sigma} + \mathbf{\Sigma A}^{\mathrm{T}} - \mathbf{\Sigma C}^{\mathrm{T}} \mathbf{R}_{\mathrm{o}}^{-1} \mathbf{C\Sigma} + \mathbf{\Gamma Q}_{\mathrm{o}} \mathbf{\Gamma}^{\mathrm{T}} = 0. \qquad (3.9)$$

The structure of the LQG compensator may be derived as the series connection of the Kalman-filter with the state feedback gain matrix.

The block diagram of control system may be seen in Figure 4.

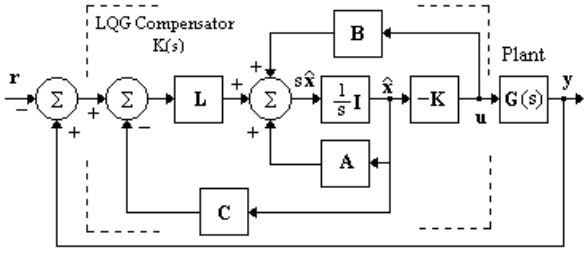

Figure 4. The Structure of the LQG Compensator

This representation of the control system may be applied if the linear plant model is the reliable one, and there are well-defined stochastic processes to be considered. In this particular case the concern is to minimize the cost function defined by equation (3.6).

During solution of the LQG controller synthesis problem weighting matrices **Q** and **R** – used for Linear Quadratic Regulator design stage – and weighting matrices $\mathbf{Q}_{\mathrm{o}}$ and $\mathbf{R}_{\mathrm{o}}$ – used for Linear Quadratic Estimator design phase are applied as tuning parameters [1, 2, 3, 4, 7, 8, 9, 10, 11, 13, 14].

4. CONCLUSIONS, FUTURE WORK

Optimal control law synthesis technique is widely applied in design of dynamic systems controllers. The design process is supported by large scale references, and also many application examples are available.

The LQG method is more realistic than the LQR one. These methods may be applied for preliminary design of the automatic flight control systems. The model-based design supposes existence of the identified model of the aircraft.

Methods are based on preliminary settings, and further heuristic settling of the weights in integral criteria defined by equation (2.2).

Application of these methods predicts high level of theoretical knowledge, and experiences in working with heuristic setting of weights in solution of optimal control systems.

The paper is proposed to use in design of optimal dynamic systems, namely for design of the automatic flight control systems of the UAV.

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UNMANNED AERIAL SYSTEMS USED IN THE ARMIES OF DEVELOPED COUNTRIES

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Abstract: *The article deals with the issue of unmanned aerial systems used in the armies of developed countries. Air forces of modern armies nowadays are equipped with powerful aerial technologies with many combat possibilities of fulfilling a large spectrum of tasks. On the other hand, piloted combat aircrafts represent very expensive and complex weapon systems dependent on airports and the corresponding infrastructure. The development of combat options of modern means of anti-air defence, which can be part of the armament of the potential enemy, represents a bigger threat not just for the combat aircraft, but fore mostly for the crew. Thus it is natural, that new ways and means of eliminating risks are being searched for. One of the ways is the usage of unmanned aerial systems, which moreover save finances.*

Keywords: *unmanned aerial systems, UAV, aircrafts, aerial technologies, Air Force*

INTRODUCTION

Unmanned aerial vehicles (UAVs) are not new, they have a long history in aviation. UAV missions flew mainly to cover areas determined too hazardous for manned reconnaissance aircraft. Additionally, these missions occurred at a fraction of the cost of and risk to manned aircraft. UAVs will play a significant role in future operations. UAV technology can not replace the human operator, but it will increase the requirements for skilled airmen. The UAV debate was born in World War I but new technology has recently nurtured the argument. World War I introduced the airplane, manned and unmanned, to the world as a military technology. Manned aircraft were capable of numerous combat duties and became a glamorous weapon of war. Unmanned aircraft were experimental, never achieved any measure of success, and thus were always behind the scenes.

Current international agreements prohibit space based weapons and our information metasystem is only a concept, so this essay will focus specifically on the UAV issue and explore the possibility that airmen will be replaced by unmanned vehicles in the nearest future.

The Air Force is now envisioning other potential missions for UAVs beyond the traditional reconnaissance mission. Also, Micro UAVs (Fig. 1), less than 15 cm long, could provide the basis for even more potential applications.

Fig.1 AeroVironment, USA

Increased sensitivity to risking human life in combat is pushing the Forces towards expanding UAV applications. Also, the rapidly advancing technologies are pulling us towards the economic viability of expanding the role of UAVs in the future force structure. As the USA military evolves to become a more flexible force across the spectrum of conflict, clearly UAVs will be an integral part of thier ability to meet the challenges of the 21st century.

1 UNMANNED AERIAL COMBAT VEHICLES

In 1982, the Israeli Air Force overran Syrian defences in the Bekaa Valley and destroyed the Syrian Air Force in one of the largest air battles since WWII. Key to that victory was small unmanned aircraft used to deceive and destroy the Syrian integrated air defence system. This incident focused world wide military attention on the UAV issue. The principal argument for UAVs is that they save lives.

Weapons and equipment that face destruction at the enemy's hand should be unmanned. Unmanned aircraft could be used in any situation. They could fly into extensive defence networks, with no regard for human life.

The Gulf War laid this foundation and set the standard for modern combat operations. The expectations produced by these operations may be unrealistic. While low casualties are desirable, the expectation that losses will be minimal on a fluid battlefield may inhibit the future use of force as an instrument of national power.

The importance of saving human life has become critical to the success of, for example, USA military operations. In August of 1995, a Predator UAV was completing a reconnaissance mission in Bosnia when it was shot down. The Predator served as a loyal soldier and hardly a mention of its shoot down was noticeable in the world press. There may be a greatly added political benefit to this life saving drone aircraft. When they are shot down or fall from the sky they have little impact on the world's political fabric.

Taking the human being out of the aircraft allows a significant reduction in developmental and operational costs. When aircraft were first developed little thought was given to what is now called the pilot-vehicle-interface. In today's complex and demanding environment, cockpit design and pilot life support systems consume a considerable amount of total resources available. It will cost approximately $17 billion to design and implement the F-22's advanced pilot-vehicle-interface. Almost 30 percent of the total F-22 program cost is invested in the pilot alone. Operational costs may go much higher. The cost of flight training for a single USA fighter pilot is now estimated at $2 million. That's just initial training cost. The maintenance cost of two thousand actively flying F-16 pilots is close to $1 billion per year. [2] Removing the human operator results in a significant dollar savings and consumes less design resources. Time in development is also reduced as an expensive interface becomes unnecessary.

Eliminating the cockpit, life support systems, and pilot leads to another great advantage: size and weight reduction. Aircraft performance is severely limited by aircraft size and weight. Removing the pilot and his or her supporting architecture produces a corresponding increase in aircraft performance. Also, the unmanned aircraft will not be limited by the physiological barriers that nature has placed upon the pilot.

Endurance becomes limited only by fuel supply, not the pilot's bladder, physical comfort or exhaustion level. Regardless of the

altitude, a UAV will not require oxygen or expensive pressure suit equipment.

This experimental UAV is capable of achieving acceleration levels that would kill the human pilot. The UAV with reduced size and increased performance will also have a corresponding reduction in signature and thus is more survivable. Saving lives, reducing cost, and improving performance are strong motives for removing the human from the cockpit.

The most successful UAV to date has been the cruise missile. The cruise missile is nothing more than an unmanned aircraft on a one-way mission (Fig.2). The cruise missile has its origins in WWI and WWII. During WWI an unmanned aircraft carrying an explosive device was designed. The device was launched from a track and was set to fall on its target after flying a specific heading for a specific amount of time. The device provided all the benefits of UAVs: its use did not threaten the life of a pilot; when they were dying at an unprecedented rate, and the cost was low at four hundred dollars to put three hundred pounds of explosive over a target.

Fig.2 Submarine-launched Tomahawk cruise missile

The cruise missile relies on an inertial navigation system upgraded throughout the flight by comparing memorized topographical maps with actual areas of the earth's surface and recently improved with Global Positioning System updates.

Like the cruise missile, for example the Predator UAV has been combat tested in 1996. The Predator is capable of flying at twenty-five thousand feet for up to 50-hours.

Fig.3 General Atomics AS, USA

The Predator is remotely controlled and relays its video, radar, infrared or elint information to a line-of-sight ground station or to overhead satellites. The Predator embodies all the benefits of the UAV: it eliminates the need for humans to perform high risk or mundane intelligence gathering missions, it is relatively inexpensive, and the aircraft can far outperform any human with its 50-hour endurance.

The benefits of UAVs are highly desirable and as the preceding examples show, have already been effectively demonstrated. If lives and money can be saved, with a corresponding increase in mission effectiveness, unmanned vehicles will become an essential warfighting tool. In regard to these issues, UAVs will greatly serve the national interest.

2 THE FUTURE OF UAV

The computational power of computers is multiplied 4,000 times every decade and by 2015 10 gigabytes of memory will fit on a crystal smaller than a sugar cube. Several

USA experts predict that autonomous weapons using artificial intelligence supported by automatic target recognition algorithms employing multispectral sensors will rule the battlespace. They predict that in the next 20 years data fusion rates will be 10,000 times faster and more accurate than they are now and data storage capabilities will be at least 1,000 times greater. These capabilities are predicted to produce computers that mimic thought and maybe even think for themselves with some level of self awareness. This increase in computational power may provide the human qualities of flexibility and adaptability to all types of UAVs.

There are two categories of unmanned aircraft: Man-in-the-loop (MITL) and autonomous. MITL systems have some type of human operational interface. The aircraft is airborne and humans control it from the ground. Predator is an example of this UAV category. On the other hand, autonomous systems takeoff and fly with no human interaction. Autonomous UAVs are further subdivided into programmable or independent systems.

Programmable systems fly a pre-planned profile based on a preset software program. Truly autonomous (independent) platforms make the decisions required to complete their mission. DarkStar and the cruise missile are autonomous UAVs. Both types of UAVs offer unique benefits and have unique support requirements. MITL systems currently offer a greater degree of adaptability as mid-mission inputs allow course, altitude, and/or target flexibility. MITL systems use data-link to communicate with a ground station or relay control signals through satellite systems.

Data link or radio control transmissions create a vulnerability. An adversary could jam or engage these signals or take command of the aircraft or at least intercept the downlink to determine what we are observing. Existing high power microwave or EMP technology already presents a significant threat to data link operations. [2]

The problem with MITL UAVs or any remotely controlled weapon is that they depend on vulnerable communications. If these links breakdown, or are disrupted, or sabotaged or, worse yet,manipulated by the enemy, the UAV becomes useless.

Like MITL UAVs, autonomous systems have their own problems and benefits. Independent UAVs will be different from the programmable cruise missile in that a cruise missile is preprogrammed to fly to a point in space.

The largest benefit is that this type of system does not require a vulnerable line of sight support infrastructure of hardware or personnel. Traditional aircraft maintenance systems will be required but once the system is airborne it will be on its own, free to carry out its specific mission

The human operator or airman will be required in several future roles. This does not lead to the demise of the UAV. The UAV represents a significant force multiplier and UAV technology should be exploited for all missions.

Airpower gives the USA an asymmetric advantage over every nation on Earth. This advantage is not created by technology but by highly trained men and women.

UAVs will play a large role in our future but airmen will be required to ensure that UAVs are employed correctly and manned aircraft will be vital for dealing with the uncertainties of war. Cooperation and unity of effort will be essential to the successful integration of UAVs, for any mission, into our force structure.

UAVs are a critical part of our future. UAVs will be an essential force multiplier and will enhance each Air Force core competency and thus make the nation stronger.

CONCLUSION

UAVs will play a significant role in future operations. However, the Air Force must not forget the significant contribution of the human operator. The Air Force cannot ignore the true nature of war. No matter how good the computer programmers are or the artificial intelligence becomes there is no substitute for the human brain.

The UAV, however, represents a significant force multiplier and UAV technology should be exploited for all

missions, including the most complex, as a complement for manned systems. UAVs should be used in the following areas:

1. When the lethality of the airspace to be penetrated is too great for manned aircraft.
2. When the airspace to be penetrated is too politically risky for manned aircraft.
3. When the airspace to be penetrated is too toxic for human operators.
4. When lower priority missions could be performed by UAVs to free highly skilled airmen to handle higher priority tasks.
5. When overall mission effectiveness could be improved with UAVs.

UAV operations will expand the role of airmen. As more unmanned vehicles are pressed into service, airmen will be required to lend their unique expertise to operating these aircraft. Airmen will provide the following to a force employing UAVs:

1. Provide airmindedness and leadership to the control of MITL UAV operations.
2. Become specialists for specific UAV airframe capabilities and limitations.
3. Assist in the development of high fidelity simulators to provide realistic training for MITL UAV crews.
4. Assist design and software engineers in the baselining of software for programmable and independent autonomous UAVs.
5. Assist design and software engineers with updating tactics in the software baseline of programmable and independent autonomous UAVs.
6. Advise staffs on employment of UAVs in a manner consistent with mission requirements and the tactical situation at hand.

Airpower currently gives, for example, the USA an asymmetric military advantage over every nation on Earth. This advantage is not created by technology but by highly trained men and women. UAVs will play a large role in our future but airmen will be required to ensure that UAVs are employed correctly and manned aircraft will be vital for dealing with the uncertainties of war. Cooperation and unity of effort will be essential to the successful integration of UAVs.

Tab. 1 UAV Classification Table [1]

Class	Category	Normal employment	Normal Operating Altitude	Normal Mission Radius	Primary Supported Commander	Example platform
CLASS I (less than 150 kg)	SMALL >20 kg	Tactical Unit (employs launch system)	Up to 5K ft AGL	50 km (LOS)	BN/Regt, BG	Luna, Hermes 90
	MINI 2-20 kg	Tactical Sub-unit (manual launch)	Up to 3K ft AGL	25 km (LOS)	Coy/Sqn	Scan Eagle, Skylark, Raven, DH3, Aladin, Strix
	MICRO <2 kg	Tactical PI, Sect, Individual (single operator)	Up to 200 ft AGL	5 km (LOS)	PI, Sect	Black Widow
CLASS II (150 kg to 600 kg)	TACTICAL	Tactical Formation	Up to 10,000 ft AGL	200 km (LOS)	Bde Comd	Sperwer, Iview 250, Hermes 450, Aerostar, Ranger
CLASS III (more than 600 kg)	Strike/ Combat	Strategic/National	Up to 65,000 ft	Unlimited (BLOS)	Theatre COM	
	HALE	Strategic/National	Up to 65,000 ft	Unlimited (BLOS)	Theatre COM	Global Hawk
	MALE	Operational/Theatre	Up to 45,000 ft MSL	Unlimited (BLOS)	JTF COM	Predator B, Predator A, Heron, Heron TP, Hermes 900

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CONTRIBUTIONS OF GAME THEORY TO UNDERSTAND THE FLOW OF KNOWLEDGE WITHIN AN ORGANIZATION

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ABSTRACT:*The word "knowledge" is increasingly being joined - in contemporary economic and social environment- to terms such as management, society, economy, and politics. The word "knowledge" is increasingly being joined - in contemporary economic and social environment- to terms such as management, society, economy, and politics. This reveals that, for example organization's key resource is the knowledge hold by individuals operating within it, and their ability to use this knowledge in the activities and processes within the organization. It is almost intuitive known that the stock of knowledge represents the key element in almost every organization.*
Indeed, the research presented in this article aims to show that game theory is an effective tool in the study of organizational dynamics.

The article will illustrate, through game theory, situations in which individuals interact with one another, considering the results of those situations where individuals have different preferences regarding the exchange of knowledge and also the consequences of these interactions on the organization, at the aggregate level Methodology includes the assumption, as a fundamental scientific assumption, used most commonly on the theoretical description of the context. The results will provide information on strategies that players must take in their interactions, the consequences for both individuals and the organization after the interaction between them and last but not least, about the strategy "tit-for-tat" which can be applied to maximize an employee's own results and to increase overall cooperation. This study may represent a starting point for researchers interested in analyzing the flow of knowledge within an organization, through game theory. The article will provide a better understanding of the motivations underlying the decision to share knowledge with individuals or within organizational surrounding. It is noted that a limitation of the approach presented in the article is that it does not facilitate predictions, and therefore is highly advantageous in complementary use of other approaches and methods - for example, agent-based modeling.

Key words: *international organization; game theory; prisoner's dilemma; knowledge management;*

INTRODUCTION

For organizations to function efficiently, individuals and teams within organizations has to coordinate efforts and activities in this regard. In 1988, Peter Drucker (1988) stipulated the exchange of knowledge between organizations, as an essential point of competitive advantage. Knowledge management has become a primary concern and was the subject of numerous academic studies and organizing projects. Defined as "the idea of capturing and disseminating knowledge of individuals was obtained by others in organizations" in the last decade it has become an extremely fertile source of inspiration for both research and for practitioners.

Problem Statement

This article applies game theory tools, examining the results of interactions between different individuals within organization, with

distinct preferences in terms of knowledge sharing. Brown and Duguid (2000) advocate the importance of this process and its critical dependence on the environment font, but especially the social work situation. Studies have shown that individuals may be motivated to share knowledge in some cases and not share in others. (Ardichvili, Page& Wentling, 2003). Starting from organizations objectives and their organizational behavior, questions arise and the present study attempts to answer: "What is the dynamics of interpersonal relationships in an organization"; "Which are the compatibilities / contradictions that exist between individuals and the organization's" and “What might management do in order to enhance knowledge sharing?”

Organization’s calssic and modern theories

The classical theories are: classical scientific management, bureaucracy and human relations theory. Scientific management principles formulated by Frederick Taylor, in his book of the same name published in 1911 reveals the following attributes: developing science-accumulation of all knowledge about effective methods of production-, scientific selection and progressive development of workers, incentives given to selected scientific worker, principle of cooperation between workers and management and the division of responsibilities / work. Bureaucratic organization, has been defined by one of the classics of sociology, Max Weber as the ideal form of organization. Considering authority as the three-charismatic, traditional and rational-legal-Weber said that the latter type is one who can produce the most effective form of organization: bureaucracy. She appeared in Weber's acceptance a formal type of organization, with a specific structure of statuses and roles in which the power to influence the actions of others grows forwarding to the top of hierarchy of the organization. Theory of human relationships (Hawthorne experiment) was a completely unintentional result of a discovery, made by American scientists in '20 years. George Elto Mayo and Fritz Roethlisberger were two reputed specialists in psychology, respectively sociology, who initially tested the influence of illumination level of the workspace in two groups: one in which conditions were kept unchanged (control group) and another in which the light intensity was changed periodically. To general surprise, labor productivity has remained constant and was not reduced, as scientists had expected. In work published in 1933, "The Human Problem Of An Industrial Civilization" Elton Mayo described and explained, among other things, what happened when Hawthorne experiment: that the group of five young women worked together for a long time created friendship and collaboration between them and between them and between them and managers and researchers; being in the spotlight, feeling important and being treated properly, they had superior performance. Constant and size of the group were also positive.

Modern theories, appeared in the second half of last century, addresses the organization a more complex perspective, holistic, taking account of individuals, groups, relationships, organizational culture, organizational processes, organizational environment, etc. One of the researchers who helped develop the modern theory of human resources *(adapting to human nature*) is that in 1960, Douglas McGregor published "*The Human Side of The Enterprise*", which starts from two theories:

- **Theory X** - the managers are pessimistic about the employees
- **Theory Y** - the managers are optimistic, the author considering more useful the assumption of theory Y.

Contingency theory *(to adapt to the context)* is a theoretical approach saying that there isn't a certain recipe for driving people in an organization and the optimal solution for obtaining performance must be adapted to the context of organizational context. Fiedler's theory believes that managers must adapt their leadership styles and behaviors to group members and to situation. Performance is a good combination between the group members, situation and leader.

Specific styles of this theory are:

- management based on objectives
- management based on relationships

Gareth Morgan and metaphorical approach of organizations supports their characterization using metaphors. The eight organizations are used to describe situations:

- cars
- living organisms
- brains
- cultures
- political system
- prisons of the psyche
- flows and transformation processes
- instruments of domination

Using metaphors facilitates understanding of complex entities by using the like. The problem of using metaphors is that there is a perfect similarity between the object and its image analysis. The problem of using metaphors is that there is a perfect similarity between the object and its image analysis. In Gareth Morgan's perception of the organization as a car or as a mechanic way of thinking, reflects the use of organization forms during the scientific classic management period, with fixed structures and rules, in which employees function as commodities, ways which are rotated positions within the machine is the organization. Mechanistic way of thinking, presented by the author in Chapter II of the paper "*Organizations like cars*" says mechanization lead to increased economic performances, but the side effects adversely affect certain aspects of people's lives and organizations.

Some side effects are:

- Occurrence of stress
- lack of attractiveness and satisfaction in work, family life;
- reducing creativity and innovative spirit;

From the perspective of human relations theory, organizations are seen as living organisms that respond to human needs to motivate individuals and groups. Morgan sustained the idea to integrate the needs of individuals and organizations.

The role of knowledge management in organizations

Management is the process of exercising control and facilitation and coordination within and between departments of an organization. Being a relatively new management, knowledge management is focused on process and resources. Accordingly, knowledge management regards not only "relations of production", but rather the relationship between people and their work results, oriented towards creation, dissemination and knowledge, necessary for the evaluation of development strategies. The process of acquiring knowledge presupposes the existence of information sources and other sources from which, according to specific methodologies or technologies may obtain or extract ("data mining") "raw" data, choosing them, encoding them according to some well-defined standards. Evolutions in theoretical and applied knowledge management are in congruence with the defining elements of the competitive game and the type of competition prevailing in the economic life of the world. Many scholars, businessmen, and politicians appreciate that the kind of society that awaits mankind is a society of knowledge, supported by a knowledge economy.

Social developments have shown that the main features of the knowledge society are (Draganescu, 2004) relating to: the expansion and deepening of scientific knowledge, management and use of existing knowledge in the form of technological and organizational knowledge, production of new technological knowledge through innovation, the emergence of a new economy in the process of innovation becomes crucial; unprecedented dissemination of knowledge to

all citizens through new media (internet, e-books, e-learning); shaping the global community, producing a cultural revolution based on knowledge, need environmental sustainability through rapid technological adaptation.

In this type of society, new economy, the so called knowledge-based economy, owes its appearance to a number of important forces that act today in terms of changing the rules of business and national competitiveness: globalization, the intensity of knowledge and information, computer networks and connectivity, and increasing the share of workers with skills in more than 80% of the employed population. Foundation of the knowledge economy concept was created by Peter Drucker.

In 1966, he described the difference between manual workers and the knowledge worker: a manual worker uses his hands to produce "things" and a knowledge worker uses his intelligence to produce ideas, knowledge and information. Knowledge economy or knowledge-based economy is a concept that refers to the use of knowledge to produce benefits. The phrase was popularized by Peter Drucker in his book "The Age of Discontinuity" (Drucker, 1969). A key principle used is that education and knowledge are considered productive assets of a business, as they may be the most valuable primary elements in making a product or service.

Dynamics of interpersonal relationships

To understand interpersonal behavior within organizations we have identified two important factors: psychological contract and trust.

Psychological contract: the expectations of individuals

Whenever there is a relationship between individuals of a particular type, each will have expectations on how the relationship will progress. Psychological contract refers to the perceptions, beliefs about what a person expects to receive from others involved in a relationship. Psychological contract depends on individual characteristics and personal values of the two actors: the employer and employee, sending a message between subliminal limits, and tacit agreement between these two, but with great importance and influence of the employer, resulting in flawless effects, after transposition psychological ideas of the contract. Rousseau (1995) presents four fundamental characteristics of the psychological contract. First, the fact that he is essentially a subjective perception which varies from one individual to another. Secondly, it is stated that a psychological contract is dynamic, meaning that changes over time during the relationship between employee and employer. Thirdly, psychological contract refers to the mutual obligations based on promises made by both parties investing in them, with the hope of a positive outcome for themselves. Another feature is the fact that psychological contracts are closely related to the context of employment relation, neither individuals or organizations beeing able to create them separately. Since the psychological contract is based on trust, it's violation can lead to strong negative emotional reactions and the feeling of being cheated. Robinson and colleagues (1994) thinks that, after a breach of the contract, it becomes more transactional. The employee withdraws from the relationship and give more attention to financial and economic aspects. This idea is developed by Herriot and Pemberton (1996), referring to the fact that violation of a transactional psychological contract lead to new explicit negotiations, adjust their investment in relationship or even giving up that job. In relational contracts, amendments are primarily at an emotional level, developing the reaction of disappointment and disbelief, changes that ultimately lead to the transformation of relational contracts in the transaction.

Other effects of psychological contract violation is reflected in the decline of loyalty (as a component of trust), the loyalty to the organization, workplace satisfaction and pronounced intention to leave the organization. But so far investigated the effects were largely limited to attitudes such

as loyalty or satisfaction at work, while the health studies have been rare. (Guest, 2000)

Cooperation: Providing mutual knowledge

In organizations, is common when two or more individuals, teams, or even some organizations that work together to offer their assistance to achieve their mutual common goal. These actions are known as cooperation. Cooperation is essential to organizational success. There exist some important factors that cause people to cooperate within organizations:

Principle of reciprocity: „Golden Rule" determine individuals not to treat others the way thay woluldn't like to be treated. However, this rule does not describe exactly how individuals behave. Instead, treating the others as we would like to be treated, most people tend to treat others as they were previously treated by them. Thus, another principle comes into the scene:

„*Tit-for-Tat*" or „*Eye-for-an-Eye*". Sociologists call this principle "The principle of reciprocity" - the tendency to treat others as they treated us in the past. Reciprocity principle describes how individuals behave when interacting with others. The main issue in establishing cooperation between individuals in an organization is the initiative. Once individuals or teams within an organization began to cooperate, the process can be self-sustaining. To encourage cooperation, managers should try to put on the wheels.

Personal orientation. Some individuals tend to be more cooperative than others by nature. In contrast, others tend to be more competitive, interested in making things better than others in one way or another. Scientists have classified individuals into four different categories in terms of their predisposition to work / compete with others. These are:

- competitors: people whose main goal is to make things better than others, challenging them in open competition
- individualists: people who can maximize their own gain and who do not care about the actions of others
- cooperators: people that are concerned with maximizing the benefits that result from partnerships, getting as much as possible from their team
- equalizers: people whose main goal to minimize differences between themselves and others

Despite individual differences men tend to favor the competitive orientation trying to exploit people around them. On the other hand, women tend to favor cooperative orientation, preferring to collaborate with people around them and tend to develop friendships with others. However, it would be a mistake for managers to automatically assume that men and women fall into a certain category. Managers are advised to devote their time to know their employees personal orientation and then assign them responsibilities that suit them best. For example, competitors may be effective in negotiation situations, while cooperatives are most effectively in teamwork.

Not only the differences between people make them to cooperate but also differences in the nature of *reward organizational systems*. Despite good intentions, companies often create reward systems that lead his employees to compete against each other. With an eye towards the elimination of such problems and encouraging cooperation, more of today's companies adopt the rewards systems for teamwork.

Cooperation and competitiveness can occur at the same time. This is because people may have different motivations that

operate simultaneously. In business competition is the natural order of things. Employees from the same company are competing for a promotion, companies compete for government contract and retail businesses compete for the same customers.

Game Theory Analysis

Prisoner's Dilemma

This implies that the two suspects were arrested and charged with committing a crime. They are interrogated in separate rooms, and each has two response options: either to remain silent, that is to deny that he committed the crime or to accuse the other prisoner. If the suspects are accusing each other, then they will receive as punishment 7 years in prison. If both deny, then the punishment will be imprisonment for one year each, and if one denies and the other accuses, then the complaining will be released, and the one who denies will be punished with 10 years in prison. Suppose that there are two employees (players) who have the perception that controlling their own knowledge and decline sharing knowledge is in their interest.

Elaborating the statement:

Motivations for and against the exchange of knowledge

- The desire for recognition as an expert
- Considering his own knowledge a public asset
- Feeling a moral obligation to share knowledge
- "Generalized reciprocity"- sharing knowledge in community, in order to be rewarded by someone else in the same way in the future
- Individuals may believe that their knowledge is a competitive advantage over their peers
- They may fear of loss of power or control
- They may fear ridicule or criticized

We consider two employees with perception that not sharing their knowledge is in their best interest. Whether or not they share their knowledge, it is a type of prisoner's dilemma; If the first player decides not to share their knowledge and player 2 decides to do, the benefit (utility) of the player 1 will be 6 (max), and the player's 2 will be 1. In this case we assume that player 1 gets the player 2 knowledge, and at the same time it keeps it's own confidential.

If none of the players do not share the knowledge, they will both gain utility 2, and player 1 will be in a disadvantaged situiation from the previous one, because he no longer holds the player 2 information.

Figure 1. Matrix of benefits if players do not share knowledge

	Share	Not share
Share	(5,5)	(1,6)
Not share	(6,1)	(2,2)

If player 1 share, and player 2 not share, this situation provides the greatest benefit for player 1.

If none of the players do not share their knowledge, then they will find themselves in a bad situation because of lack of knowledge they would be gained due to an exchange of knowledge.

If player 1 share, and player 2 not, utility of player 1 will be minimum, because he no longer has control over his own information, as opposed to player 2, which accumulates knowledge and keep them confidential.

If both players share the knowledge, they will both have the utility 6. The reason that the organization can encourage the exchange of knowledge between employees is to obtain profit. Sharing knowledge can be in the benefit of all by helping to achieve corporate objectives.

This game in normal form can be represented as matrix.

Rows and columns of the matrix indicates the player's feasible strategies (pure strategy) and matrix cells will contain the earnings of each player, depending on the strategies chosen, the first number indicating the benefit of player 1 and the second the benefit of player 2. We assume that rational players (we mean by rational player that player who always seeks to maximize its gain

depending on the choice of strategies by other players) will never choose to play a dominated strategy.

Figure 2. Matrix of benefits if players share knowledge

	Share	Not share
Share	(5,5)	(6,1)
Not share	(1,6)	(2,2)

But when a player with a predisposition to share knowledge will meet a player with a predisposition to gain knowledge and not to share, then the benefits will be as shown in the Fig. 3 matrix..

Figure 3. Matrix of benefits if players share knowledge

	Share	Not share
Share	(5,5)	(6,6)
Not share	(1,1)	(3,3)

This is a non-conflict game in which both players have dominant strategies. Both players will be happy with the decision either to share or not share knowledge.

Infinitely Repeated Prisoner's Dilemma

If infinitely repeated games are considered, the balance will be determined by the results presented by the folk theorem

Analysis through folk theorem: Given the G stage-game and infinitely repeated G(∞) game and $\underline{u_i}$ minmax gain of player *i,* then for any vector of gains v with $v_i > \underline{u_i}$, $\forall i$, there is $\underline{\delta} < 1$, so that $\forall \delta \in (\underline{\delta}, 1)$ there is a Nash equilibrium of game G(∞) given by repetead strategies that ensures the gain v.

Suppose there is a pure strategy such that $u(a) = v$ (cu $v > \underline{u}$) and for any player *i* the following strategy: "i will play a_i in period 0 and i will continue to play a_i as long as in previous period was played *a*. If not, will be played m_i (minmax gain appropriate strategies) for the rest of the game."

It is possible that the player i win because of the deviation from this strategy?

The answer is yes, but today's gain from deviation will be far below of gains from cooperation in the future.

Demonstration

- We will note G=(XA_i,*U*) the stage-game and A_i the space of distributions of probabilities on A_i actions of player *i*;
- The games are held in perfect and complete information and at the end of each stage every player knows the game and earnings history.
- We will note $a^t = (a_1^t, a_2^t, \dots\dots, a_n^t)$ the choosen action of the *n* players at the moment t, and the game history will become $h^t = (a^0, a^1, \dots\dots, a^{t-1})$
- A pure strategy in repeated games is represented by a sequence of pure strategies of the game-step, from beginning to end the game.
- A mixed strategy P_i will be described by a sequence of mixed strategies $\alpha_i \in \Lambda i$
- Gain function will be described by $U_i = E_p (1-\delta) \sum_{t=0}^{\infty} u_i(p^t(h^t))$
  E_p = strategy p expected gain;
  δ = intertemporal discount factor
  δ = 0 – represents players who don't have the patience to continue playing and stop after first stage;
  δ = 1 – players are perfectly patient, for that the earnings of each period are equivalent.
- The criteria in choosing the strategies followed by the players is to maximize the average earnings (expected) per unit time, respectively

$$\max_{T \to \infty} \liminf E\left(\frac{1}{T}\sum_{t=0}^{T} u_i(p^t(h^t))\right)$$

Suppose there is a pure strategy so that $u(a) = v$ cu ($v > \underline{u}$) .
At the time he will deviate he will win, and after that he will win $\underline{ui}$ (minmax, strategy that brought gains), so by the end of each round will win $\underline{ui}$ in each stage.

In conclusion, the gain brought be the deviation in *t stage* will be: $\underline{\delta i}$

$$uD = (1-\delta_i^t)ui + \delta^t \max_a ui \quad (a) + \delta^{t+1}$$

$\underline{ui}$

Note: Among the gains we have the following equation: $\max_a ui$ (a) >ui> $\underline{ui}$

Acest castig este mai mic decat *ui* cat timp se depaseste nivelul este $\underline{\delta i}$, definit prin:

$$(1-\underline{\delta i})\max_a ui\ (a) + \delta i\ \underline{ui} = vi \quad (*)$$

If v*i* > $\underline{ui}$, then solution $\underline{\delta i}$ of equation (*) is < 1.

If $\underline{\delta i} = \max_i \underline{\delta i}$, so there is δ so thet $\forall \delta > \underline{\delta i}$, game balance is given by the strategies that ensure winning v. q.e.d.

Suppose the situation in which two employees (players) are placed in a situation where both are threatened with losing control of a situation, matter fact their job, if they decide to share their knowledge. Being a normal game, we represent the matrix form:

Figura 4. Matrix of benefits if players do not share knowledge

	Share	Not share
Share	(-4,-4)	(-5,-2)
Not share	(-2,-5)	(1,1)

If G(T) is the sequence that is repeated in each stage dynamic game
s^* = strategy that ensures Nash equilibrium of the stage game

$\underline{U_i}(s^*)$= minimum gain if players play the best possible
Suppose that
$\exists\, s^{**}\ a.i.\ U_i(s^{**}) > \underline{U_i}(s^*), \forall\, i, s^{**} =$ ***strategia de cooperare a jucatorilor***
cooperation strategy of both players
Suppose that
$\exists\, s'\ a.i.\ U_i(s') \geq U_i(s^{**}), \forall\, i, s' =$ ***strategia de deviere***
deviation strategy
Infinitely repeated game equilibrium will be strategy s^{**} repeting throughout the game, $\forall \delta_i > \delta$
Castigurile asteptate:

$$E(U_i^C) = \sum_{T=0}^{t'-1} \delta_i^t u_i(s^{**}) + \delta_i^{T'} U_i(s^{**}) + \sum_{t=T'+1}^{\infty} \delta_i^t U_i(s^{**})$$

$$E(U_i^D) = \sum_{T=0}^{t'-1} \delta_i^t u_i(s^{**}) + \delta_i^{T'} U_i(s') + \sum_{t=T'+1}^{\infty} \delta_i^t U_i(s^*)$$

$$E(U_i^C) \geq E(U_i^D)$$

Comparing

$$\delta_i^{T'} U_i(s^{**}) + \sum_{t=T'+1}^{\infty} \delta_i^t U_i(s^{**}) \geq \delta_i^{T'} U_i(s') + \sum_{t=T'+1}^{\infty} \delta_i^t U_i(s^*)$$

$$\sum_{t=T'+1}^{\infty} \delta_i^t \left(u_i(s^{**}) - u_i(s^*)\right) \geq \delta_i^{T'} \left(u_i(s') - u_i(s^{**})\right)$$

$$\delta_i^{T'+1} \frac{1}{1-\delta_i} \geq \delta_i^{T'} \frac{U_i(s') - U_i(s^{**})}{U_i(s^{**}) - \underline{U_i}(s^*)}$$

$$\frac{\delta_i}{1-\delta_i} \geq A;\ \delta_i \geq A - A\delta_i;\ \delta_i + A\delta_i \geq A;$$

$$\delta_i \geq \frac{A}{1+A}$$

$$\delta_i \geq \frac{U_i(s') - U_i(s^{**})}{U_i(s^{**}) - \underline{U_i}(s^*)} (0,1) = \underline{\delta_i}$$

In other words the threshold δ from which players will adopt a cooperative behavior will be $\underline{\delta} = 0{,}5$, respectively for any

δ ∈ (0,5 ,1), the players will cooperate.

The game is symmetric we get $\underline{\delta_1} = \underline{\delta_2} = 0{,}5$

Observations

If the optimum is reached for a pure strategy, then it can be for a mixed strategy too, and the demonstration will remain the same. In the demonstration we considered the

fact that one stage of the game only one player deviates.

In other words, if $\delta > \underline{\delta}$ then a player will not be tempted to deviate because the gain from deviation does not cover future losses.

Conclusions

For organizations, the results suggest that techniques to promote a culture that encourages knowledge sharing proves to be very beneficial. Furthermore, organizations should promote measures to encourage clusters of employees, in order to increase opportunities for knowledge flow.

This study may represent a starting point for researchers interested in analyzing the flow of knowledge within an organization, through game theory. The paper presents the motivations underlying the decision to share knowledge with individuals or within organizational surrounding. It is noted that a limitation of the approach presented in the article is that it does not facilitate predictions, and therefore is highly advantageous in complementary use of other approaches and methods - for example, agent-based modeling. Article demonstrates that game theory can be an important aid in the analysis of organizational phenomena.

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Mention

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ISSUES CONCERNING PERFORMANCE OF PRESSING PROCESSING TOOLS IN BIMETAL VERSION

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Abstract: *This paper describes the problems that arise and how to solve them, the reconditioning process by pressing, made of alloy steels.*

Currently two situations which are common to the degradation of deposited layers in the race for reconditioning parts mentioned above, namely:

- *Creating the recovery in the base material of white spots (soft), which causes fatigue cracks in that area that causes the separation of material deposited on the supports.*
- *Creation of interface defects frequently in tools made of iron loaded with cutting edges by welding used in the automotive industry.*

In the second part of the paper are some examples of practical applications.

Key words: *bimetal,*

1. GENERAL

Manufacture of tools for processing by hot pressing or cold, in the version obtained by loading bimetal welding is a process commonly used in the current period.

One of the major advantages of the reconditioning process is easily degraded mining tools at the cutting edge of active areas or, in some cases mounted on press tools [1].

Due to the severe conditions of application, frequently in severe abrasion wear of metal on metal type combined with thermomechanical fatigue [2], anti-wear layers are composed of complex alloy steels and micro [3].

Deposits are made in many cases by power manual processes, or WIG electrodes coated with the hollow rods or cast tool steels.

Chemical composition of base materials [4], are shown in Tables 1 and 2.

Table 1. Tool steels for cold

Line No	Mark	Chemical Composition% by mass									
		C	Si	Mn	P	S	Cr	Mo	Ni	V	W
1	90VMn20	0,8 0,95	0,1 0,4	1,8 2,2	0,03	0,03	≤0,35	-	≤0,35	0,05 0,2	-

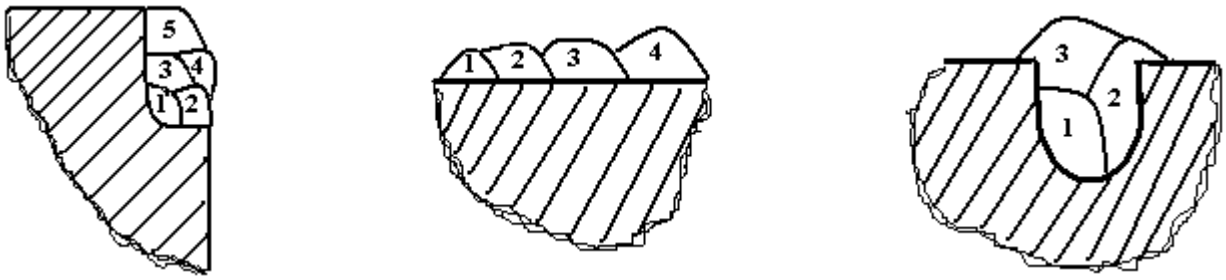
2	105MnCrW11	1 1,1	0,1 0,4	0,8 1,1			0,9 1,1	-	≤0,35	-	1 1,3
3	117VCr6	1 1,25	0,15 0,3	0,2 0,4			0,5 0,8	-	≤0,35	0,07 0,12	-
4	100VMoCr52	0,9 1,05	0,1 0,4	0,5 0,8			4,8 5,5	0,9 1,3	-	0,15 0,35	-
5	165VWMoCr115	1,55 1,75	0,25 0,4	0,2 0,4			11 12	0,5 0,7	≤0,35	0,1 0,5	0,4 0,6
6	155MoVCr115	1,5 1,6	0,1 0,4	0,15 0,45			11 12	0,6 0,8	≤0,35	-	-
7	205Cr115	1,9 2,2	0,1 0,4	0,15 0,45			11 12	-	≤0,35	-	-
8	90VCrMn20	0,85 0,95	0,1 0,4	1,9 2,1			0,2 0,5	-	≤0,35	0,05 0,15	-
9	105CrW20	1 1,1	0,15 0,35	0,15 0,40			0,6 0,9	-	≤0,35	-	1,8 2,2

Table 2. Tool steels for hot working

Line No	Mark	Chemical Composition% by mass									
		C	Si	Mn	P	S	Cr	Mo	Ni	V	W
1	31VMoCr29	0,28 0,35	0,10 0,40	0,15 0,45	0,03	0,03	2,7 3,2	2,6 3	≤0,35	0,4 0,7	-
2	36VSiWMoCr53	0,32 0,40	0,9 1,2	0,3 0,6			5 5,6	1,3 1,6	≤0,35	0,15 0,40	1,2 1,4
3	39VSiMoCr52	0,36 0,42	0,9 1,2	0,3 0,5			4,8 5,5	1,1 1,4	≤0,35	0,25 0,50	-
4	40VSiMoCr52	0,37 0,43	0,9 1,2	0,3 0,5			4,8 5,5	1,2 1,5	≤0,35	0,9 1,1	-
5	55MoCrNi16	0,5 0,6	0,1 0,4	0,5 0,8			0,5 0,8	0,15 0,30	1,4 1,8	-	-
6	55VMoCrNi16	0,5 0,6	0,1 0,4	0,65 0,95			0,6 0,8	0,25 0,35	1,5 1,8	0,07 0,12	-
7	55VMoCrNi17	0,5 0,6	0,1 0,4	0,85 0,95			1 1,2	0,5 0,6	1,6 1,9	0,1 0,2	-
8	57VMoCrNi17	0,52 0,62	0,15 0,35	0,6 0,8			1 1,2	0,5 0,6	1,6 1,9	0,1 0,2	-

9	30VCrW85	0,25 0,35	0,15 0,35	0,2 0,4			2,5 2,8	-	≤0,35	0,3 0,4	8 9

Deposition of anti-wear are geometrically designed according to the purpose pursued in three distinct ways, fig. 1, cutting edge type (1.a.), the active surface type (1.b.), and reinforced the notch type (1.c.).



a). b). c).

Fig 1. Deposits anti-wear

a) - cutting edge type b) - type active area, c) - type in the reinforced notch

Product Brand	Chemical composition in%							
	C	Mn	Si	Cr	W	alte %	Hardness HRC	Application
EI CrW2	0,4-0,6	1,5-2,2	0,8-1,3	0,8-1,2	2,3-3,0	-	58-62	Charging by welding active part of punches made of unalloyed or low alloy steel in hardening their view.
EI Cr5WTT	0,5-0,7	0,9-1,1	0,9-1,1	5-6	1,2-1,5	max.1,5 Ni; 1,3-1,6 Mo; 0,3-0,5 V	55-60	Loading active parts subject to wear and abrasive load of earthmoving equipment wear layer on the parts of manganese steel.
EI Cr2.5W4.5V	0,2-0,5	-	1,0-1,5	2,0-3,0	3,5-5,5	max.1,5 Ni; max. 1,0 Mo; 0,4-1,0 V	pe stratul 3, in stare sudata: min. 45	Loading and reconditioning of dies for forging and hot pressing
EI Cr17W4	0.7	1.2	0.7	17	4	Fe	35-40	Load and reconditioning process by hot pressing at temperatures up to 650 ° C

2. Loading welding materials

Areas of use and physicochemical characteristics of the materials in current production [5] are shown in Table 3.

Table 3. Areas of use and physicochemical characteristics of the materials in current production

3. SPECIFIC ISSUES

The reconditioning process tool for processing by hot pressing or cold are two situations to be solved, namely:

- Creating the recovery in the base material of white spots (soft), which causes fatigue cracks in that area that causes the separation of material deposited on the supports. As a solution to eliminate the disadvantage mentioned above are used for applications using buffer layer (intermediate) of austenitic stainless steels with high resistance electrodes, made by alloying with tungsten or to make deposits with a thickness large enough so that maximum stresses caused by contact repeated tools with workpieces to be deposited in the layer.
- Creation of interface defects frequently in tools made of iron loaded with cutting edges by welding used in the automotive industry. In order to solve the incompatibility between the material and the deposited materials were developed specialized type of Fe-29% Cr-9% Ni.

Physico-chemical characteristics of newly developed materials are shown in Table 4.

Table 4. Physico-chemical characteristics of newly developed materials

Hallmark	**Indication**	**Weld metal chemical composition in%**						
		C	**Mn**	**Si**	**Cr**	**Ni**	**W**	**Others**
18.9MnW2	Prescribed	0,04-0,14	3,0-3,5	1,2	18,0-11,0	9,0-11,0	-	-
18/8/6W2	Determined	0,12	5,8	0,70	18,5	9,1	2,5	Ti 0,1
E 29/9	Prescribed	0,12-0,18	1,5-2,5	0,3-0,7	28,5-30,5	8,5-9,5	-	Fe
E 29/9	Determined	0,15	1,9	0,4	29,1	9,2	-	Rest

4. CONCLUSIONS

In order to reconditioning by welding tool for processing by hot pressing or cold were similar in manufacturing a wide range of materials for welding, which largely covers industrial needs.

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RESEARCH ON BIMETAL TYPE MOULDS WITH HIGH RELIABILITY

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Abstract: *Research has aimed to achieve through the welding load of hot stamping moulds for the type "of glass" pieces.*

Active surfaces of the mould for processing by hot pressing operation are found to intense abrasion type metal corrosion and metal combined with thermo-mechanical fatigue. This abrasion causes loss of material and circular-radial cracks of the working bodies which are made of tool steels low-alloyed with chromium, nickel, vanadium, molybdenum, etc., By improvement (hardening-recovery) they get a hardness of about 35 HRC and reception capability to shock but also a relatively low resistance to abrasion. Solution to increase the lifetime of the matrices developed by the authors is to strengthen highly stressed areas of bodies of work by charging appropriate welding materials developed.

Keywords: *bimetal type moulds, hot stamping, welding load, etc.*

1. RESEARCH OBJECTIVES

Research by exploratory method had the added objective of developing materials for filling the mould surfaces of the welding by TIG process, recommended in the literature [1] due to the possibility of tabling of anti-wear surfaces easily controlled geometry and physical characteristics relatively constant, and chemical technologies that achieve load and reconditioning by welding tool for making hot-pressed glass-type parts, fig.1, bimetal variant index as low cost and high reliability.

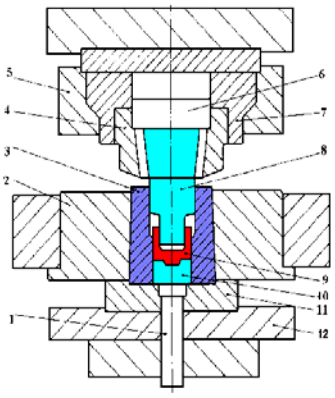

Fig. 1. An extrusion assembly tool on the hydraulic press 250 tf WPA (TPS)
1. Interior Extractor, 2. Container, 3. Extrusion die, 4. Clamping sleeve, 5. Support Ring, 6. Pressure Plate 7. Port pounches 8. Pounches extrusion, 9. Semi-finished extrusion 10. Lower Dorn, 11. Port-mould, 12. Motherboard.

Tribological analysis revealed ten mould damaged their removal from service by the degradation of punches by the abrasion wear at high temperatures approx. 450 ^{0} C, the lengths of approx. 50 mm forming cracks creep combined with a max depth 22mm max width and 4mm at the tip of the attack.

The analysis of the situation ,in fact, show up the following facts:

- Need reconditioning to increased performance and wear resistance in the active areas of stock meant to waste punches made of steels shown in Table 1 in the state enhanced

Tab. 1 Chemical compositions

Werkstoff no.	STAS 3611/88	Chemical composition,%									
		C	And	Mn	P	S	Cr	Mo	Us	V	With
1.2717	56NiCrMoV7	0,5-0,6	0,1-0,4	0,65-0,95	0,03	0,03	1,0-1,2	0,45-0,55	1,5-1,8	0,07-0,12	-
1.2344	40VmoCr52	0,37-0,43	0,90-1,20	0,30-0,50	0,03	0,03	4,8-5,5	1,2-1,5	<0.35	0,90-1,10	0,30

- Manufacture of short punches from the tool steels in annealed condition by loading welding characteristics of reuse by reconditioning.

In order to obtain the desiderata mentioned above was intended: to develop and manufacture a batch of hollow rods 2.4 mm Φ VTCr20W4Ti and testing them according to technical limitation as presented in the literature [1].

- Theoretical and experimental determination of thermal treatment and heating temperature for the metal-metal torque applied, so as to obtain their good cooperation in the exploration, the demands with high degree of thermo-mechanical fatigue and triaxiality
- Highlighting the technological characteristics and their experimental verification in order to determine the optimal level of quality of welding loaded punches.
- Experience in manufacturing process parameters to optimize the fabrication technology

The results were analyzed and applied to the manufacture and reconditioning punch above presented.

2. MAKING HOLLOW RODS.

Develop the product recipe hollow rods VTCr20W4Ti mark, diameter 2.4 mm was made through exploratory research. We aimed to achieve this goal of high-performance products accurately copied the requirements of the documentation submitted by welding on metal assimilation (MD) [1] technology traditional manufacturing composite rods hollow core band by forming the production line in Figure 2. [2]

Fig. 2: Tubular rods production line

For this purpose were used for predicting the chemical composition of MD regression equations arc transfer the main alloying elements Cr, W [3]. The experimental set fill factor, defined by the mass ratio

between the weight and the weight of the rod core, 0.55. To achieve a band of cladding was used Mn low alloy steel with a width of 10 mm and features high plasticity. The recipe was developed by optimizing the composite core mass participation in its constitution of ferroalloys, metal powders and sprouts and sprouting phase precipitation and technological parameters of manufacturing hollow rods were finally determined so as to obtain a core Tamping well anchored to the pipe.

The recipe of product was used to manufacture a lot of technology developed laboratory tubular rods with brand VTCr20W4Ti toroidal configuration with overlapping geometric wall over a width of about 1.2 mm and 2.4 mm in diameter. The lot was done to determine the characteristics of the product tested under the above mentioned prescriptions.

Chemical and physical features prescribed and experimentally determined weld metal deposited under standard conditions by TIG process are shown in the table below:

Tab. 2 Chemical composition of all weld metal

Values	Chemical composition% by mass										Hardness HRC
	C	Mn	And	S	P	Cr	Us	W	Ti	Other	
Prescriptions	Max. 1.0	Max. 1.5	Max. 1	Max. 0,02	Max. 0,02	Max. 18,0-21,0	Max. 1,0	3,5-4,5	Max. 0,5	Basis Fe	30-35
Determined	0,75	1,1	0,6	0,01	0,01	19,5	0,2	3,9	0,2	rest	33, 30, 31, 30, 32

Chemical composition was determined by spectral method with the program SPECTRUM-steel tools.

Analysis of data in the table shows the weld metal framing characteristics in technical prescriptions

3.TECHNOLOGICAL EXPERIMENTS.

Hardness values (Table 2) relatively low in comparison with the demands of high resistance to wear by abrasion intense hardening parameters to be determined after the application of surface machining by precipitation of active phases. Data in the literature [4] show for this type of material and precipitation of carbide phase Cr σ (sigma) in

the temperature range 400-650 ° C, which requires conducting experiments to optimize the heat treatment of hardening of MD and including establishing its collaboration with the base metal during the application process heating and cooling maintenance of all base-metal weld metal. For this purpose there were taken from six punches in stock reconditioned, 6 plate specimens with dimensions of 100x20x10 mm which were loaded by welding a 10mm wide layer consists of five rows stacked one third of width. Welding parameters were established through exploratory research method. Preheat temperature between rows was determined on the basis of carbon equivalent sensitivity to cracking full namely deposit, account relationships prescribed by SR EN 1011/2004- Recommendations for welding of metallic materials. Welding parameters determined experimentally are presented in Table 3:

Table 3. Welding

Electrode diameter [mm]	Welding current [A]	Current	Gas safety	Gas Flow [L / min]	Temp. preheating and inter-row	Linear Energy [J / cm]
$2^{+0}_{-0.05}$	180 ± 10	CC^{+}	Argon	12 +1	300 ± 50	approx. 10

Process parameters in the table above were used for the four samples loaded by welding according to descriptions given, and these samples were used to optimize treatment hardening heat treatment to the diagram successive tests presented in Fig. 3.

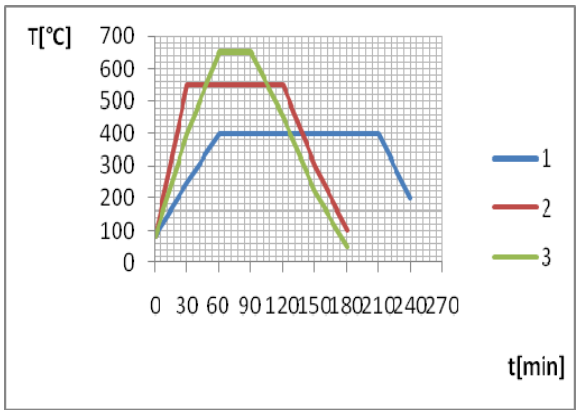

Fig. 3: Diagram of precipitation hardening heat treatment of secondary

1. Average 31.5 ± 1 HRC hardness, 2 - average 38.2 ± 5 HRC hardness, 3 - average 45 ± 1 HRC hardness

The options presented in the diagram on the basis of experimental results the optimum maximum hardness, determined on specimens tested to maintain a plateau at 650 ± 10 ^{0} C for a duration of at least 30 minutes.

4. RECONDITIONING OF PUNCHES

In order punches reconditioning existing stock it proceeded to the choice of 6 pieces of each type of material to remove surface defects in the area degraded by mechanical, metallic sheen to preheat and loading and welding, with parameters in Table 3. Anti-wear layers deposited in Figure 4 were designed so that after processing the final rates- Figure 5- there are no defects such as lack of material.

Fig. 4: Punch loaded by welding
Fig 5: Punch manufactured by the final odds

Punches thus obtained were heat treated according to the diagram in Figure 3, marker 3. Findings of the qualitative level of punches thus obtained was done by metallographic research and investigation of specific areas of assembly base metal / weld metal / heat-influenced area, carried out on samples taken from the punches. Metallographic structure and hardness variation diagram of the investigated areas is shown in Figures 6, 7.

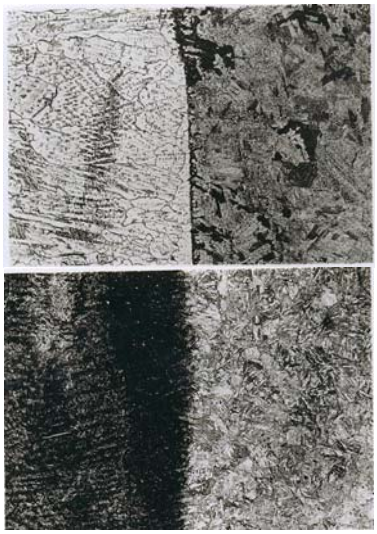

Figure 6: 100x metallographic structure

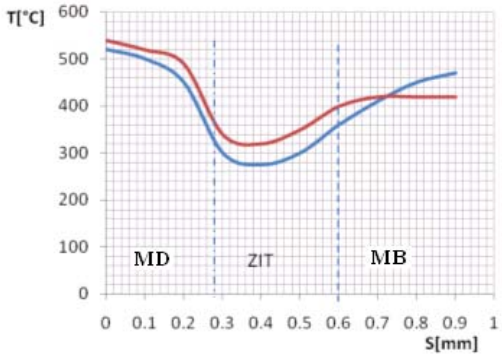

Figure 7: Diagram of hardness HV10 variation in specific areas

Data analysis of the figures presented above shows a good compatibility of anti-wear layers, which shows the structure of ferrous complex carbides rich in Cr, W and Ti, fine-grained, with the base metal that shows the structure recovery

Areas characteristic hardness variation is relatively low and insignificant in terms of reception and transmission capabilities of thermo-mechanical shock, occurring in the extrusion process, combined with high hardness of the deposit, which guarantees a smooth operation and good resistance to wear so taken punches.

5. CONCLUSIONS

There was developed a new technology for restoring and manufacturing the bimetal variant moulds by hot pressing process, the principles of sustainable development and increase the reliability requirements at lower costs.

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