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UNMANNED AERIAL SYSTEMS AS A REVOLUTIONARY TOOL IN MODERN ARMED CONFLICTS

Abstract: More than a century has passed since the third dimension of space (airspace) has become an important place where combat and non-combat activities take place. The ability of the Air Force to carry out a wide range of content of combat operations and other activities from the airspace ensured the development of new qualitative characteristics of modern armed conflicts. The absence of physical limitations, high maneuverability and dynamism, short reaction time, as well as the high intensity of actions carried out by the Air Force, have enabled these forces to have strategic importance in armed conflicts since the Second World War. In parallel with the development of civilization and the emergence of qualitatively new technologies, rapidly improved technological solutions are being developed, which are changing the way of life of people around the world, improving it literally day by day. Each technological generation brings a new level of civilizational development, leading to the symbiosis of man as a human being and modern technical and technological means. Undoubtedly, this is also the case with the development of modern weapon systems and equipment used in armed conflicts. This is also the case with the revolutionary development of new weapon systems in air forces around the world. The development of modern weapons in the air force is best seen through the development of unmanned aerial platforms (unmanned aerial vehicles). The development of these assets is a consequence of the industrial revolution of the fourth generation and the importance of these platforms in the realization of tasks in modern armed conflicts is almost immeasurable. Namely, every conflict brings exponential development of these assets, both in technical and tactical sense. The development of these means in modern armed conflicts is a continuous process that is realized on the basis of previous experiences from the tactical use of unmanned aerial vehicles in concrete combat actions.

There is no doubt that the technological progress of these means is something that in the future will enable the almost unlimited use of these aircraft in the execution of a wide variety of tasks without minimal danger to human life.

This paper, whose main goal is to describe the unmanned aerial vehicle as a tool for the execution of a wide range of tasks in an unlimited war format, consists of three chapters in addition to the introduction and conclusion. In the first chapter, the theoretical determination of the unmanned aerial vehicle as a weapon-equipment system was made. In the second chapter, the use of unmanned aerial vehicles is analyzed on the examples of armed

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conflicts in Syria and Nagorno-Karabakh. In the third chapter, an analysis of potential aviation patterns of unmanned aerial vehicles and loitering munition (also known as a suicide drone or kamikaze drone) in combat operations was carried out.

Key words: armed conflict, loitering munition, unmanned aerial systems.

INTRODUCTION

Qualitative changes in the history of warfare, which changed the physiognomy of armed conflicts, were always a consequence of the rapid progress of civilizational thoughts. The discovery of gunpowder and the beginning of its use for military purposes resulted in changes in the organization of armies, and its use at the tactical, operational and strategic levels. Due to the increase in killing power and range, during the use of military units, there is an increasing dispersion of forces and separation of units on the front line and in the depth of the combat operations zone. The development of artillery, i.e. artillery tools, had perhaps an even greater importance on the physiognomy of armed conflicts. The development of artillery coincides to some extent with the first industrial revolution, as well as the emergence of large nation-states and resulted in the formation of large standing armies. Artillery in the 19th and early 20th centuries became the most important branch at the then level of civilizational development. Wars, which were fought in this period (including the First World War), were mostly positional, with the maximum use of artillery tools for the needs of combat support during attacks, or when preventing the enemy from developing offensive formations and grouping forces during defensive actions.

The period between the two world wars brought a new revolution in the development of the armed forces and their use at all levels of organization. After the first use of the tank in the Battle of the Somme in 1916, military theorists began to understand how important this military tool would be in future wars. Also, the First World War was revolutionary due to the accelerated development of aircraft as a means of carrying out a wide range of air support tasks from reconnaissance from the airspace to the airstrikes of objects on land and in water. By looking at the combat capabilities of these highly maneuverable forces for action from the air (airplanes) or from the ground (tanks and armored personnel carriers), the most developed part of the civilized society uses the modern technology of the time to improve these means in a technical sense (Gordić, Cvetković et al. 2013: 229-245). Because of this, the exponential development of units armed with tanks and air forces enabled Nazi Germany to develop new forms of warfare in the form of Blitzkrieg (the analysis of this type of warfare was first done by the Italian Air Force General Giuliano Duet in the twenties of the last century). This form of warfare was based on a coordination by place, time and manner between air forces and forces armed with tanks during realization of combat operations. By grouping a huge number of units of this type, a quick breakthrough of the enemy's defense lines on the front and the exploitation of the initial successes in the depth of the zone of operations were ensured. Essentially, the basis of Blitzkrieg was simple and was based on the cooperation of air and ground maneuver forces in achieving rapid successes in operations, wedging the deployment of the defending unit, and the advance of highly maneuverable tank units with continuous air support (Gordić, Cvetković et al. 2013: 230).

The next phase of development will be marked by: the development of rocket and missile technology, means of mass destruction (primarily the creation and application of nuclear weapons), as well as the development of anti-aircraft defense systems – surface to air missile (based precisely on the development of missile technology) with autonomous radars. The development of the radars is a consequence of civilization's invention of a way to transmit information through electromagnetic energy at the speed of light (a consequence of the creation and development of radar technology) (Petrović, Kankaraš et al. 2016: 524). Simply, the exponential development of aircraft (planes, helicopters and aerial weapons of various purposes, range and high precision and destructive power), influenced the development of surface to air missiles intended to oppose modern air forces at a qualitatively higher level of conducting an armed conflict (essentially on civilizational development based on the dialectical principles of unity and the struggle of opposites and the transition of quality into quantity and vice versa).

The development of modern aviation, radar and anti-aircraft equipment made it possible to achieve the content of combat operations at an increasingly high quality level. All this allowed for constant analysis of the impact of these means on the physiognomy of armed conflicts and constant feedback through the provision of information on how it is possible to further improve the use of these means through technological development and improvement of tactical procedures. Also, this had an impact on: the development of highly accurate weapons of various guidance methods (radar, radio, laser, infrared, satellite guidance), the development of mobile radar equipment based on phased antenna arrays and an active electronically scanned array, as well as the development of missile, artillery and hybrid (artillery-missile) means for multi-channel surface to air systems, both by target and by missile (Banjac, Petrović et al. 2023: 285).

At the next level of development, unmanned aircraft are created and serially developed. Although the first use of a remotely controlled aircraft dates back to 1917, the development and use of these aircraft dates back to the last decades of the 20th century. Western military powers led the development of the first aircraft in all forms of use. The first use of unmanned aerial vehicles (UAVs) for the purposes of aerial reconnaissance and correction of the actions of ground forces was carried out by the Air Force of the United States of America during the Vietnam War (Bento 2008: 54-61). The exponential development of technology, especially in the field of telecommunications and computer and electrical engineering, has enabled the development of new technologies (micro and nano technology) over the past thirty years. All of this led to a sudden expansion in the development of UAVs and their application, both for civilian and military purposes. This resulted in the US Air Force not using classic reconnaissance aircraft since the First Gulf War, but optoelectronic and radio-technical reconnaissance from the air being carried out by unmanned aerial platforms. These aircraft are equipped with optoelectronic and telecommunication devices whose exponential development represents the basis of the fourth industrial revolution (Guelfi, Jayamaha et al. 2020; Gupta, Ghonge et al. 2013: 1646-1658; Hirling, Holyapfel 2012: 1-25; Rogers 2021: 482). The high level of commercial use and the possibility of their application for military purposes make these aircraft combat systems of the new military technological revolution. Namely, these robotic aircraft are slowly but surely assuming a decisive role

in combat operations, minimizing the importance of other weapons and equipment systems, as well as the human factor in an armed conflict, which will be discussed more in the following chapters of this paper.

UNMANNED AERIAL SYSTEMS AS A MEANS FOR PERFORMING MILITARY TASKS

As already noted in the paper, the use of the third dimension of space in armed conflicts is a product of civilizational development in the 20th century. Ideas about the use of aerial platforms for military purposes also exist from an earlier period (including the use of unmanned balloons that carried explosives in the attack organized by the Austro-Hungarian Empire on Venice in 1849) (Banjac, Petrović et al. 2023: 285). However, the first use of classic unmanned aerial systems for military purposes dates back to the Vietnam War, when the US used the „AQM-34 Ryan Firebee" drone for aerial reconnaissance (Banjac, Petrović et al. 2023: 285-286; Kokanović 2023: 25). After the Vietnam War, there was an exemplary technological development of UAVs, which was preceded by the states of Western civilization, led by the USA and Israel. In the 20th century, their primary purpose was aerial reconnaissance. At the beginning of the 21st century, they got their new role, based on air strikes by UAVs. Namely, in November 2002, in the Yemeni desert of Marib, a Hellfire missile fired from a BL MQ-1 Predator destroyed the car of one of the main leaders of Al Qaeda, which represents the first recorded air strike of the UAV of a modern design (the UAV was operated from Djibouti, which is hundreds of kilometers away from the object of action) (Kokanović 2023: 32). Nowadays, there are dozens of countries in the world that design various types of UAVs, which are used for military purposes. Also, with the development of combat operations in the territory of Ukraine, we are witnessing that an increasing number of micro and nano UAVs of the commercial type are being used for air strikes, as well as for the needs of reconnaissance from the airspace (especially in battles in urban areas). Today, there are numerous definitions that determine the concept of UAVs. In principle, an unmanned aircraft can be defined as an aircraft controlled by a navigator, a pilot with remote transmission of signals from the ground or that flies autonomously according to predetermined memorized data. According to the Civil Aviation Act, an unmanned aircraft is defined as an aircraft whose crew is not on board, which is controlled remotely or whose flight is autonomous (Zakon o vazdušnom saobraćaju 2012 -2020). In the Serbian Armed Forces, the definition of UAVs did not become clear until recently. Namely, the term Remotely Piloted Vehicle - RPV in military terminology primarily refers to large unmanned aircraft that are used for strategic reconnaissance and air strikes operations (range of flight, maneuvering and stability performance, ceiling of flight, endurance, capabilities, equipment and characteristics of the aircraft are adapted for the execution of strategic tasks over long distances). In contrast to RPV, the term Unmanned Aerial Vehicle - UAV refers to tactical (smaller) unmanned aircraft intended for tactical reconnaissance and air strikes operations. The term drone, which in Western terminology is used for armed RPVs, should certainly be mentioned here, but lately this term has been associated with a much wider range of robotic devices of this type (Kokanović 2023: 31). Namely, from the technical

side, drones can be seen as tele and radio-controlled or autonomous robotic systems on various vehicles (aircrafts, submarines, off-road vehicles, etc.). So, unlike UAVs, a drone is an unmanned platform of air, water or land type. Essentially, a drone is a robotic platform that performs tasks on land, water or airspace based on control commands from ground control stations. Also, it should be noted that the term drone is an acronym of the following words: Dynamic, Remotely, Operated, Navigation and Equipment (Inđić, Petrović et al. 2018: 110-126; Ilić, Tomašević 2021: 9-21). In the military sense, as a assets for air strikes, the term drone is used for loitering munitions (suicide drones or kamikaze drone). Due to the different ways of performing air support tasks, unmanned aerial systems and kamikaze drones will be described separately (although it can be said that the kamikaze drone is a type of UAV).

As already mentioned, the UAV is an unmanned aircraft that is remotely controlled from the ground. The unmanned aerial vehicles, which are used for military purposes, can perform the following tasks: collection of intelligence data from the airspace, observation, interception of non-communication - electronic (radar) and communication signals, acquisition of targets from the airspace; air strikes; electronic warfare and correction of artillery fire. The unmanned aerial vehicles enable the processing and storage of collected data obtained by optoelectronic and radar reconnaissance, as well as reconnaissance using communication intelligence (COMINT) and electronic intelligence (ELINT) stations (Banjac, Petrović et al. 2023: 285). All data on flight parameters and objects of reconnaissance and action are recorded on the UAVs. All the results of reconnaissance and weapons actions can be displayed on the monitors of the ground station for real-time control, and if necessary, the memorized results can be displayed. In addition to video images of the terrain and radar images, other data such as the position of the ground control station, flight control points, planned flight trajectory and flight parameters can be displayed on the monitors.

Nowadays, instead of the term unmanned aircraft, the phrase unmanned aerial system is increasingly used. This system basically consists of: three remotely controlled aircraft; a ground station for remote control of the system and a remote video terminal (for real-time ground image display). According to another classification, unmanned aerial system consists of the following elements: aircraft; control stations; data transmission system and take-off and landing system (Banjac, Petrović et al. 2023: 285; Guelfi, Jayamaha et al. 2020: 4-12; Gupta, Ghonge et al. 2013: 1649; Hirling, Holyapfel 2012: 1-25).

The unmanned aircraft guidance system is based on command or satellite guidance. If command guidance (guidance using a ground station) is used as a guidance system, the unmanned receives a national frequency range for exchanging guidance information (most often it is a range between 1.5 GHz and 2 GHz). If a very small frequency range is allocated for the use of the unmanned aerial system, this can lead to a limitation of the maximum number of simultaneous engagements of UAVs. Multiplied frequencies are used for aircraft flight control (up link) and sensor and weapon control (down link), one of those frequencies is basic and the others are spare, which are used in case of interference (Banjac, Petrović et al. 2023: 285; Guelfi, Jayamaha et al. 2020: 5; Gupta, Ghonge et al. 2013: 1646-1658; Hirling, Holyapfel 2012: 4). In this guidance, ground stations use commercial satellites for information transmission. These satellites enable

the orientation of the elements of UAVs and the programming of the aircraft's flight path. The telecommunication subsystem in this way of guidance enables continuous and encrypted transmission of signals (data and images) from the ground station to the aircraft and vice versa in the radio visibility zone at a distance of hundreds of kilometers. The link for the transmission of control signals („up link") should enable the transmission of signals from the ground station to the aircraft, and the link for the transmission of telemetry and video signals („down link") from the unmanned aircraft to the ground station. The transmission of all signals between the aircraft and the ground station, as well as between the aircraft and the video terminal, is crypto-protected against unauthorized use, by incorporating an appropriate cryptographic solution. Unlike command guidance, satellite guidance implies that satellite communications are used to manage the entire unmanned aerial system (Banjac, Petrović et al. 2023: 285; Guelfi, Jayamaha et al. 2020: 8; Gupta, Ghonge et al. 2013: 1650; Hirling, Holyapfel 2012: 8). This way of guidance practically enables the engagement of unmanned aerial system on any part of the planet. The only limiting parameter is the flight autonomy of the aircraft, which depends on fuel consumption, tank size, engine type, etc.

The payload of the optoelectronic subsystem on the UAS enables reconnaissance, day and night in favorable weather conditions using optoelectronic sensors (video and thermal imaging cameras). The optoelectronic subsystem is gyroscopically stabilized and has the possibility of circular movement in azimuth, while movement in elevation is usually limited from +10 to -90 degrees. In principle, the optoelectronic subsystem consists of the following elements: a television camera, a thermal imaging camera, a laser rangefinder and a laser marker (Banjac, Petrović et al. 2023: 285; Guelfi, Jayamaha et al. 2020: 10; Gupta, Ghonge et al. 2013: 1652; Hirling, Holyapfel 2012: 2-23). Furthermore, more advanced systems also contain elements for electronic warfare (EW) that enable the realization of tasks of radio technical reconnaissance and jamming of enemy radar systems. An example of the functioning of the unmanned aerial system is shown in figure 1.

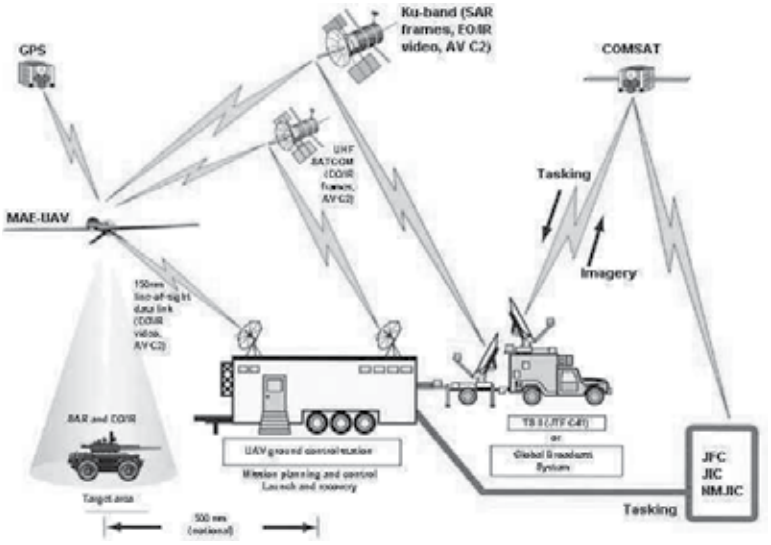

Figure 1; The system of functioning of the unmanned aerial platform

An unmanned aerial system for military purposes can perform the following tasks: it can be used as a decoy target; for aerial reconnaissance; for air strikes – aur support and realization of logistical tasks. Depending on the tasks, unmanned aerial systems can be classified into: reconnaissance aircraft; aircraft for electronic jamming - surveillance; aircraft for air strikes; multirole aircraft; radio relay aircraft and guided targets. The classification of unmanned aerial systems, according to interconnected parameters, is shown in Table 1 (Bento 2008:58; Inđić, Petrović et al. 2018: 115).

Table 1; Classification of unmanned aerial systems according to the UAVS methodology (Inđić, Petrović et al. 2018: 114; Kolarek 2010: 71)

Category name	Abbreviation	Aircraft weight (kg)	Range (km)	Maximum flight altitude (m)	Endurance (h)
micro	micro	<5	<10	250	1
mini	mini	25-150	<10	150-300	<2
small range	CR	25-150	10-30	3000	2-4
short range	SR	50-250	30-70	3000	3-6
medium range	MR	under 1250	70-200	5000	6-10
durable medium range	MRE	under 1250	>500	8000	10-18
deep penetration at low altitudes	LADP	under 350	>250	50-9000	0,5-1
long durability at low altitudes	LALE	<30	>500	3000	>24
durability at low altitudes	MALE	under 1500	>500	14000	24-48

Technology for UAS flight autonomy generally includes the following categories (Banjac, Petrović et al. 2023: 285; Guelfi, Ghonge et al. 2020:7; Gupta, Jayamaha et al. 2013: 1648; Hirling, Holyapfel 2012: 1-24):

– Fusion of information obtained from sensors (combining information from different sensors used by UAS systems);

– Communication (management of communications and coordination between multiple participants in conditions of incomplete and imperfect information);

– Determining the flight path (determining the optimal flight path for the UAS, meeting certain objectives and mission constraints, such as physical obstacles or fuel quantity);

– Generation of management according to the planned trajectory (determining the optimal management for the desired maneuver to follow the planned trajectory, or the optimal flight from one location to another);

– Trajectory movement standard (specific requirements of the management strategy with the limitation of UAS deviations within the prescribed size on the trajectory);

– Distribution of tasks (determining the optimal division of tasks among participants within the group, with time and equipment limitations);

– Combined tactics (formulation of optimal tactical sequences and spatial arrangement between the activities of the participants in order to increase the overall effect and results within the entire mission).

A special advantage of modern UAS, in addition to the optoelectronic subsystem, is the possession of weapons on the suspension points in the form of laser-guided or radar (or infrared) self-guided bombs and missiles. By arming UAS, the possibility was created for their multi-purpose use in the realization of air support tasks without the risk of loss of human life, thus, with relatively cheap production, these aircraft become dominant in the realization of combat tasks. Typical representatives of UAS are: Bayraktar TB2 и Akinci (both types produced by Baykar Defense, Turkey), Eitan (produced by IAI - Israel), X-47B (produced by Northrop Grumman, USAC-70 Охотник-Б (produced by Sukhoi, Russian Federation), MQ-9 Reaper (USA), etc. All these systems, as well as many others, whose exponential development is in progress, can realize multirole combat air support operations.

In addition to classic UAS, which have the possibility of multirole use, kamikaze drones are used as a special subcategory of UAS for the realization of air support. Kamikaze drones are so-called loitering munitions. Unlike classic bombs and ballistic missiles, whose use is one-time (regardless of whether they succeed in destroying the target or not), kamikaze drones have the ability to land again after launch in case they do not detect a target in the area of effect. This is provided by a guidance system that is the same as other UAS. Kamikaze drones do not have special weapons systems on them, but have a warhead that allows them, after detecting a target, to transform from a UAS into a lethal tool that acts on that target. The control method, components and guidance systems of kamikaze drones are the same or similar to those of other UAS (Ilić, Tomašević 2021: 10; Rogers 2021: 485). Kamikaze drones are launched from special launchers - platforms in swarms of up to several dozen aircraft at a time. They are launched directly from the launcher container or (in the case of micro or nano drones) from a land platform and no runways are needed for their launch. The exponential development of information technologies and artificial intelligence has enabled the rapid development of this type of weapon in the last twenty years. Literally, the technological leap of drones nowadays takes place during a single conflict (as can be seen from the case of the war in Ukraine and Nagorno-Karabakh) and is based on experiences from use in concrete combat operations. This technological leap is both technological and tactical. As with UAS, the main advantages of using kamikaze drones are reflected in: reduction of human losses in conflict, simple design and modernization technology, the possibility of cheap serial production and the possibility of inflicting massive air strikes on enemy forces both on the front line and in operational depth. The most significant representatives of this type of weapon that have been used in armed conflicts in the last decade are: Harop, Harpy, Mini Harpy and Sky Striker (Israel); Kargu and Alpagu (Turkey); Shahed-136 (Iran); Lancet (Russian Federation), etc. Essentially, all these kamikaze drones have similar basic characteristics and are intended for the destruction of firearms, bunkers, resistant points, but also for the suppression of enemy air defense and the implementation of many other air support tasks.

EXPERIENCES FROM THE USE OF UNMANNED AIRCRAFT IN MODERN ARMED CONFLICTS

Modern armed conflicts are characterized by the massive use of all forms of the UAVs for the purpose of performing air support tasks. In this paper, as examples, case studies related to the use of UAS in Syria and Nagorno-Karabakh have been selected.

Experiences from the use of unmanned aerial systems in Syria

The civil war in Syria, which began in 2011, is officially fought between the government loyal to President Bashar al-Assad and the opposition, which has the support of Western countries. The conflict became more complicated over time, because regional and superpowers (the USA, the Russian Federation, Turkey, Israel, etc.) openly intervened, protecting their own interests, as well as the Islamic State and Hezbollah. Syria has suffered enormous destruction and material damage during this war, and unfortunately, it has become a testing ground for weapons systems, including UASs (Kokanović 2023: 13-14). According to the experience of the air defence officers of the Russian Federation in Syria, mass UAS and suicide drone strikes are continuously carried out on populated areas in combination with the effect of cruise missiles (strikes with more than fifty missiles were also recorded at the same time). In such conditions, it was simply not possible to protect the air defense facility, regardless of the number and quality of air defense missile units (there is knowledge that the defense of the facilities could not be carried out by the multi--domain air defense forces armed with the surface to air missile „Buk M2" and „Pancir S1", regardless of their ability to inflict mass damage simultaneous air defence actions).

The attack on the Khmeimim base can be singled out as a classic example of a mass air attack using kamikaze drones. The attack by a swarm of thirteen armed kamikaze drones took place on January 6, 2018. Ten drones attacked the Russian Khmeimim base, and the other three attacked the logistics base in the port of Tartus (Kokanović 2023: 14). This is just one of many air attacks on this base in Syria. Besides being a classic example of the mass use of kamikaze drones, this attack was carried out on the basis of precise intelligence. According to Russian officials, the drones were precisely controlled and avoided a large number of surface to air missile systems consisting of „S-400" and „Pancir-S1". By combining the operations of assets of electronic warfare, six drones were grounded, while the other seven were destroyed by surface to air missile „Pancir--S1". The drones were improvised, but they used high technology and were armed with small-sized weapons. Due to the manner in which the attack was carried out, in which whoever controlled the drones knew exactly the positions of the surface to air missile and avoided a good number of them, Russian officials suspect that the Islamists were receiving intelligence from US forces. This suspicion is reinforced by the presence of the American P-8A „POSEIDON" patrol aircraft near the Russian Khmeimim base. According to Russian officials, either data was sent from this aircraft to the Islamists via protected communications or the aircraft was directly controlled (Kokanović 2023: 14).

This example is one of many that indicates the increasing use of suicide drones (and classic UAS) in air force formations according to the doctrinal patterns of organizing air strikes.

Experiences from the use of drones in the armed conflict in Nagorno-Karabakh

The roots of this conflict date back to the 19th century and the connection between the Kingdom of Armenia and the Armenian population in Artsakh (Nagorno-Karabakh). The actualization of the ethnic problem is a consequence of the collapse of the Soviet Union and the remaining of this territory as part of Azerbaijan, despite the fact that the majority of the population is Armenians (in 1923, this territory was annexed to Azerbaijan) (Rashid 2021: 62-70). After numerous tensions and two conflicts fought between Armenia and Azerbaijan, the third Armenian-Azerbaijani war focused on the use of UAS and kamikaze drones took place in 2020 (Antal 2022; Banjac, Petrović et al. 2023: 285; Ben 2021: 24-38; Bivainis 2022: 61-61; Congressional Research Service 2021: 1-22; Maciej 2021: 3; Mitzer, Oliemans 2020; Neeraj 2021: 85-97; Shaikh, Rumbaugh 2020; Terzić 2022:1020).

This conflict began on September 27, 2020, with an attack by Azerbaijani artillery on the armed conflict positions of Armenia, and ended 44 days later, on November 10, 2020. The conflict was preceded by various preparations of the conflicting armies. Azerbaijan has invested over $25 billion in the military over a period of 11 years (2008-2019), with a major emphasis on the acquisition of more modern weapons systems such as UAVs, kamikaze drones and sensor systems (Antal 2022: 76-78; Ben 2021: 24-35; Bivainis 2022: 51-61; Congressional Research Service 2021: 8). In its effort to prepare as well as possible, Azerbaijan sought the need for high-tech solutions outside of cooperation with Russia, in which Turkey and Israel played a major role. Their goal was to develop the capabilities to defeat the opposing side, which was well fortified, on difficult terrain and with extremely respective military potential. On the other hand, Armenia has been building traditional military capacities by implementing experiences from previous local conflicts. Modern funds were procured, but at a significantly lower level than Azerbaijan. The attitude of the Armenian side regarding preparations for this conflict is best illustrated by the following statement by the Deputy Minister of Defense: „It is completely unnecessary to buy expensive drones when the target can be hit with an ordinary grenade launcher" (Ben 2021: 28; Bivainis 2022: 51-61; Maciej 2021: 1; Neeraj 2021: 85-97).

The armed conflict ended with the victory of the armed forces of Azerbaijan, and UAS and kamikaze drones played a decisive role in achieving strategic effects.

The analysis of this conflict led to the following conclusions:

– the human factor, especially in the conditions of the mass media, is extremely important in achieving results (forming public opinion and causing defeatism in the other side of the conflict is a cruisal);

– special importance is also in the use of assets for electronic warfare, the goal of which is the electronic support of swarms of drones and UAS, but also the fight against communication routes mamanged by artificial intelligence from the air;

– a better qualitative-quantitative integration of air defense forces is needed and

– the fourth conclusion refers to the new era of the use of UAS and drones in armed conflicts.

How effective the approach was based on the mass use of UAS is shown by the fact that, regardless of the fact that Azerbaijan was attacking, Armenia suffered seven times more losses than Azerbaijan (Ben 2021: 29; Bivainis 2022: 51-61; Maciej 2021: 1; Neeraj 2021: 85-97; Shaikh, Rumbaugh 2020; Terzić 2022: 1024). Air defense, mechanized and

artillery units suffered the most losses. Unmanned aircrafts were used for two basic tasks, reconnaissance and air strikes. From the point of view of the use of UAS, the experiences of the armed forces of Azerbaijan are particularly significant. They used two basic categories of UAVs. The first category referred to the unmanned combat aerial vehicle - UCAV Bayraktar, which belong to the Medium Altitude Long Endurance (MALE) UAS category. Also, the armed forces of Azerbaijan used Harop kamikaze drones produced by Israeli Aerospace Industries. Skystriker and Orbiter 1K kamikaze drones were also used. According to estimates, the armed forces of Azerbaijan had the following UAS: Bayraktar TV2 about 10-12, Harop about 50, Orbiter 1K about 80, Orbiter 3 about 10, Skystriker about 100 and about 40 unmanned platforms mostly of reconnaissance type. In addition to these unmanned platforms, some of the older Antonov An-2 aircraft have been modified into UAVs (Antal 2022: 77; Ben 2021: 30; Bivainis 2022: 51-61; Maciej 2021: 1-4; Mitzer, Oliemans 2020; Neeraj 2021: 92; Shaikh, Rumbaugh 2020).

The tactics of using UAS were based on the following. Reconnaissance drones were extremely actively used to search: the positions of enemy forces and artillery assets, detect enemy formations in motion and find less defended elements of the enemy's operational layout. Reconnaissance UAS have been used to correct artillery fire or to guide kamikaze drone air strikes. In this way, significant results were achieved in a short time with the shock effect (effect based approach). Also, in the next phase of operations, due to the damaged defense lines, there was an increase in the maneuvers of the Armenian Army forces, which made it possible to determine the real situation on the ground (through continuous reconnaissance from the airspace) and to immediately react to the appearance of any targets in the controlled area. Because of this, the Armenian side suffered heavy losses and was practically paralyzed on the battlefield (Antal 2022: 78; Banjac, Petrović et al. 2023: 285; Ben 2021: 32; Bivainis 2022:51-61; Congressional Research Service 2021: 1-23; Ilić, Tomašević 2021: 14; Maciej 2021: 3; Mitzer, Oliemans 2020; Neeraj 2021: 86-97).

Overcoming Armenia's air defenses was based on the approach that involved mass airstrikes by kamikaze drones and UAVs. These unmanned platforms were supported by the Koral electronic warfare system (produced by Turkey). In this way, it is difficult to detect small targets in the airspace and it is possible to concentrate a large number of UAVs in the area of combat operations (formation of swarms). Surface to air missile systems were provoked by demonstrative actions performed by modified aircraft „An-2" and drones for reconnaissance. The effect of air defence led to the unmasking of the combat positions of the units, so the assets were quickly destroyed by air strike groups of kamikaze drones or UCAVs Bayraktar. With the gradual disruption of the air defence, the action of the Armenian side was increasingly reduced to the independent engagement of battery-level tactical units, which could not respond to the assigned tasks. This resulted in a dramatic increase in the number of destroyed surface to air missile systems (Ben 2021: 24-38; Bivainis 2022: 54; Maciej 2021: 1-4; Neeraj 2021: 88).

Experiences from the Nagorno-Karabakh conflict have shown that UAVs have become an extremely simple, cheap and accessible tool for achieving superiority and great effects at the tactical level. Regardless of the level of economic opportunities, it is shown that funds invested in equipping multi-purpose UAS bring multiple benefits and multiply combat power (Rashid 2021:62-68).

DOCTRINAL PATTERNS OF USING UNMANNED AERIAL WEHICLES

Doctrinal air operations patterns in modern armed conflicts get a new form of manifestation thanks to the use of UAS of different types and roles. These patterns in all phases of the realizaton of air operations will represent a combination of air forces based on the use of conventional aircraft and UAVs of different types and roles.

The basic air operations pattern would be applied in classic armed conflicts of an approximately symmetrical character (figure 2). The objective of the use of air forces would be based on: the achievement of supremacy in the airspace in the area of operation; realization of air support tasks (close air support or air interdiction); carrying out an air landing; ensuring maneuvers of land army; the destruction of more important elements of the enemy's operational layout, etc. The forces, that would carry out air operations according to this air operations pattern, are generally classified into: forces for electronic warfare from the airspace; forces for demonstrative operations; forces for suppressions of enemy air defence and air strikes forces (Petrović, Kankaraš et al. 2016: 527).

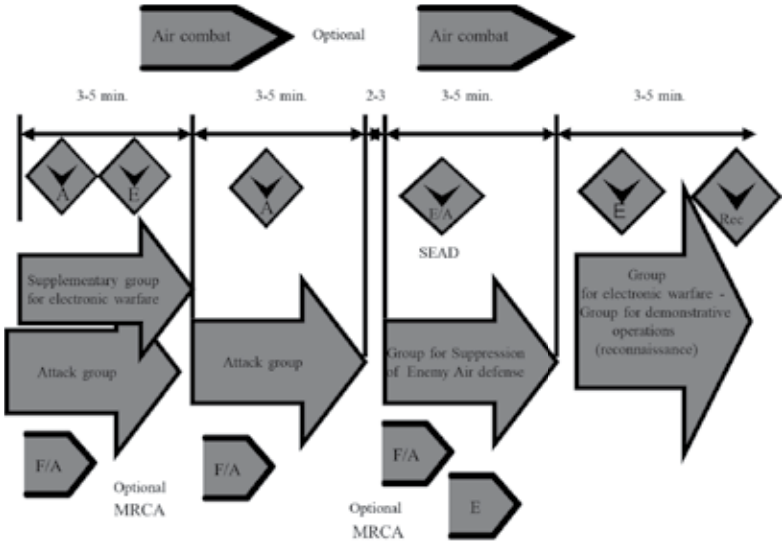

Figure 2; Variant of the doctrinal pattern of air force operations in case of symmetric conflict (phase of aerial warfare)

In the first phase, forces for electronic warfare would be engaged for aerial reconnaissance in the area of operation. Based on previous experience, these forces would consist of a combination of classic E-type aircrafts and UAVs intended primarily for electronic warfare. After them (or simultaneously with them), group for demonstrative operations would be engaged with the aim of unmasking the positions of air defense missile units and air surveillance, early warning and guidance units. These forces would also be used as forces to deceive the enemy about the true intentions of the air force. The group for demonstrative operations would consist exclusively of UAVs and kamikaze drones equipped with optoelectronic means intended

for the identification of sources of electromagnetic and infrared radiation. Part of these UAVs will be equipped with airborne weapons with passive radar or infrared guidance. After the group for demonstrative operations, the group for suppressions of enemy air defence would be engaged with the goal of conducting operations against the main air defense forces (air defense missile units and air surveillance, early warning and guidance units). These forces should destroy or disable the air defense system of enemy and ensure the unhindered flight of air strike groups of UAVs. The group for suppressions of enemy air defence would be formed from: classic multi role combat aircrafts, UAVs (which are armed with anti-radar missiles) and kamikaze drones (the guidance system of these drones would be based on passive radar guidance). In the end, the air strike forces would be engaged together with the forces for electronic warfare, which would destroy the remaining air defence units and realize other tasks in the operation. The air strike group would be formed from classic multi-role combat aircraft and UAVs armed with laser-guided air bombs, as well as kamikaze drones.

In addition to this pattern, the potential air operations pattern in the event of an asymmetric armed conflict would experience some corrections. Namely, the formation of the group for demonstrative operations in this case would depend on the first phase of the operations, which would be based on selective cruise missile air strikes. If the objectives of the first phase of the operation were to be achieved through selective air strikes, the demonstrative operations would have a limited character (especially in the case of achieved supremacy in the airspace). The forces, which would perform operations according to this air operations pattern, are generally classified into: forces for electronic warfare from the airspace; tactical forces for air strikes from a distance; forces for suppressions of enemy air defence and air strikes forces (Petrović, Kankaraš et al. 2016: 524-528). An example of this type an air operations pattern is shown in figure 3.

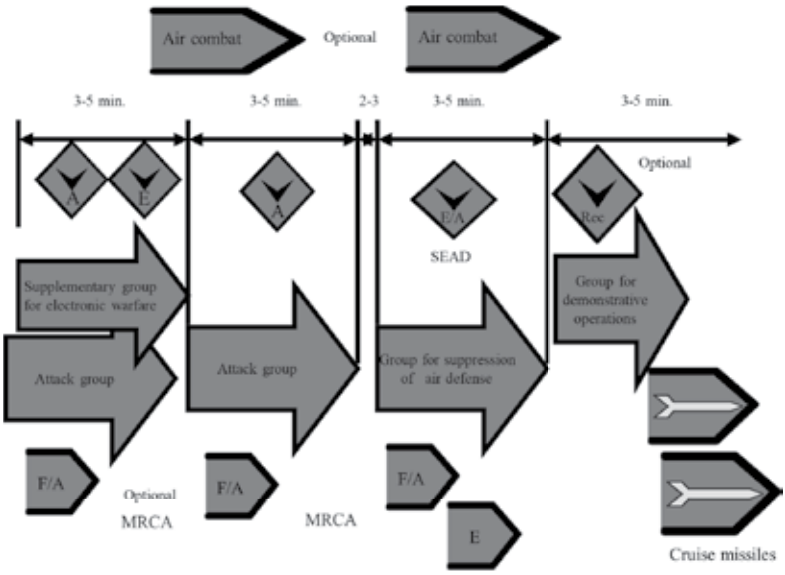

Figure 3; Doctrinal pattern of air force operations with UAS in case of asymmetric conflict (phase of aerial warfare)

In both patterns, whether it is a reconnaissance UAVs, or a UAVs intended for air support, the flight would take place in a formation flying with a lead aircraft which may itself be autonomous. After the flight of UAVs to the target, there would be a maneuver in the area of the target and the transition of the formation flying into the formation that basically corresponds to the circular patrolling zone. After the discovery of the target, there would be the air strike with laser-guided aerial bombs, where the laser marking and targeting of aerial bombs would be done from one platform, while the launching of aerial bombs would be done from the suspension points of the second or third UAV (most of the video clips are made on based on the thermal imaging image from the platform from which the target is laser marked). A typical air strike group would consist of three unmanned platforms guided from a single ground station. A similar mode of formation flying is also present in kamikaze drones. The difference is that one air strike group would consist of significantly more drones (from six to usually twelve) launched from containers from one platform. Kamikaze drones also perform a maneuver in the area of the target, while the air strike is realized autonomously or based on control commands from the ground station (this usually depends on the guidance system and the ability to select targets).

In both cases of the formation of air forces, the increase in the number and quality of UAVs would reduce the need for the formation of forces intended for: fighter escort and fighter sweep.

In any case, the mass use of unmanned platforms (significantly cheaper than conventional military aviation and without the fear of losing pilots) will lead to revolutionary changes in the approach to the use of air forces. Changes in the approach to the use of air forces will significantly affect the change in the approach to the use of forces intended for air defense.

CONCLUSION

The development of artificial intelligence is a consequence of the fourth technological revolution. In such conditions, new weapons and equipment systems are also being developed. Such assets include UAVs and kamikaze drones. The use of these assets will increasingly lead to the robotization of combat operations on the battlefield. There is no doubt that any form of future air operations will be based on the use of UAVs and suicide drones. These robotic air assets will perform all air support tasks in the future. These tasks are: aerial reconnaissance, airlift, close air support, air interdiction, as well as search and rescue in the event of a wide variety of aviation accidents. All these operations will be coordinated with the actions of unmanned platforms of land and water type that will perform a wide range of combat tasks.

Under such conditions, the physiognomy of armed conflict will also change significantly in the future. These conflicts, depending on their character, will be aimed at dissymmetric or asymmetric forms of warfare. Whether these wars will be of a frontal or non-linear type will depend, first of all, on the technological capabilities of the parties to the conflict and their ability to continuously improve: the technical capabilities of weapons and equipment systems and tactical procedures based on previous experience from the conflict. In such conditions, UAVs and kamikaze drones will be developed

in combination with guided aerial weapons such as cruise missiles. All this will lead to massive air strikes using the most sophisticated air combat platforms. Mass strikes of this type will be aimed at destroying the centers of gravity of enemy forces, including not only sophisticated weapons and equipment systems, but also command posts (decision centers for the use of sophisticated assets). Also, it should be noted that UAVs will be increasingly used to carry out difficult and life- and health-threatening tasks, which will make it easier for the parties to the conflict to justify the conduct of the conflict in their public opinion (it should be noted that during the Vietnam War, the problems of the American elite began with the return of soldiers from Vietnam in coffins). In such conditions, all armies of the world will have to continuously work on developing the ability to oppose such forces, through the improvement of their weapon systems. On the one hand, there is a need for the development and modernization of sophisticated assets such as UAVs and kamikaze drones, while on the other hand, there is also a need for the development of assets that will allow opposing the actions of these forces. A special emphasis in countering modern aviation weapons systems will be directed towards the development of: a wide range of electronic devices for disabling the electronic transmission of information between weapon systems and equipment and command and control ground stations and assets intended for their physical destruction (surface to air missile systems based on the most modern technologies). In any case, the development of air force assets and air defence assets will be conditioned by the knowledge of modern technologies for the production of unmanned aerial platforms. Only in this way is it possible to understand the further way of improving them, as well as the way of developing opposition with these means in future armed conflicts. (Parezanović et al. 2022: 59).

Also, it should be noted that the experiences related to the use of the UAVs in modern conflicts (Syria, Nagorno Karabakh, etc.) influenced the change (improvement) of the doctrinal patterns of the use of air forces in symmetrical and asymmetrical conflicts. It is necessary to incorporate these experiences into normative legal documents related to the development, organization and use of the armed forces. The doctrinal grounding of experiences from the use of the UAVs will ensure the development of armed forces that will be able to adequately use UAVs, as well as to oppose airstrikes by them in future armed conflicts.

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БЕСПИЛОТНЕ ЛЕТЕЛИЦЕ КАО РЕВОЛУЦИОНАРНО СРЕДСТВО У САВРЕМЕНИМ ОРУЖАНИМ СУКОБИМА

Резиме

Прошло је више од једног века како је трећа димензија простора (ваздушни простор) постало значајно место одигравања борбених и неборбених активности. Способност ваздухопловних снага да извршава широку лепезу садржаја борбених дејстава и других активности из ваздушног простора обезбедило је развој нових квалитативних карактеристика модерних оружаних сукоба. Непостојање физичких ограничења, висока маневарабилност и динамичност, кратко време реакције, као и високи интезитет дејстава које ваздухопловне снаге изводе, омогућило је да ове снаге од Другог светског рата имају стратегијски значај у оружаним сукобима. Паралелно са развојем цивилизације, и настанком квалитативно нових технологија, развијају се скоковито унапређена технолошка решења која значајно мењају начин живота људи широм света, унапређујући га буквално из дана у дан. Свака технолошка генерација доноси нови степен цивилизацијског развоја доводећи човека као људског бића до нивоа симбиозе са модерним техничко – технолошким средствима. Несумњиво је да такав случај постоји и у развоју савремених борбених система оружја и опреме која се примењују у оружаним сукобим. Такав је случај и са револуционарним развојем нових бробених система и у ратним ваздухопловствима широм света. Развој савременог наоружања у ваздухопловним снагама најбоље је уочљив кроз развој ваздухопловних платформи беспосадног типа (беспилотне летелице). Развој ових средстава представља последицу надолазеће индустријске револуције четврте генерације и њихов значај у реализацији задатака у савременим оружаним сукобима је готово немерљив. Наиме, сваки сукоб доноси експонецинјални развој ових средстава, како у техничком, тако и у тактичком смислу. Развој ових средстава у савременим оружаним сукобима је континуиран процес који се одиграва на свакодневном нивоу на основу претходних искустава из тактичке употребе беспилотних летелица у конкретним борбеним дејствима.

Несумњиво је да је технолошки напредак ових средстава нешто што ће у будућности омогућити готово неограничену примену ових летелица у извршавању најразличитијих задатака без минималне опасности по људски живот стране која их примењује.

Овај рад, чији је основни циљ да опише беспилотну летелицу као средство за извршење широке лепезе задатака у нелимитираном ратном формату, се поред увода и закључка састоји још из три поглавља. У првом поглављу је извршено теоријско одређење беспилотне летелице као система оружја – опреме. У другом поглављу је анализирана употреба беспилотних летелица на примерима оружаних сукоба у Сирији и Нагорно – Карабаху. У трећем поглављу извршена је анализа потенцијалних ваздухопловних шаблона налета беспилотних летелица и дронова самоубица у борбеним дејствима.

Кључне речи: Беспилотне летелице, дрон, оружани сукоб.

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