LONG TERM DEVELOPMENT PERSPECTIVES FOR UAV POTENTIAL

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Abstract

The long-term perspectives in the potential development plan are based on the analysis of trends in global development. On this basis, an assessment of the requirements for future military capabilities is made. The long-term trends caused by the development of military technology are viewed. As a result, the use of robotic systems will increase in the armed forces. All this poses new challenges for the EU armies. In this regard, groups of factors can be distinguished which shape the trends in the development of military UAVs. And since technology will inevitably be transferred from the military to the civilian sphere sooner or later, it would be particularly useful for national security to analyze which of the areas of application of UAV complexes could be of greatest benefit in the civilian sphere and in the interests of national security.

Keywords: unmanned aerial aircraft, military integration, national security, planning.

1. INTRODUCTION

The Capability Development Plan reviews military capabilities the EU must be capable of by 2030. It should be emphasized that the capacity development is a "long-term endeavor" and, therefore, military development must proceed in such a way that EU military capabilities are prepared to operate "in different situations, some of which may not be predictable" and the EU Armed Forces "respond to a wide range of possible scenarios". The Armed Forces would not require the most technologically advanced UAVs if they are not capable of meeting their combat requirements. Eventually, technologies will inevitably be transferred from the military to the civilian sphere. An analysis on the areas of application of UAV complexes would be particularly useful for national security and eventually bring the highest benefits in the civilian sphere and in the interests of national security. The civilian application of UAVs can be divided into three categories: security; research purposes and commercial use.

2. LONG-TERM PERSPECTIVES IN THE RESEARCH DEVELOPMENT PLAN

Long-term perspectives in the potential development plan (PDP) are based on the analysis of trends in global development. Based on the abovementioned analysis an assessment on the requirements for future military capabilities is made. The shortcomings and capabilities of EU defense industry research are also evaluated. Afterwards an evaluation is made on the identified trends, information received from Member States and EU Military HQ, assessment on the potential deficiencies and opportunities for combining resources and responsibility distribution. Based on the above mentioned Member States choose a priority action area for military potential development. These actions can be carried out both within and outside the EAO. The PDP currently identifies five areas of priority action:

- Attaining an intelligence superiority;

- Cyber security;
- Satellite communications;
- Improved battlefield information and communication systems;
- The use of unmanned aerial vehicles (UAV) for observation.
- Battlefield personnel protection;
- Increase of personnel mine protection;
- Increase in personnel protection against the factors influencing WMD (weapon of mass destruction);
- Anti-aircraft and missile defense in the theater of operations.
- Conducting expeditionary operations;
- The use of aviation between combat operation theaters;
- Combat capabilities in the theater of operations;
- Increased logistics support for deployed forces;
- Medical assistance during operations.
- Protection of naval communications;
- Naval patrol and escort;
- Naval surveillance systems.
- Issues affecting different areas;
- Energy and environmental protection;
- Research within the project SESAR (Air Traffic Management system);
- Modeling and experimentation;
- Space information systems.

Compared to 2011 the current PDP is focused on high-tech warfare and on strengthening the naval component.

A detailed look on the military-technical aspects of European Union military planning is provided by the EAO document “Future Potential, Emerging Trends and Key Priorities” published in 2014. This document reveals some initial data on which the EU PDP is based. The document begins with an analysis of EU security threats. At the same time, it is immediately noted that "the changes over the last few years have highlighted the difficulty of accurately predicting what may even happen in the short term." It can therefore be said that the principle of strategic uncertainty is enshrined in both EU and NATO military planning.

Based on this principle, the authors of the document proceed from the fact that "it is necessary to take into account the full range of opportunities that can be realized by 2030, from a generally peaceful to aggressive world environment involving inter-state conflicts”. Therefore, we can assume that EU military planning is based on a scenario in which there are several for the development of the international situation, from positive to the negative. Moreover, the criteria for positive and negative are taken from the state of the international environment, and not from other considerations, such as strengthening one's own influence or "maintaining world leadership", as in the USA.

The authors of the document identify changes in the nature of threats most likely due to the Ukrainian crisis and the corresponding actions of Russia, although this has not been explicitly mentioned. However, the document notes that "Europe's lack of security ... again brings the issue of territorial defense on the agenda." Previously, the EU was focused on resolving crises abroad, which required expeditionary forces. The document further emphasizes that "the financial situation of Member States will not allow the deployment of separate defense forces on the ground and for operations and crisis management". According to the document, such forces differ significantly in structure and weaponry, although for a number of parameters they can be interchangeable. It is therefore necessary to create a military capability that fulfils both functions (Antonov, Hristozov, 2017a; Terziev, Petkova - Georgieva, 2019b).

The document reviews what military capabilities the EU should have by 2030. It is emphasized that capacity development is a "long-term endeavor", so that military development must proceed in such a way that the EU

military capabilities are prepared to act "in different situations some of which may not be predictable, and the EU's armed forces "respond to a wide range of possible scenarios." This reaffirms the scenario approach for predicting future security threats (Antonov, Tsonev, 2016; Stoev, Zaharieva, Mutkov, 2019).

It is also stated that these threats will change significantly in the future. These will include the possibility of an attack with the help of various types of WMDs, as well as economic, legal, diplomatic measures and attempts to destabilize the information and political systems of states. "Opponents will seek to use technologically advanced and improper methods of war in all possible fields: on land, at sea, in the air, in space and in cyberspace," the document said. In order to repel these threats, the European Armed Forces must have "greater flexibility, speed and adaptability".

The long-term trends caused by the development of military technology are then discussed. It is stated that the use of robotic systems in the armed forces will increase. Fire support will be enhanced by the use of "Beyond-visual-range" weapons, directional energy weapons and laser technologies (Antonov, 2017a; Terziev, Petkova - Georgieva, 2019c). The weapon tactics will change accordingly. A deadly weapon will appear, as well as a "dosing" action, ie. which allows you to change the power of the used ammunition.

The above listed poses new challenges for EU armies. In this regard, four groups of factors can be distinguished, which shape the trends in the development of military UAVs:

- Functional factors – user requirements, ie the armed forces interested in having such UAVs that meet their current and future practical requirements for the accomplishment of their tasks and the protection of national security;

- Technological factors - the development of new and refining already existing technologies for the development, research and production of UAVs for different purposes, including the various possibilities of their payload;

- Psychological factors - the massive introduction of UAVs fundamentally alters the psychology of decision making;

- Material and financial factors and reasonable development costs for manufacturing and operating standard UAVs for the interests of the armed forces.

The functional purpose of a UAV plays a major role in these factors. The Armed Forces would not even need the most technologically advanced UAVs if they are unable to meet their requirements. But this is a far more complex problem. For understandable reasons, the various agencies have their own set of UAV requirements, making interagency cooperation in this area difficult. For the Armed Forces, an important requirement is for example low visibility and noisiness while for the specialized structures and units of the MoI (Ministry of Interior) such requirements are not essential. Furthermore, the Armed Forces need reliable and secure channels for UAV communication, operational capabilities in all weather conditions, the ability to work reliably in day, night conditions and in low temperatures. As a result a UAV that meets the requirements of the Ministry of Defense may be poor in regards to the requirements of others (Stoev, Zaharieva, Borodzhieva, 2019a; Terziev, Bankov, Georgiev, 2018-a).

Under the influence of the above four groups of factors, trends in the technological development of modern UAVs are formed. Based on the experience analysis of economically developed countries, we can talk about the formation of two multidirectional centrifugal trends:

- First, an increase in the functionality of UAV systems, including an increase in flight coverage and time spent in the air;

- Second, minimizing the size of UAVs.

All this coincides with another important task - maintaining the correct level of "information management and operational environment". The importance of this factor will be increased given the large amount of information that needs to be processed and properly distributed. According to the authors of the document, "duplication of systems, cryptography as well as the optimal use of air and space communications will become the key elements of future operations". At the same time, the standard means for obtaining information will be UAVs by air, sea and land, although the role of personnel will remain significant.

The document pays close attention to the issue of "compatibility and complementarity" in troop operations from different EU countries. This is not surprising given the lack of a unified armed force in the EU, which requires the ability to interact in joint operations. This task is of particular importance, according to the document in "high intensity conflicts". And the "modular" approach during the development of military potential is seen as a mean of cost reduction of such development. Essentially, the fact is that each country

must specialize in its own field and then provide that potential element of a joint "reserve" of resources to the European Union troops allocated for the accomplishment of a specific task (Terziev, Arabska, Dzhumalieva, 2016a; Terziev, Dzhumalieva, 2015; Nichev, 2009; Terziev, Dzhumalieva, 2016b-e).

Unmanned aerial vehicles are marine and ground based devices that have the capability to perform the task automatically without the presence of humans, eliminating the need for humans to be in dangerous conditions, to perform tedious monotonous work, which, however, requires certain skills and concentration with great cost of error caused by the notorious "human factor". Currently, UAVs are mainly used in the area of security and defense. Evidence of this is the weekly (if not daily) media coverage of the successful use of UAVs by US, Israeli and other armed forces in international conflicts.

A high priority is given to the task of protecting the Armed Forces personnel from the harmfull efects of enemy weapons. First of all, this applies to different types of WMDs - nuclear, chemical, bacteriological and radiological. In this context, the development of early warning systems, missile defense and air defense is planned. It is noted that Europe's technological superiority in this area can be lost in the midterm without the appropriate investment. Increasing the individual protection of military personnel on the battlefield is also required. "Political support for operations is very sensitive about casualties, additional efforts must be made for casualty minimization," highlighted in the document (Stoykov, 2011-a; Stoykov, 2002; Stoykov, 2003; Stoykov, 2005).

Finally, an important direction in the development of the European Union's military potential is the acquisition of the ability to deploy troops in every region of the world. This includes increasing the capabilities of both aviation and maritime transport. At the same time, deployment in remote theaters requires "mobile and maneuverable forces supported by adapted and integrated reconnaissance systems". One of the directions for the creation of such potential must be special forces. In addition, remote deployment of medical personnel and equipment is required. Part of the potential of global deployment is the ability to provide maritime communications for European trade and other interests.

The document additionally addresses the tasks for each branch of the armed forces: ground forces, navy and air force. Regarding land forces, there is a requirement to increase their flexibility both by structure and by application. "The operational context for the use of ground forces ranges from low-intensity humanitarian operations and stabilization operations to high-intensity interstate conflicts," higlited in the document. Consequently, troops must be able to adapt to the situation.

The remainder of the document addresses the role of the Air Force. It states that the main task facing EU Air Force is to maintain control of airspace, which, as highlighted in the document, is not guaranteed. "The distribution of modern air defense systems (Air Defense) is a fact... Maintaining European excellence in fighter aviation will increase the use of advanced integrated ground defense systems by the adversary", is stated in the document. Moreover, non-state participants get access to these systems. The ability of EU countries to suppress their opponent's defense is inadequate and cannot deliver the necessary result without US assistance. This heading is a challenge that the EU can tackle by developing strike systems and means of electronic warfare. According to the authors of the document, the nature of air fighting will not change significantly in the future. However, it will include unmanned aerial vehicles (UAVs) and cruise missiles, which will lead to prolonged air operations "in a more complex environment". As one of the tasks of aviation is to assist ground operations, this will require a concentration of firepower, accuracy, range, fire reaction speed during all-weather conditions. Helicopters will continue to play a key role in this regard. The importance of reconnaissance, surveillance, target detection and the related information processing is increasing. Therefore, the role of UAVs, manned and space vehicles will increase. Air-to-air refueling will remain a challenge for the EU's air force, due to the limited number of appropriate means and their dispersal. This requires both new investment in this area and pooling of available resources (Terziev, Bogdanova, Kanev, Georgiev, 2019b-d; Petrov, Georgiev, 2019e; Terziev, Georgiev, 2017b).

And since technology will inevitably transform from the military to the civilian sphere. Eventually, an analysis conducted on the application of UAV complexes would be particularly useful for the interest of national security. UAVs civilian application can be divided into three groups:

- Security;
- Research purposes;
- Commercial.

The first group consists of: patrolling the land and sea borders, traffic monitoring, all kinds of emergency monitoring, fire monitoring, environmental monitoring.

The second group includes the following types of aviation work: climate and atmospheric monitoring, monitoring the state of natural landscapes and vegetation, monitoring of glacier and ice cap status, ocean exploration, including marine mammal observations.

The main activities characterizing the third group are the monitoring of industrial infrastructure facilities, monitoring of agricultural and forestlands, spraying of chemical reagents for agricultural purposes, geophysical aerial surveillance, aerial photography and video recording, aerial mapping.

From the above listed it can be identified that except from spraying reagents all other applications of UAV complexes supply data to its users. A necessary prerequisite for the successful progress of modern manufacturing processes is timely and reliable information. This is especially true for projects and tasks that are spread over large areas. Aerial photos for decades have been an effective tool for conducting surveying activities in geodesy, geophysical research and conducting various types of monitoring. With the advent of aerospace images, the market for geoinformation data is emerging. Modern geoinformatics provides users with a powerful tool for visualizing, analyzing, organizing, storing geospatial data. Geoinformation systems (GIS) are used not only by government agencies (such as cadastral records), but there are numerous corporate GIS applications to help make informed decisions on complex projects for the use of natural resources, construction, agriculture and more. The issue of GIS content and their updating is decided on the basis of available funds. Now this data is mostly space and aerial photos.

Despite the continuous refinement of the aeronautical remote sensing toolkit in the aerospace industry, such a study has some methodological limitations, which are mainly determined by the inability to conduct the study at any time, anywhere because of the climatic conditions and the geometry of the orbits of the satellites. Unmanned aerial vehicles are much better than spacecraft at capture speed. For the observation of lengthy objects such as trunk pipelines, power lines, maritime and land borders, railways and highways. The flight of a UAV can be predetermined in such a way that the carrier can track the object, for example, while flying over a section of the border area. However, different type of UAV information can be transmitted in real time or after delivery and processing, but in practice on the the monitoring was performed. UAV air monitoring systems are used to update and refine geospatial information. The resulting image is superimposed on a digital terrain model, after which the data can be used to measure distances, define areas, as a substrate for overlaying other data (Terziev, Nichev, 2017c-i; Terziev, Nichev, Bogdanov, 2017j-k; Terziev, Madanski, Georgiev, 2017l-m).

3. CONCLUSION

The first real results from the implementation of strategic initiatives will be visible in only a few years, although intermediate results can be seen today, for example the implementation of projects such as e-Quip, Gateway Procurement, the integration of civilian UAVs. Unmanned aerial vehicles are much better than spacecraft at photographing speed. The different types of UAV information can be obtained in real time or after delivery and processing, but practically on the same day they were monitored.

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