UAVs AND THE MILITARY LEADERSHIP

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Abstract *Basic and applied research of our days result in the emergence and development of technologies like drones and their recent development require further changes and improvement in the skills, abilities, capabilities and know-how of their users. Technological development affects therefore also changes of those competencies of the military leader that are needed in 21st century operations.*

By describing some of the presently known top military technologies and their potential in combat use, the author outlines of the ongoing change in military arts and the nature of combat, in order to assess what competencies the new generations of military leaders will need to be able to remain personally responsible for the operations of their units.

Key words: *drones, nanorobots, artificial intelligence, competencies of military leaders, commanders*

1. INTRODUCTION

Based on the ongoing research we can say that autonomous systems (i.e. drones) will be the most widely used tools in the wars of the future as well as in civilian organizations. Nowadays due to the continuing information revolution the cost of operating unmanned devices are becoming cheaper and more widely used. Technological progress has allowed the mass proliferation of smaller drones with improved data processors. The implementation of high-speed data transfer options, accurate navigation capabilities, and compact digital sensors has allowed UAVs to a become effective weapons systems. The appearance of drones on the scene of military and non-military areas, but the same purposes as operations (e.g. an urban environment, information theatre, digital battlefield) is not fiction, but unquestionable fact. Today implementation of armed kinetic operations and other functions of developed robots are part of military weapons systems for all branches. [1][2]

The appearance of new technology development of information and decision making systems requires the preparation of decisions and adoption of accessibility, availability, and security issues of today and the needs are intertwined with each other fully in the implementation of military tasks as well as in military thinking. Military commanders and their subordinates evaluate the environment in order to meet assigned military objectives, knowledge of the objective area is indispensable for leading military operations. Commanders must be knowledgeable of potential modern technology options and they must possess the skills required for their application. The commander must be a person who can perform various tasks efficiently and dynamically by coordinating the available resources at their disposal, whether those are drones, autonomous machines, or living, sentient human beings. [3][4]

2. THE CHANGED OPERATIONAL ENVIRONMENT

Due to today's dynamic environment, military operations planning must provide options for unforeseen situations, including operations in large battlefields with large traditional forces and special forces operators, operations with only a few soldiers, or drone only operations. The design should take into account the full spectrum of climate and terrain features.

Urban warfare has caused the disappearance of traditional demarcated front lines, the location of the position or protected areas are not the sole measure of success. The availability of resources in a minor or non-state opponents cannot compete with the modern well-equipped military forces. The linear battlefield will be replaced by a 360-degree dynamic front, utilizing new high-tech weapons and non-conventional forces. The 360-degree dynamic front will be applied using a unique combination of technology and uses of power. Such military operations are carried out with complex operations that use various military professionals and various specialists in design and implementation. The objectives of today's military operations (political target) are not designed to completely destroy the area as one of the paramilitary occupation. The complete destruction enemy infrastructure (manpower, roads, etc.) as determinant of success is not advisable if the desired end state is to create a safe and liveable environment. Military planners should not completely destroy the buildings and population, instead, planners must be provided with the skills necessary to influence cultures and limit civilian casualties. The strategy of cultural influence can be successful by military influence. New approaches and models are needed that can also be applied to the changed security environment, including one as the effects-based operations, which seek to control all aspects of the conflict including the time line. The concept of the effects-based operations is not new. The theory of the concept is based on placing the measurability of the effectiveness of military operations in the forefront of the design process. This process will require the use of military and non-military forces utilizing old and new equipment (e.g.: Robots) to achieve the strategic end goal or effect. [13][14][21]

The new strategy concentrates on identified and weak points of the enemy (focal points) chosen for destruction by concentrating available forces and capabilities to eliminate them or at least to put them out of action. Also, it emphasises the use of more precise forms of targeting, so that it can execute, in the final stage, a powerful strike by using both high-precision kinetic and non-kinetic means to reach their goals. The effects-based operations by linking a political end in itself with military and non-military operations (i.e. reinterpreting the "how to act" logic by asking "why to do it?") are changing the military focal points and concepts. These changes are due to the force-structure and expanding diversity of operating procedures. The purpose is to create and use an effects-based approach to network-centric warfare in order to reach effectiveness and success under the conditions of decision superiority. To do this, the armed forces and the collaborators should form an integrated network operations centre which requires the combined use of manpower, robots, UAVs, and the appropriate permissions defined by the size of the operation. Success depends on carrying out tasks and functions efficiently, information sharing, quick decision-making, and the appropriate instrument is used at the correct time for use in operations between the assigned forces. [19]

The physical and psychological effects, which is the result from the activity of the subsystems (like drone systems) and behaviour of the individuals, expand for a whole system's status (political, military, economic, social, infrastructure and information etc) and also a wide variety of possible areas. Consequences may be direct or primary, secondary, tertiary, or even multiple. [15][16]

The effects-based approach requires a comprehensive reflection from the battlefield commander and the military operation planners. All commanders staff wherever they are in the leadership hierarchy, must know and understand the strategic final state. Also, they need to keep in mind who are the operation participants, stakeholders, and caused effects by the activities impacts (it is important that not only the primary effects). [16][17]

The implementation of the military operations are based on forces and resources, which have to provide for the following:

- intelligence professionals who can quickly and accurately assess information and provide it to planners for cause and effect analysis, and the key decision makers in a system (E.g.: includes the sensors into only one integrated system, the decision makers and the kinetic and non-kinetic "weapons systems");
- network-oriented, effects-based operational planning capabilities (current situation, constant adaptation, and the ability of selective strikes, etc.).
- the decision-making agility, accuracy, and consistency on the battlefield, the transformation of combat capability and mission effectiveness information;
- the personnel with the right skills and prepare and equip them for rapid execution of assigned duties. [13]

In conclusion, in the effects-based operations, commanders and soldiers should know, understand and use the connections in the war, its art, and the capabilities and effectiveness of assigned resources. They must have knowledge of old and new technologies, methods, devices, systems and the opposing party's resources.

3. UAVS IN MILITARY OPERATIONS

One of the most important research projects are the development of robots, unmanned vehicles (air, ground, water). As technology advances, the drones take over those tasks quickly, which were operated by direct human-powered solutions and help for humans to solve tasks associated with excessive risks. Their tasks are carried out direct human supervision (not necessary for the employer and the device to be in the place, but to be there timely is a necessary condition).

Nowadays because of the information revolution, the unmanned devices are becoming more common and cheap. The development made possible the increasingly smaller size and weight, but more and more data processing capability. The use of high-speed data transmission capabilities, accurate navigation capabilities, the compact digital sensors (sensor systems), automated systems prevalent at the end of the 20th century. By the use of nanotechnology it is possible to make tools (e.g.: electronic and information technology, mechatronical equipments, etc.) smaller and smaller, and in addition to getting faster and faster data processing capability with less and less energy using. [3][5]

The execution of military operations the mini, micro and nano-sized robots, robotic systems, including biotechnology hybrids, may cause even further changes. The development outcomes can be predicted spread in many areas in the not too distant future (e.g.: intelligence, information gathering, target destruction, logistics, etc.).

As technology advances, the drones take over the activities, which were solving by the soldiers or the direct human-operated power tools. [3]

The IT capabilities for researching towards the creation of robots with artificial intelligence is available. The widespread use of fast data transfer and punctual navigational capabilities and small digital sensors (transducers) lay a foundation for technological advancement of the end of the 20th century.

Scientific developments in the last decades made it possible for robots (autonomous, semi-autonomous, remote-controlled, etc.) to be effective weapon systems. [1][3]

Nanotechnology (0.1 - 100 nanometre, NT) provides the possibility for the improvement of technical parameters of the current electric and IT equipment (sensors, actuators, etc.) and the border between physics, chemistry and biology will fade away. The spectrum of NT researches spreads from electronics to biology, however nowadays most researches have only the basics, but the examination of the military use of these technologies have started. [9]

Cost effective mass production capabilities will provide the massive appearance of drones. The application of military robots will further improve if they are used as a system, whether reusable or single use equipments, like:

- large number of nano drones are deployed on logistical roads, e.g.: they block the air-intake of vehicles, making them unable to move or fight;
- a similar sized drone squad deployed in the air as a platform or as a dense cloud can damage or even destroy airplanes;
- deployed on land or in water, linked together a huge number of drones can make biological, chemical or nuclear reconnaissance;
- miniature weapons, intelligent target-searching robotic weapons can damage infrastructure, objects or persons, can pollute (or clean) the environment. [1]

These new weapon types can change the place for settling of conflicts for traditional battlefields to new battlegrounds, and can provide real-time information to the commander about the effects on the soldiers. [10]

On the other hand using proteomics research it is possible to develop weapons able to select the target (e.g.: according to genetical marks). Numerous imaginable concepts can signal the implanted systems, which firstly can do bio-medical analysis. [11][12]

We must also mention robot (NT, artificial intelligence) applications in space. The satellites, their carrier and launcher vehicles can be smaller and their production can be cheaper, which increases their availability for example to observe Earth in swarms (information gathering) or attack satellites. They can be used as kinetic space weapons too (destroying smaller satellites by colliding with them). [3][10]

We must calculate with the presence of artificial intelligence, robots, automatic or autonomous equipments in future wars, so in the current security environment we can't forget about their abilities and their various application fields. It is already visible, for example that nano-sized robots can be injected into the body of the soldiers, which constantly monitors their life functions, and give these informations to their commanders about their combat abilities. The appearance of three or more dimensional semi-autonomous weapon systems is an unquestionable fact. [6][9]

In future wars everything will be controlled and monitord, and the situation will require fast and exact decision-making, and precise, effective execution.

The change toward autonomous warfare can be caused by for example that machines are cheaper than human lives, their data-processing capabilities are faster, their capacity if bigger, their reaction time is shorter, they don't suffer from environmental effects, they are tireless, fearless and can withstand monotonic works. [7][8]

The ever changing security environment means the appearance of newer and newer challenges. An effective military organization has to constantly maintain and upgrade its defensive mechanism and learn to adapt to both the old and new requirements.

We can say about the future of an organization, that it's highly regulated by their past capabilities, which doesn't mean that we have to toss away the past, instead that it should be constantly re-evaluated. This adaptation must include the change in the leaders' point of view. The military answer to the present challenges can be only effective and successful if the organization can forget old routines, (but also keep good traditions) and the disappearance of these bad habits can be the hardest point in the process.[26][27][28][29]

The use of equipment already present and the understanding of new technologies is not only the jog of engineers. The commanders and lawmakers both have to understand the limits of their applications. They need further knowledge than to know the application fields of robots, robotic systems, they also have to understand direct and further consequences of their use.

4. MILITARY LEADERSHIP AND THE COMMANDER

Management science is the system of knowledge that helps the work of leaders. It is the complex system of knowledge areas that helps building together, on the basis of the philosophical and systemic foundations of human thinking, the rational tools and methodologies of managers as well as the results of various areas of natural and social sciences in order to make individual work and organizational operations, as well as their management easier.

Management science like all sciences, are based on a systemic approach. All the knowledge, that can help the work of the leader, so the operation of organizations (groups, individuals) takes the foundation of the philosophical-systematics thinking and builds the system into the various disciplines.

Leadership with Taylorist, task-oriented views is present, even determinant in most military organizations, and it leaves less independence for subordinates, forming such organizations a command-driven leadership systems. This requires the automatic accomplishment of the tasks given by the commander. The resources of a mass army can be led by this philosophy, but changes in military leadership since require constant improvement.

Opposed to this, leadership in the USA since World War 2 is becoming more and more objective-driven due to the fast changes in production technologies and structures, as well as the change in society Creativity and innovation as a main feature in the leaders' way of thinking have gained primary importance probably only in the course of the second half of the century. [22]

The changed and expanded operational environment makes it necessary to re-evaluate the earlier specified tasks and features of the leaders. Leadership is not only about the exercise of power, there must be ways to make decisions which can be reversed, and empathy must be important during the decision-making. [24]

The goal of improving the organization is the increase effectiveness. The criteria in effectiveness can be divided into two groups: human factors (behaviour, communication, etc.), and material factors (structure, technology, etc.).

The efficiency of the leader is governed by personal traits (creativity, analytic skills, networking skills, practical skills, etc.). [32][33]

Managing organizations in an international environment can only be accomplished with smart and practical leaders and experts. [34] Their efficiency heavily depends on the abilities of the maintained equipment and systems.

The present technological advancement is faster than ever, and it is getting even faster. The accusation and maintenance of the required qualified workforce is necessary, their constant improvement is almost unimaginable. The current level of available resources the reliable knowledge and the focus on unused functions of current systems can produce results.

Due to the rate of amortization of present technologies, and the difficulties with ongoing modernization, one may think that most of our complex systems consist of the modernest parts as well as outdated ones having only a use-value and we have to maintain and operate them together.

The only way to success may be the improvement of operative knowledge about these "multigenerational" systems and the creation of a different operational strategy for their application. [29]

Centralized organizations tend to neglect knowledge care, because it is against the principles of centralization. This can completely ruin innovation, inner motivation, professional or personal development, and even the foundations of the improvement and renewal of the organization. The neglected, unimproved knowledge, skill loses its relevance, applicability very fast. To overcome this trend advanced professional and leadership knowledge, attention and work is required. [27][28]

New knowledge is made of the combination of different areas, and it is important for the group in the process to have diversity, motivation and coordination. The goal of management is for the commander to realise the values and motivations of his subordinates and his own. How can he summarize this and act according to this, because this activity is inseparable from the needs of both the organization and the people working in it. [23]

Military leadership is a community act, which makes the military leader (commander) affect his subordinates to fulfil tasks in a way it is specified by the superiors [25]. So the commander is a person, who can make his subordinates do assignments effectively and dynamically. Military leadership is, however, also a cooperative, situational styled activity, which is based on knowledge, behavior and self-developing techniques that makes the commander able to help with his work the strategic development of the organization by his status in the organization. Management in carrier, talent, time and performance all connected to the numerous requirements in the fulfilment of leadership can provide quality solution. [25]

Any good solution must combine such elements as a career and talent management scheme combined with the use of time and quality management systems, all matching the complexity of present and future tasks.

In the decision making process the professional arguments and teamwork must be in focus. The successful task requires the collective thinking, analysis of effects and evaluation. Good networking is able to organize different expertises, abilities, and potentials together, and the leader in a coordinating position can provide cooperation.

The leader must give real values for the task, by drawing up possibilities, guides and goals, which provides the experts in the organization to do their parts creatively and effectively, like:

- the conscious formation of working environment;
- the creation and regulation of communication channels;
- maximizing the suitable, dynamical changing task oriented performance;
- optimal time-management;
- helping the implicit knowledge become organizational knowledge;
- leading by example;
- motivating, personal improvement, management of carrier.

According to the American and English authors [18][20] the most basic type of element of any organization are the people, who have suitable skills, and are able to form groups within them. The quality of the organizations is set by the competence and commitment of the people working in it. Leadership, like all other skills, need experience, particular competences and knowledge. The "right person for the right place" principle can only be applied successfully, if it is exactly specified, what factors are indispensable in the position in question. The competence as a concept contains that leader's behavior, personality, skills, motivation and with what type of knowledge will he accomplish his goals.

Behavior and activity for the success of the task is essential, but it also contains personal traits. The success of the leaders activity is influenced by competences specifically in the execution of tasks in the given environment, so the behavior patterns have to be specified, and the results constantly measured. [35]

Commanders therefore must be able to adapt their behaviour and competencies to the task as well as to other factors of the command environment, such as the motivation, capabilities and readiness of their people, the features of the organization they form a part of, not forgetting its culture, the decision environment, etc. [36]

Military leaders have to be able to control and lead their subordinates (systems) and reach the goals. The competencies practical utility has to be defined with forms of behaviour, and improve and measure them. With the appearance of the robotic systems and artificial intelligence the measurement and inspection of these views are becoming more and more actual.

On of the most important task of the commander (even the engineer commander) is the preservation of the own forces (both human and technical), preparation, maintenance, handling of current situations, the execution and enforcement of orders. [29] The leader is a specialist, a skilled communicator, networker and has implicit knowledge that helps to suitably operate, and if needed, improve on the one hand the communication between the subordinates, the cooperation, the effective task setting, and on the other hand the task orientation of the organization, the mission performance, so to improve chances for the organization to experience not only short-, but also long-term survival.

The measurement of the leader's activity should contain the implementation of the best possible decisions and the best and most efficient time management. [22] A commander culture, leader attitude and mentality is needed, where the leader's introspection and self-education is accepted and natural. The more a leader understands himself, the better and more successful decisions he can make. [30] A commander with these abilities can implement his knowledge in both the everyday routine and in the solving of unexpected situations, has to make intuitive and rational decisions. The leader has to reflect the operational and special knowledge and understanding of the guided process systems, explanation provided by the related theory and its limit, as well as human nature. [31]

A unique personality, the creative use of experience and analogical thinking, the ongoing internalization of new knowledge inputs and the constant re-creation of one's own mental complex are as necessary for a commander as the ongoing improvement of risk management skills, including the capability of purposeful risk searching. Without such leaders, I believe, there can exist no successful and effective innovative organization in the 21st century. The mixing of various soft and hard methods and approaches will improve our military organizations, if we let it. Versatile thinking is one of the fundamental principles of modern military leadership.

CONCLUSION

Nowadays armed conflicts contain all equipments and theories that a given side will use in order to effect the other side. In the 21th century there are very few equipments or methods that cannot be used as weapons in order to achieve military or non-military goals.

One of the most important security development can be experienced in the field of robotics, unmanned vehicles, and the elaboration of the laws and doctrines for their application.

The equipment and robots currently employed or under development are not intelligent, sentient beings with human values, but the advanced (silicon-based or more advanced) IT capabilities provide opportunities, which can improve their situation awareness, adaptability and decision-making skills.

Engineering creativity and know-how opens new areas of opportunities for decision-makers that make it possible to improve decision processes and knowledge management of our learning organizations. To make the best possible use of them is a prime responsibility of present-day managers. [3]

Using new technologies in itself brings not only the development of new competencies, but also new responsibilities. Legislation may have to face a constant challenge of continuously developing technology in need of legal network of regulation. Such a situation will request openness and continuous learning from the lawmaker as well.

In the choice and improvement of leaders it is advised and justifiable to examine those personal traits which are related to the understanding of modern technologies and personal adaptation. The new operational environments and the examination of the elements make it necessary to re-evaluate the earlier specified tasks and competitions of the leaders, because the success of any mission, in the end, depends on the commander.

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