



"HENRI COANDA"  
AIR FORCE ACADEMY  
ROMANIA



"GENERAL M.R. STEFANIK"  
ARMED FORCES ACADEMY  
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER  
AFASES 2015  
Brasov, 28-30 May 2015

## UNMANNED AIR VEHICLES IN ROMANIA. STEPS TO THE FUTURE

**Ion Magdalena\***

\* Teamnet, Bucharest, Romania

### 1. THE EUROPEAN CONTEXT FOR USING UNMANNED AIR VEHICLES

Lately, unmanned air vehicles became a presence of growing importance in military, civilian, scientific and economic activities, developed by different states of the world.

Unmanned air vehicles are aircrafts without human crew on board, which can be operated from a distance or perform flights autonomously, having dedicated sensors on board for various military and civilian applications. According to the principles of air safety, unmanned air vehicles are considered to be projected, built, operated and maintained in activity for air traffic activities, and their equipments are also qualified, according to the relevant provisions in the field of aeronautics.

The use of unmanned air vehicles was set up for the first time by the provisions of the Chicago Convention, on December, 7th, 1944, Article 8 stating that: *"Any aircraft able to fly without a pilot aboard cannot overfly without a pilot the territory of a contracting State without a special authorization of the respective state and in accordance with the provisions of this authorization. Each contracting State commits to take the necessary measures so that the pilotless flight of such an aircraft in the open regions of the*

*civilian aircrafts be controlled, so that it can be avoided any danger for civilian aircrafts.*

Starting 1960, the unmanned air vehicles were most commonly used in the military field, performing mostly surveillance and recognition activities. Subsequently, to the end of the XXth and beginning of XXIst century, the interest in the research and development of such means have led to the emergence of a real industry, within which new technologies were adopted, allowing for a large variation of products in the field and a permanent increase of their performances.

Thus, there has emerged unmanned air vehicles specialized in collecting relevant information, at tactical, operational and strategic level, in order to discover and mark the targets, and, more recently, for hitting various objects.

A significant number of European states use unmanned aircrafts, especially beginning with the second half of the eighth decade of XXth century. At an initial stage, they imported these means from the main manufacturers - USA and ISRAEL. Lately, it is recorded an increase of the European States' interest for developing their own industries in this field, focused on manufacturing small and medium size unmanned aircrafts, command-control systems, components and various sensors. The achievements in this field are mostly

based on the results of the researches conducted according to each state's own contributions.

Also, there are programs developed based on the collaboration between the large manufacturers in the field, especially for manufacturing unmanned aircrafts of high altitude, height and endurance, such as those used for fight, extent to which it is remarkable the French-Israeli collaboration for achieving the HARFANG unmanned aircraft, the one between firms in France, Sweden, Greece, Switzerland and Italy for developing the nEUROn system. In addition to these, there are the actions conducted in Great Britain, by BAE Systems company, in order to manufacture the drone TARANIS, to mention just a few of the actions conducted currently in Europe.

## 2. THE ROMANIAN EXPERIENCE IN USING UNMANNED AIR VEHICLES

In 1987, the Romanian Military Aviation was endowed with the VR-3 unmanned research aircraft system of Soviet production, which equipped an unmanned research squadron.



The squadron was provided with 12 unmanned, reactive, VR-3 aircrafts, of 950km/h of speed, the maximum flight ceiling of 5000m and the action ray of 200km. Among these, eight aircrafts could perform photogrammetry missions, and four aircrafts were specialized in video research, for which the transmission of information was done via a radio connection to a ground station.

VR-3 unmanned aircraft system was completely autonomous and dislocable, the staff having the entire technological support needed available for the preparation of control systems and equipments, maintenance on ground, preparation for launching, launching, recovery, transportation and aircraft

maintenance, as well as for the reception, processing, interpretation and transfer of information to the upper echelon, the beneficiary of research missions.

At the beginning of the 2000s, the unmanned research squadron was dissolved and the aircrafts were stocked and subsequently destroyed, except one, which is currently in the Museum of Romanian Aviation.

The introduction, in 1999, in the endowment of the Air Forces and the equipment with unmanned aircrafts of American production of the SHADOW 600 type represented an important step forward on the direction of using the unmanned air vehicles in the Romanian Army. The squadron operated, until 2003, as part of the Romanian Air Forces, and afterwards was transferred under the subordination of the Military Information Direction.



The SHADOW squadron was used in many actions in the operation areas outside borders, with important results in ensuring relevant information of forces during the development of military actions.

Besides the surveillance, recognition and intelligence systems, presented above, for training and performing machine gun shootings, artillery and surface-to air missiles, in time, there were used about 800 unmanned aircrafts produced in Romania, from the ATM series, manufactured in a department of 80 workers, especially set up in the Furniture Factory in Târgu-Mureș,



ATM 1M

ATM 001

ATM 3



"HENRI COANDA"  
AIR FORCE ACADEMY  
ROMANIA



"GENERAL M.R. STEFANIK"  
ARMED FORCES ACADEMY  
SLOVAK REPUBLIC

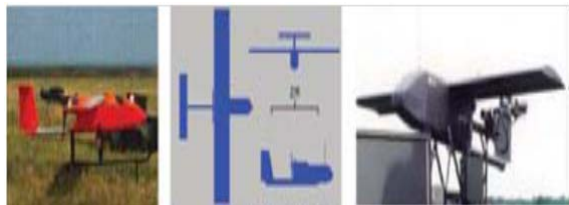
INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER  
AFASES 2015  
Brasov, 28-30 May 2015

the unmanned aircraft **ATT-01**, manufactured by Electromecanica Crângu lui Bot Company,



and **FOX TF -1** unmanned aircraft system produced in France.

From those presented above, one can conclude that the Romanian Army was endowed not only with important unmanned air vehicles, the only indigenous systems being those provided for training and performing shootings by the subunits, units and great defense units of the air space with the ground station.



### 3. ROMANIAN ACHIEVEMENTS IN THE FIELD OF UNMANNED AIR VEHICLES

In Romania, there was interest in building a certain type of unmanned aircrafts, but these, most of the time, remained at the project stage, or various prototypes or demonstrators were manufactured.

Usually, the research-development activities were conducted in research institutes and universities in the field, and recently, by private companies, on projects financed from institutional funds.

Up to now, the Romanian governmental authorities refrained to manifest interest in developing projects with unmanned aircraft systems, although the events taking place lately at global level show the need and

importance of using these means to collect information for various fields of military and civilian activity.

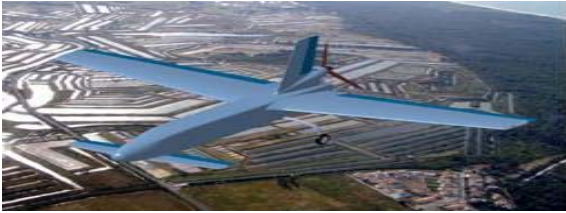
In this context, **The National Institute of Aerospace Research (INCAS)** produced the prototype IAR-T, a mini pilotless aircraft of a weight of 20kg, being equipped with a video system in real time, with the maximum speed of 180km/h, an endurance of 30 minutes and a maximum ray of action of 10 km. It was designed to be used especially in the field of scientific research, but due to the lack of orders, it was no longer developed.



At its turn, **The National Aviation Institute S.A.** produced the prototypes of two pilotless aircrafts, **ARGUS S** and **ARGUS XL**, both of them being left out in the research-development stage.

The pilotless aircraft **ARGUS S** was designed to perform surveillance missions, being projected for a maximum weight of 140 kg and a maximum speed of 240 km/h, with a ray of action of 200 km in autonomous flight. The take-off and landing are radio-controlled from the ground, by an operator, while the cruise flight is based entirely on the systems on board.

The **ARGUS XL** system is a pilotless aircraft in Canard configuration, built entirely out of composite materials. The wings and tail surfaces are detachable, and the main landing gear is an elastic blade, equipped with mechanical brakes and is not retractable. The nose gear is fixed, with direction and oleo-pneumatic piston.



Within the **Environmental Engineering Science Faculty of "Dunărea de Jos"** University there is set up a Center of Excellency on Environmental Issues, where an unmanned air vehicle was manufactured, with a flight autonomy of 150km, which can be used for surveillance, reconnaissance, drafting cadastral maps, environmental and biodiversity observations.

The **Military Equipment and Technologies Research Agency** within the Ministry of National Defense is currently developing the microsystem of unmanned aircrafts **SACT5-BOREAL**.

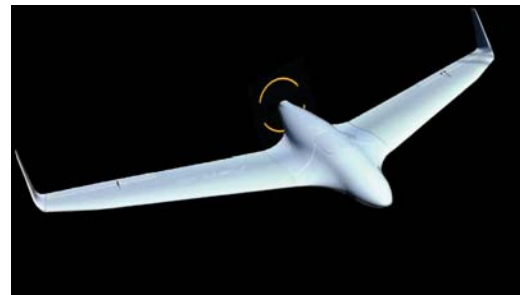


Developing a research-development project, financed from their own funds, **S.C. TEAMNET INTERNATIONAL S.A.** has until now achieved two types of drones, **OIM-I** and **OIM-II**, **HIRRUS** mini - system, with ISR (intelligence, surveillance, reconnaissance) capacities and currently handles the development of the **SIGNUS** tactical unmanned air vehicles.

**OIM-I** and **OIM-II** aircrafts reach speeds between 50m/sec. and 80m/sec., reach ceilings of 3000 m, with action rays of 30 km and 100 km, have an autonomy of one hour and six hours respectively, being able to satisfy any requirement for training and performing shootings with machine guns, artillery and ground-based rockets, in specialized shooting ranges.



The **HIRRUS** system is designed to fulfill missions in the military and civilian field, being destined for surveillance and recognition, for real-time data collection, needed by military or civilian decision-makers in order to take the necessary measures. It can be equipped with a gyrostabilized camera for daytime filming, gyrostabilized monochromatic sensor for night time or color photo module for daytime.



The Romanian recent achievements, especially those in the private sector, prove the Romanian experts' capacity to design and produce unmanned air vehicles at a technological level comparable with the one reached by large manufacturers worldwide, thus being created the premises for developing a new secondary branch of the aerospace industry in Romania. However, the possibilities for manufacturing them depend, on one hand, on the limited financial resources of producers, and on the other hand, on the low interest of the Romanian authorities to purchase such systems of internal production.

#### **4. THE FUTURE OF UNMANNED AIRCRAFT SYSTEMS IN ROMANIA**

**In the military field**, considering the importance given to information, surveillance and recognition in real time for squads, as a consequence of them being continuously improved the unmanned aircraft systems will clearly emerge as extremely important means for the preparation and performance of military actions, with important influences on the results.

Under these conditions, the management of the Romanian Army will have to take an extremely important decision, regarding the introduction of the unmanned aircraft systems



"HENRI COANDA"  
AIR FORCE ACADEMY  
ROMANIA



"GENERAL M.R. STEFANIK"  
ARMED FORCES ACADEMY  
SLOVAK REPUBLIC

INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER  
AFASES 2015  
Brasov, 28-30 May 2015

in the army endowment, especially in the fields of data collection, surveillance and reconnaissance (ISR - intelligence, surveillance, and reconnaissance) as well as the preparation of defense squads in the air space while using the target-drones.

Also, the participation of the Romanian Army to military actions in the theaters of operations outside national borders, under the aegis of UNO, within NATO or comprised in military alliances, shall have as a basic requirement the use of UAVs, in the tactical field as well as at operational or strategic level. Nevertheless, one of the lessons learned revealed the role of increased importance of the information structures in collecting, processing and making available of information needed to commanders at all levels, in real time, while using, at large scale, the unmanned aircraft systems.

At the same time, the special forces units, part of the actions to be undertaken, will depend on the real-time information about the objective or forces they are to act upon, situation in which the information provided by the unmanned aircraft systems shall prove to be extremely useful.

An increased importance will gain the use of unmanned aircraft systems by the military units of battalion-type, as the basic elements in collecting relevant data for the preparation and development of actions against the enemies, their surveillance and monitoring, as well as for assessing the effect of strikes on the forces and objectives of the enemy.

**In the civil field**, the use of the unmanned aircraft systems in Romania is at a starting point. There were various actions in this field, but most of the time, they were performed sporadically, or consisted of demonstrative flights.

The experience gained worldwide with such systems, shifted the focus on applications

which can be practically achieved in all areas of social, economic and scientific activities. To this extent, we are making apparent the preoccupation of the aeronautics authorities to find practical ways to extend the use of air space by the unmanned aircraft systems.

However, it is noticeable that actions are taken towards cancelling all restrictions related to the use of air space by unmanned air vehicles and integrating them in the controlled air space, which will allow the extension of the fields in which it could have applicability.

Currently in the USA, FAA (Federal Aviation Administration) has authorized for the first time that two unmanned air vehicles - PUMA and SCAN EAGLE - act in the civilian field, in the controlled air space. This process will also continue, as it is in an advanced stage in other states, as well.

It should also be mentioned the fact that the diversification in the civil field is determined by the high number of sensors which can equip the unmanned aircraft systems. These can be day and night cameras, photogrammetry, cartography and cadaster modules, communication means or various devices for the analysis of the atmosphere and the ground.

Considering these, it is expected that the use of the unmanned aircraft systems, in the daily activity or in emergency situations, **in the field of internal affairs**, aims at the supervision and monitoring of borders, road traffic and the areas where natural disasters and catastrophes were produced, for assessing the effects of disasters and natural calamities, search-rescue of survivors, as well as for supervising and monitoring critical structures.

**In the field of agriculture**, the unmanned aircraft systems, provided with specialized sensors, will be used to supervise and monitor crops, determine their growth degree, the emergence and spreading of pests, supervision

and monitoring of animal herds in the pasture areas or irrigation systems, raising necessary data for performing cadaster works of agricultural and non-agricultural lands, forests and localities, as well as for achieving the protection of agricultural property.

A field where the unmanned aircraft systems will be used at a large-scale is **the protection of the environment**, a field where the applications will focus mostly on environmental and climate change monitoring, surveillance and research of forests, census of wild animals, establishing the pollution level of the atmosphere, soil and waters where disasters and natural calamities were produced, surveillance and monitoring of watercourses and the Danube Delta, the inspection of dams and protection works against floods, collecting data for designing maps for hydrographic basins, as well as photogram for the areas of interests belonging to them, research and monitoring of pollution sources and polluted areas, surveillance of environmental incidents, especially in nuclear plants and companies with a high risk of pollution of the atmosphere, soil and waters.

The important applications which can be achieved in **the field of transport** for the transport surveillance and monitoring on the Danube River and the main transport means, the surveillance and monitoring of harbor activities and large railway hubs.

A programme of extreme importance which Romania is part of is the programme **ALLIANCE GROUND SURVEILLANCE (AGS)**. It was to be achieved according to a NATO initiative, adopted at the Summit in Chicago, in May 2012, which until now, 14 states adhered to. It is intended to purchase **five unmanned aircrafts GLOBAL, HAWK** and the command and control systems needed. The system will be operational starting 2017 and will be operated by a NATO structure, following that the information obtained be made available to all 28 member states of NATO. The **AGS** system will be able to handle the surveillance of an extended ground surface, with platforms which will perform from big heights, on long periods of time, under any conditions of time and weather. The

main operation basis will be set in the Air Base SIGONNELA, in Italy.

A new probable direction of action in Romania in the future was open by the European Council Summit, in December 2013, in which there were analyzed the problems of the EU member states in participating to the achievement of four programs meant to develop the capacity of the European states to act in crisis situations - **fuel supply while in air, satellite communications, information security and unmanned aircraft systems**.

Regarding the need to develop an **European unmanned aircraft system**, there was agreed to create a work group for elaborating the requirements and technical description for a system of medium altitude and great endurance (MALE), to which member states should confirm their intention to participate in. Meanwhile, France and England started the operations for the achievement of a UCAV, program to which Italy will also join.

To this extent, Romania will have to analyze the possibility to achieve such a system, either by initiating their program, or by adhering to the European program.

The development of a national program for the production of the unmanned aircraft systems could be Romania's answer to the challenges at the beginning of this millennium, among which the relevant and timely information, especially that it becomes more and more important the role played by real-time information, in the management of all areas of activity. Having at the basis the experience already gained while using various unmanned aircraft systems, as well as manufacturing such systems, it is necessary to develop an autonomous program of unmanned air vehicles, in order to cover the needs in the military as well as civilian field. A first step would be to manufacture an unmanned air vehicle with dual use - civilian and military - of a small weight of 150 kg, based on certain operational requirements elaborated by the main users of such systems.