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## APPLICATION OF UNMANNED AERIAL SYSTEMS IN THE AIR FORCE

### ZASTOSOWANIE BEZZAŁOGOWYCH SYSTEMÓW POWIETRZYNYCH W SIŁACH POWIETRZYNYCH

**Abstract**

The article discusses the use of unmanned aerial vehicles (UAV) in Iraq and Afghanistan. During the operation in Afghanistan the RQ-1A was used for the first time to carry out assault missions. The legal aspects of the use of unmanned aerial vehicles in the Polish airspace are described. They determine the increase in the use of UAVs.

The tasks that are and can be carried out by UAV in modern combat operations and the directions of their further development are also presented.

**Keywords:** unmanned aerial vehicles, Iraq, Afghanistan, drone

**Streszczenie**

W artykule omówiono wykorzystanie bezzałogowych statków powietrznych (BSP) w Iraku i Afganistanie. Podczas operacji w Afganistanie RQ-1A po raz pierwszy został użyty do wykonywania zadań szturmowych. Opisano prawne aspekty użycia bezzałogowych statków powietrznych w polskiej przestrzeni powietrznej. Determinują one wzrost wykorzystania BSP.

Przedstawiono także zadania, jakie są i mogą być realizowane przez BSP we współczesnych działaniach bojowych oraz kierunki ich dalszego rozwoju.

**Słowa kluczowe:** bezzałogowe statki powietrzne, Irak, Afganistan, dron

## 1. INTRODUCTION

Unmanned aerial vehicles are much older than the manned. The lack of a pilot reduces the risk during flight tests, accelerates the experiments and reduces their costs, and shortens the time of introduction of new technologies. This is the role of unmanned aerial devices today, and it can even be said that they are flourishing. Currently, there is a worldwide tendency to transfer various tasks to unmanned vehicles. The technical modernization of the Polish Armed Forces is also heading in this direction. In the perspective of 2030, they are one of the most important components of the organizational structure of our Armed Forces. The assault systems of the Polish Armed Forces will consist of manned and unmanned land platforms (remotely controlled vehicles), air and sea platforms equipped with modern navigation and targeting systems and precision destruction weapons, as well as non-lethal means of destruction<sup>1</sup>. Our armed forces are now able to use modern combat systems and, in the future, to own the latest inventions of advanced aviation technology. This also applies to unmanned aerial vehicles. Already today, unmanned aerial vehicles perform many tasks on the modern battlefield.

## 2. COMPONENTS OF THE UNMANNED AERIAL SYSTEM

The following two components are distinguished in the operation of unmanned aerial systems: air and ground. The air component consists of an unmanned aerial vehicle with sensors installed on it. The ground module consists, in addition to the supervisory staff, of control elements, data transmission component, supporting elements and users.

It can be assumed that an unmanned aerial system consists of three essential elements:

- control station,
- communication infrastructure,
- air platform.

The first is the control station, which allows for constant observation and control over the flying platform. Another component is the broadly understood communication infrastructure responsible for sending all the necessary data. The third, most important element is the air platform, i.e. the unmanned aerial vehicle. The complete system, however, consists of the following modules:

- UAV – unmanned aerial vehicle;
- ground control station (GCS), handled by an operator;
- communication system between the control station and the vehicle in the air;
- interchangeable loads, used depending on the nature of the mission;
- software for processing the collected data;
- auxiliary equipment for transporting and operating the entire system<sup>2</sup>.

<sup>1</sup> Vision of the Polish Armed Forces – 2030, Warsaw 2008, pp. 30–33.

<sup>2</sup> M. Adamski, J. Rajchel, *Bezzałogowe statki powietrzne. Cz. I: Charakterystyka i wykorzystanie*, WSOSP, Dęblin 2013, p. 51.

These modules are necessary for the efficient and effective operation of the entire system, but the main elements of the system are the pilot-operator and the unmanned aerial vehicle. The use of the terms: unmanned aerial system and unmanned aerial vehicle interchangeably is possible, however, with the awareness that the unmanned aerial vehicle functions properly only within the system.

### 3. EXPERIENCE WITH THE USE OF UNMANNED AERIAL VEHICLES IN RECENT ARMED CONFLICTS

In Iraq and Afghanistan, the Americans use several types of unmanned aerial vehicles (UAV). Their use is getting wider. It is mainly related to the lack of human factor and minimizing the costs of fighting.

On the modern battlefield, already at the tactical levels of command, there is a current need for information about the enemy and the need to provide fire support. UAVs are suitable for the tasks of observation, battlefield reconnaissance and fire support of subunits. In 2003, the US Army was equipped with a mini UAV for the needs of the battalion-company and platoon-squad. Such a small Raven, weighing about 3 kg, powered by batteries, carries an infrared camera and data transmission devices. It can stay in the air for 1.5 hours, Fig. 1.



Figure 1. RQ-11A Raven

Source: [www.army-technology.com/projects/rq11-raven](http://www.army-technology.com/projects/rq11-raven) [access: 3.06.2020].

Such mini devices can be carried in soldiers' backpacks. They fly up to an altitude of 300 m and preparing them for use takes no more than 10 minutes. The image from the camera mounted on them is transmitted to a portable computer. Routes are planned using a GPS receiver. Pre-planned routes, depending on the needs of the battlefield situation, can be changed during the flight. Such devices, as early as in

2006, were used by every company of the 3rd Brigade of the 101st Airborne Division and the 10th Mountain Division of the USA deployed in Afghanistan. Unmanned aerial vehicles of this type work in sets consisting of three unmanned aerial vehicles and a ground control station. Currently, the Americans operate about 3,000 of such UAVs.

The Polish Military Contingent in Afghanistan is equipped with mini sets, the reconnaissance UAV Orbiter<sup>3</sup>, Fig. 2.



Figure 2. Mini reconnaissance UAV Orbiter

Source: [www.altair.com.pl/magazines/article?article\\_id=356](http://www.altair.com.pl/magazines/article?article_id=356) [access: 20.06.2020].

The crew of the Mini UAV Orbiter<sup>4</sup> supports troops in Afghanistan by providing them with information from air reconnaissance, supervises a specific area, indicates targets and assesses the effects of fire strikes. They perform these tasks both during the day and at night, in various weather conditions. In Afghanistan, the crew of the 11th shift made over 300 reconnaissance flights during the day and night. Flights take from 1 to 1.5 hours. The camera weighs 8 kg, films in color during the day from a height of 500 m. The mini aircraft can provide an image even from a distance of 15 km. In Afghanistan, due to strong winds in the mountains, the Team is limited to a distance of about 10 km<sup>5</sup>.

The RQ-7 Shadow was used to a large extent by the US Army in Iraq, Fig. 3.

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<sup>3</sup> Tactical and technical data of the Mini UAV Orbiter: operating ceiling – 180–650 m; operating radius – 15, 30, 50 km; speed – 40–100 km/h; max speed – 130 km/h; ceiling – 6 km; maximum head weight – 1.5 kg; operating time – 2.5–3 hours.

<sup>4</sup> The Mini UAV Orbiter is operated by soldiers whose home unit is the Air Reconnaissance Squadron in Mirosławiec, divided into two stationary services at the Polish bases Ghazni and Waghez.

<sup>5</sup> Information obtained from the Operational Command of the Polish Armed Forces.



Figure 3. RQ-7 Shadow

Source: [www.google.pl/search?client=opera&q=/AIR\\_UAV\\_RQ-7\\_Shadow\\_Maintenance\\_on\\_Flightline\\_lg.jpg](http://www.google.pl/search?client=opera&q=/AIR_UAV_RQ-7_Shadow_Maintenance_on_Flightline_lg.jpg) [access: 24.06.2020].

The RQ-7 Shadow 2000 set consists of a ground control station and four UAVs. In Iraq, these sets were used to observe convoy routes, for monitoring and reconnaissance missions. The RQ-7 Shadow sets were used as a protection against unexpected attacks by the 4th Mechanized Division in Iraq. In the “Iraqi Freedom” operation, 39 RQ-5A / B Hunter UAVs were used, Fig. 4.



Figure 4. RQ-5A/B Hunter

Source: [www.google.pl/imgres?imgurl=http://img156.imageshack.us/img156/591/92608464.jpg&imgrefurl=http://www.defence.pk/forums/military-forum/32863-ngc-hunter-unmanned-air-system-successfully-completes-gps](http://www.google.pl/imgres?imgurl=http://img156.imageshack.us/img156/591/92608464.jpg&imgrefurl=http://www.defence.pk/forums/military-forum/32863-ngc-hunter-unmanned-air-system-successfully-completes-gps) [access: 5.07.2020].

Hunters can operate in the air for up to 15 hours during the day and night. They have a range of up to 125 km. In Iraq, this type of UAVs operated in pairs, one of them acted as a retranslator. This application increased the range of the pair to 200 km. In the Operation Iraqi Freedom, the Hunters performed tasks for the corps and often for the CJTF (Combined Joint Task Force). Hunters are adapted to the following tasks:

- Observation;
- Tracking;
- Recognition;
- Indicating targets;
- Assessment of impact results;
- Cooperation with artillery;
- Real-time data delivery;
- Making attacks with rockets, bombs and ammunition from the plane.

They can be classified as multi-purpose unmanned aerial vehicles.

The RQ-1A Predator unmanned aerial vehicles participated in the “Enduring Freedom” operation, Fig. 5.



Figure 5. RQ-1A Predator

Source: [www.google.pl/imgres?imgurl=http://defense-update.com/images/predator050506-F-0000S-002.jpg&imgrefurl=http://defense-update.com/products/p/predator](http://www.google.pl/imgres?imgurl=http://defense-update.com/images/predator050506-F-0000S-002.jpg&imgrefurl=http://defense-update.com/products/p/predator) [access: 12.07.2020].

Predators, in addition to the reconnaissance, also cooperated with strategic aviation, providing precise data on the coordinates of detected objects. Such cooperation contributed to high efficiency in the implementation of the tasks of the B-52H and B-1B bombers.

Over time, the list of UAV<sup>6</sup> tasks was expanded with new ones, including impact missions. Since 2001, UAVs have been armed with precision missiles and laser-guided bombs<sup>7</sup>. UAVs have a great merit in combating terrorism.

For the first time in 2001, the RQ-1A was used in Afghanistan to perform assault missions by firing a Hellfire rocket from its deck. The RQ-1A drone detected and

<sup>6</sup> Unmanned Aerial Vehicle – a powered aircraft that has no human aboard.

<sup>7</sup> K. Krzysztofowicz, *Bezpilotowe środki latające (BSL)*, “Lotnictwo” 1994, no. 1, p. 4.

destroyed the target with one of the two Hellfire missiles under its wings<sup>8</sup>. This date is considered to be the beginning of the era of combat unmanned aerial vehicles.

In the following years, subsequent modernized versions of the Predator RQ-1A, Predator B and the much larger MQ-9 Predator B were introduced, Fig. 6. Larger UAVs provide wider possibilities of using:

- Satellite communications;
- Sensors as components of a larger system;
- Sensors as standard equipment;
- Sensors previously used only in manned aircraft.



Figure 6. MQ-9 Predator B

Source: [www.google.pl/imgres?q=mq-9+predator+b&sa=X&biw=1333&bih=645&tbn=isch&tbnid=bMI6Ny0pbrxUaM:&imgrefurl=http://www.airwar.ru/enc/bpla/mq9.html&docid=ZVYTZOsxFzSLNM&imgurl=http://www.airwar.ru/image/idop/bpla/mq9/mq9-2.jpg](http://www.google.pl/imgres?q=mq-9+predator+b&sa=X&biw=1333&bih=645&tbn=isch&tbnid=bMI6Ny0pbrxUaM:&imgrefurl=http://www.airwar.ru/enc/bpla/mq9.html&docid=ZVYTZOsxFzSLNM&imgurl=http://www.airwar.ru/image/idop/bpla/mq9/mq9-2.jpg) [access: 11.08.2020].

Here are a few examples of their use and a presentation of their capabilities.

In 2006, an MQ-1 Predator, while observing the hideout of terrorists in the Iraqi village of Hibhib, transmitted live images to ground command centers, cooperating with F-16 aircraft on duty in the previously designated zones. The crew of the F-16 aircraft dropped two 250-kilogram bombs on the house where the terrorists were hiding. During the implementation of the task, the unmanned aerial vehicle was commanded from the Nevada air force base in the other hemisphere. The task was secured by an air tanker, enabling the F-16 to be on duty for a long period on a signal from the ground.

In the fall of 2007, the MQ-1 Predators fought back terrorists carrying out covert rocket and mortar attacks on the important US Balad logistics base in Iraq. The action was commanded from operational centers in the United States. There was only a small group of operators at Balad taking care of take-offs and landings. Predators

<sup>8</sup> J.M. Brzezina, *Szkolenie operatorów bezzałogowych statków powietrznych (cz. III)*, "Przegląd Sił Powietrznych" 2009, no. 6, p. 40.



detected and eliminated terrorist groups eight times. Thanks to this air cover, the number of terrorist attacks has significantly decreased.

The capabilities of UAVs are constantly developing. An example is the Predator B, which can carry four 250 kg bombs each and stay in the air all day long.

Operating at high altitudes of approximately 20 km, Global Hawks, Fig. 7, can carry out missions from 24 to 28 hours long and can launch complex battlefield apparatuses. Global Hawk, performing tasks at such high altitudes, is inaccessible to enemy fighter planes and air defense missiles.



Figure 7. Global Hawk

Source: [www.google.pl/imgres?imgurl=http://upload.wikimedia.org/wikipedia/commons/2/29/RQ-4\\_Global\\_Hawk.jpg&](http://www.google.pl/imgres?imgurl=http://upload.wikimedia.org/wikipedia/commons/2/29/RQ-4_Global_Hawk.jpg&) [access: 11.08.2020].

Global Hawk<sup>9</sup> also does not require cooperation with the operator. The route is programmed on the ground and the operator only checks the task in progress. However, in a situation where it is necessary to make corrections or change the planned route, the operator may change the previously entered parameters. On board of this unmanned aerial vehicle there is a SAR radar with a tracking radius of up to 160 km, a camera that sees in infrared at night, the EO/R sensor which can operate within a radius of up to 50 km. Global Hawks are commanded from three Combined Air Operations Centers (CAOC). Images obtained from radars and sensors installed on board of this UAV are exchanged in real time via the Internet, classified voicemail, electronic chat and used in real time for planning and conducting combat operations. In the near future, UAVs will be adapted to airlift and air refueling tasks as well as other jobs resulting from the needs of the dynamically developing battlefield.

<sup>9</sup> Tactical and technical data of RQ-4B Global Hawk: drive - turbofan engine – “Rolls-Royce AE 3007H”; maximum flight duration – over 36 hours; cruising speed – 310 kts / 574 km/h; practical ceiling – 60.000 ft / 18.300 m; wingspan – 39.9 m; length – 14.5 m; height – 4.6 m; maximum take-off weight (MTOW) – 14.628 kg; maximum payload – 1360 kg.



Currently, there is a race of the armed forces in the use of UAVs on the modern battlefield. However, their application will only increase after the use of airspace by manned and unmanned aerial vehicles is regulated.

#### 4. LEGAL ASPECTS OF THE USE OF UNMANNED AERIAL VEHICLES IN THE POLISH AIRSPACE

The development of unmanned systems, particularly visible in the plans to modernize the armed forces, is the result of the progress of new technologies and the needs of the military. It extends the possibilities of advancing the “robotization of the battlefield”.

Currently, there are over 250 types of UAVs in the world, of many classes, from miniature flying apparatuses to those that can carry out long-term flights with technologically modern weapons in the stratosphere and space. The systematic growth of unmanned aviation equipment and its increasing use make them become noticeable airspace users.

The state civil aviation administration bodies, the representatives of the Polish Armed Forces and international organizations are currently working on the provisions on the use of unmanned aerial vehicles. The most important of the organizations are:

- International Civil Aviation Organization – ICAO;
- European Organization for the Safety of Air Navigation – Eurocontrol<sup>10</sup>;
- European Defense Agency – EDA;
- European Union Aviation Safety Agency – EASA.

The regulations contained in the draft amendments to the aviation law regarding the use of the Polish airspace are consistent with the arrangements and guidelines of the above-mentioned organizations, and in particular with the guidelines of the European Organization for the Safety of Air Navigation. Eurocontrol is of the opinion that the widespread use of UAVs will only be possible if these vehicles meet the same safety criteria as those of manned aircraft.

Generally speaking, UAVs and their systems have to move in the controlled airspace in accordance with ICAO rules for manned aircraft. The aim of ICAO’s activities in relation to unmanned aviation is to provide a basic international legal framework by introducing:

- relevant standards;
- procedures;
- recommended practices;
- advisory materials providing the basis for the skillful and safe performance of all types of UAV operations in the common area with the manned aviation.

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<sup>10</sup> EUROCONTROL was established in 1960 pursuant to the provisions of the international convention for cooperation in the field of the safety of air navigation EUROCONTROL, signed on December 13, 1960 in Brussels, as amended by the additional protocol of July 6, 1970, as amended by the protocol of November 21, 1978, fully amended by the protocol of February 12, 1981 (Journal of Laws of 2006, No. 238, item 1723). Currently, this organization has 38 member states.

The general goal of ICAO's activities is the following motto: the level of aviation safety after the integration of the UAV with non-segregated airspace - cannot be lower than that for manned aviation.

The Chicago Convention<sup>11</sup> stipulates that UAVs may only fly over the territory of a Contracting State with a special authorization from that State and in accordance with the terms of such authorization. A Contracting State provides UAV flights control in areas open to civil aircraft.

By means of international legislative measures, the aim is to achieve a level of safety that will ensure that UAV flights in air traffic services spaces do not pose a greater threat to persons and property on the ground and in the air than caused by manned aircraft of the appropriate class and category. Representatives of the Member States, representing civil and state aviation authorities, industry and research and development centers, participate in the work of task forces working within these organizations. Aviation regulations are agreed on a global scale in accordance with the Convention on International Civil Aviation. International standards and proposed methods of conduct in this field are updated and adopted by the ICAO Council, adding them as annexes to this Convention. The organization also publishes various normative documents that define the procedures of air navigation services.

Summing up, it should be stated that the international tasks of military aircraft are carried out in accordance with the ICAO regulations.

The provisions regarding UAV appeared in the Aviation Law after the amendment of June 30, 2011 (Journal of Laws No. 170, item 1015), which entered into force on September 18, 2011. Before the amendment, the law prohibited any unmanned aerial vehicle from flying in controlled airspace without the prior consent of the President of the Office specifying detailed rules for this type of flights.

The amended aviation law contains two provisions directly related to the issue of unmanned aerial vehicles, art. 126<sup>12</sup> and 149. Art. 126 allows for the performance of UAV flights in the Polish airspace on the basis of a flight plan and provided that they

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<sup>11</sup> Article 8 of the Chicago Convention.

<sup>12</sup> In the amended Aviation Law, Article 126 was replaced by the following:

1. Unmanned aerial vehicle flights may be performed in the Polish airspace.
2. Unmanned Aerial Vehicle (UAV) shall be equipped with the same facilities for flight, navigation and communication as a manned aircraft operating according to visual flight rules (VFR) or instrument flight rules (IFR) in the specified airspace class. The derogations applicable to manned aircraft in this respect apply equally to unmanned aerial vehicles (UAV).
3. The flights of the unmanned aerial vehicles equipped in accordance with paragraph 2 may be conducted on the basis of a flight plan in the manner and under the conditions referred to in item 5, subject to article 149.
4. Flights of unmanned aerial vehicles without the equipment referred to in item 2, can be performed in zones separated from the airspace generally accessible to aviation, taking into account the regulations issued on the basis of article 121 paragraph 5.
5. The minister responsible for transport, in consultation with the Minister of National Defense, shall define, by way of a regulation, the detailed method and conditions of performing flights of the UAVs within the Polish airspace, and the procedures for cooperation between the operators of the vehicles and air traffic service providers, taking into account the principles of safe use of the airspace.

are equipped with the same devices enabling flight, navigation and communication as a manned aircraft performing a flight according to visual flight rules (VFR) or instrument flight rules (IFR) in the specific airspace class.

The flights of unmanned aerial vehicles without the required equipment may be performed only in areas separated from the airspace open to aviation.

Paragraph 5 of article 126 contains an authorization for the minister responsible for transport and the Minister of National Defense to define, by way of a regulation, the detailed method and conditions for the performance of flights by unmanned aerial vehicles in the Polish airspace, and the procedures for cooperation between the operators of these UAVs and the air traffic service providers, taking into account the principles of safe use of the airspace.

Whereas in art. 149<sup>13</sup>, the legislator stated, in accordance with the interpretation of art. 8 of the Chicago Convention that: the performance of international flights by civil unmanned aerial vehicles requires an authorization granted by the President of the Office in agreement with the relevant military authorities.

Due to the fact that apart from the aforementioned regulations, no other executive regulations have been established so far, there is practically no legal basis for UAV flights in the air traffic services spaces in the FIR Warsaw flight information area.

According to the rules of the use of the Polish airspace, UAV flights can only be performed inside unclassified structures managed by AMC Poland, i.e. in dangerous zones (D) – above aviation, artillery and sea training grounds or in temporarily separated zones (TSA), i.e. based on the rules that are in force in the European countries. Unfortunately, although the new regulations open the Polish airspace for the UAV users, they cannot be used anyway, because there is still a regulation under development that is to specify the detailed method and conditions of UAV flights. Due to the lack of legislative arrangements, in FIR Warsaw UAV flights can be performed only in the segregated elements of the space structures. It should be emphasized, however, that the draft regulation introduces a division into UAVs weighing up to 30 kg and weighing more than 30 kg, setting different conditions of use for them.

UAVs weighing up to 30 kg will be considered models. The draft assumes that they will be able to fly in the controlled airspace on the basis of the authorization of the air traffic control unit. They are forbidden to perform flights in a distance of less than 150 m from densely built-up cities, towns and settlements, and in a distance of less than 50 m from people, buildings and vehicles.

On the other hand, the flights of UAVs weighing more than 30 kg will be carried out in accordance with the air traffic regulations for the flight information area, the so-called FIR Warsaw, on the same terms as in the case of manned ships, according to the airspace class. The flight of such a vehicle will be continuously tracked to keep it in accordance with the approved flight plan.

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<sup>13</sup> In the amended Aviation Law art. 149 was replaced by the following: The performance of international flights by foreign civil unmanned aircraft requires a permit granted by the President of the Office in consultation with the relevant military authorities.

An unmanned aircraft weighing more than 30 kg must be equipped with similar devices for flight, navigation and communication as a manned aircraft performing a VFR or IFR flight. The derogations that apply to manned aircraft in this respect will also apply to unmanned aerial vehicles.

The draft regulation also proposes precise rules that will guarantee the safety of flights in the Polish space.

In the event of losing the radio communication between the pilot-operator and the UAV, its technical equipment must ensure the flight in accordance with the planned parameters.

The emergency mode must also ensure the safety of other airspace users. The UAV pilot-operator and the air traffic controller will be required to be familiar with the specific flight procedures and parameters. It means that even if the pilot-operator loses the ability to remotely control the aircraft and it changes to autonomous control, the pilot-operator must know all possible variants of the autonomous aircraft flight in such a situation and must inform the air traffic control about them on an ongoing basis.

Moreover, the same separation rules will be applied to UAVs as to other airspace users.

Also, the Polish Air Navigation Services Agency has developed a document called "Air Traffic Safety Analysis", which provides the basis for designating zones for UAV flights used by the Polish Armed Forces and establishes the safety rules for the use of this space. The main assumptions of the Safety Analysis define the rules of UAV flights, introduce the need to secure these flights by segregating the airspace. Certain security systems should be ready to secure flights within the designated zones, even in the event of a complete loss of control over the flying UAV by the pilot-operator. The responsibility for keeping the UAVs in the zone lies with the pilot-operator, who is obliged to maintain safe altitudes and distances from the boundaries of the established zone according to the rules, for example: Orbiter – 500 m, Aerostar – 1500 m from the horizontal boundaries and both types – 150 m from the vertical boundaries of a certain zone.

## 5. PLANNING THE USE OF UNMANNED AERIAL VEHICLES IN COMBAT OPERATIONS

It can be assumed that the main area of application of the UAV on the future battlefield will be the zone from a few to several kilometers into the enemy group, i.e. the zone of operational and tactical activities. In this zone, the opponent has a large potential of forces and resources concentrated.

In the today's dynamic battlefield, the most important thing is to receive information at the right time, preferably the confirmed information about the position of the troops.

These most important factors, combined with the environment of military operations, define the requirements which must be met by UAVs, and determine the methods of their application.

In the today's battlefield, meeting the needs of various types of forces, UAVs will be used mainly in three groups of tasks:

The tasks of the first group include recognition, observation of the battlefield and determination of the effects of attacks. These tasks include:

- Recognition of the enemy's combat group at tactical, operational and strategic levels;
- Tracking the movement of troops on land and at sea;
- Tracking the movement of the reserve;
- Recognition of the aviation home bases;
- Recognition of ground components of precision weapon systems;
- Recognition of command systems, surface and underwater objects;
- Identification of the means of anti-tank defense and anti-aircraft defense systems and other means radiating electromagnetic energy;
- Observation of the battlefield and identification of targets for firearms;
- Determination of the effects of firearms strikes and other reconnaissance tasks resulting from immediate military needs.

The second group are fire tasks. This group will include tasks carried out in the field of:

- Direct support;
- Air isolation;
- Participation in an airborne operational or strategic attack;
- Other types of activities on land, sea and in the air.

The third group will be supporting and auxiliary tasks. These will be tasks such as:

- Special;
- Propaganda;
- Sham.<sup>14</sup>

## 6. SUMMARY

In conclusion, the use of UAVs for military purposes and the purposes of the national economy will become more and more common. UAVs are becoming more and more perfect and they already perform tasks previously reserved only for manned aircraft. Their further development is closely related to the further pace of development of modern technologies. However, the rapid development of such areas as: miniaturization, robotization, availability of GPS channels, and IT confirms the belief that their further development is inevitable and very close. It can be assumed that such tasks as air refueling, transport, space observation, fighting maneuvering and counteracting air targets will be real in the near future, i.e. in the next 10–15 years.

<sup>14</sup> J. Karpowicz, K. Kozłowski, *Bezzałogowe statki powietrzne i miniaturowe aparaty latające*, AON, Warsaw 2003, p. 97.

But, the implementation of UAVs is associated with the following requirements:

- the Polish civil and military aviation must be made ready by introducing appropriate legal regulations, to implement new, deemed revolutionary not so long ago but common today, technological solutions;
- appropriate legal regulations should aim at establishing uniform terminology in line with the international nomenclature;
- it is necessary to create rules of law for the safe use of UAVs in space, defining the rules for their separation from other aircraft, rules for using airports and performing airport operations;
- providing UAVs with access to controlled and uncontrolled airspace requires the definition of incident and air accidents involving unmanned aviation investigation regulations, as well as the rules of legal liability for damage caused by their participation.

To sum up, the introduced legal regulations should aim at providing all users of the Polish airspace the required level of flight safety.

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