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THE USE OF UNMANNED AERIAL VEHICLES IN CONTEMPORARY ARMED CONFLICTS – SELECTED ISSUES

ABSTRACT Armed conflicts which have been taking place since the end of the Cold War are characterized by, inter alia, the increasing scale of the use of unmanned means and systems, especially unmanned aerial vehicles. Scientists dealing with the history of technology look for the beginning of unmanned aerial vehicles not only in the time of the Second World War, but even earlier, going back to the beginnings of aviation. Undoubtedly, however, the development of unmanned aerial vehicles took place during the Cold War and resulted directly from the experiences of armed clashes in Vietnam, the Middle East and analyses of the hypothetical course of a Third World War. The armed conflicts initiated by the Arab Spring in 2011 and Turkey's participation in them, the fighting in Nagorno-Karabakh in 2020 and the conflict in Ukraine have once again demonstrated the growing role of unmanned aerial vehicles used for military purposes. It is worth taking a closer look at the role of unmanned aerial vehicles in the aforementioned armed conflicts and try to answer the question whether they are a miracle weapon like the Excalibur, or rather an element of a more complex system involving the ability to reconnaissance, precision strike and electronic warfare? This issue is all the more interesting as not only United States, Israel, Turkey, and China are producers of effective unmanned reconnaissance and strike systems. This type of modern weapon system is also manufactured in Poland. It has been positively tested in the conflicts in the Middle East, Ukraine and during the crisis on the border of Belarus and Poland in 2021.

Keywords: Unmanned Aerial Vehicles, armed conflicts, Libya, Syria, Nagorno-Karabakh

AN INTRODUCTION TO THE SUBJECT AND A BRIEF HISTORICAL OVERVIEW

The first two decades of the 21st century were marked by numerous armed conflicts. It was the so-called global war on terrorism, as well as armed conflicts in Africa, Asia and Europe. Many of them have been smoldering since the Cold War and have flared up again. These conflicts are accompanied by the development of military technologies. The areas undergoing constant evolution include, in particular, reconnaissance, precision strikes, and radio-electronic warfare. One of the tools clearly illustrating the progress of military technologies in the above areas are unmanned tools, including the particularly dynamically developing Unmanned Aerial Vehicles (UAV), including the strictly military Unmanned Combat Air Vehicles (UCAV), which are part of the increasingly complex Unmanned Aerial Systems (UAS).

Unmanned Aerial Vehicles do not need anyone onboard and can be operated autonomously or by remote pilot control. UAV is an integral part of the unmanned aerial system which incorporates UAV, communication link and ground control station. The UAVs themselves can be classified according to their range, flight duration, weight, type of propulsion, etc. However, it is worth paying attention to the classification used by the North Atlantic Treaty Organization (NATO), which uses the term UAS. NATO categorizes UAS into three dedicated classes, ranging from Class I for the micro, mini and small ones, to Class II for medium-sized, tactical systems, to Class III for medium-altitude long-endurance (MALE) and high-altitude long-endurance (HALE) aircrafts.[1]

The research problem discussed in this article concerns the usefulness and the manner of using UAVs in armed conflicts over the last decade. The research problem outlined in this way has to face serious limitations in the form of censorship and propaganda (known today as information operations) imposed by the parties of conflicts, and the confidentiality of much of important information.

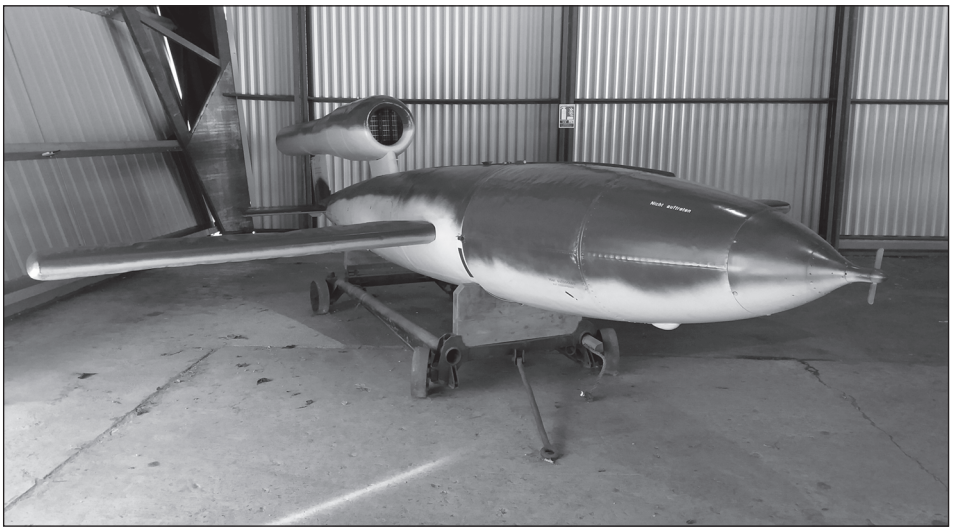
The research objectives include, apart from presenting the origins of UAVs on the modern battlefield, indicating the tasks for which UAVs were used in the discussed armed conflicts. It is also important to answer the question whether UAVs are an independent tool or rather an element of a wider system of philosophy and practice of war.

This article is based on qualitative desk research utilizing scientific studies as well as studies and reports from the news media on the above-mentioned armed conflicts.

Although historians of aviation and technology recognize the roots of the history of UAVs already during the First World War, and sometimes even earlier, the dynamic development of military UAVs undoubtedly took place during the Cold War. On the one hand, the experiences related to the war in Vietnam and the conflicts between Israel

[1] A. Haider, "Introduction", in *A Comprehensive Approach to Countering Unmanned Aircraft Systems*, Kalkar 2021, at https://www.japcc.org/chapters/c-uas-introduction/, 20 September 2022; D. Ehredt, "NATO – Joint Air Power Competence Centre", June 2010, at http://www.dcabr.org.br/download/eventos/eventos-realizados/2010/seminario-vant-27-10-2010/cd-uvs-yearbook/pdf/P061-062_NATO_Dave-Ehredt.pdf, 20 September 2022.

and Arab states contributed to this. On the other hand, the development of electronics, materials technology, navigation tools and artificial intelligence has enabled the technological development of unmanned aerial vehicles.[2]



Picture 1. The German V-1 flying bomb is considered an early cruise missile as well as a combat unmanned aerial vehicle (photo by the Author)

Suppression of an enemy's air defences (SEAD) based on modern radars and missiles turned out to be a huge challenge for the United States and Israel air forces. Air reconnaissance was also problematic, as proved by the diplomatic crisis, when the U-2 spy plane flown by U.S. pilot Francis Gary Powers was shot down by the Soviet Air Defence Forces while performing photographic aerial reconnaissance deep inside the Soviet territory in May 1960. In turn, the breaking of the North Vietnamese air defence caused surprisingly large losses to the United States air force. These losses were not only limited to the loss of aircraft, but also affected airmen, which translated into social, psychological, financial and political issues.

Similar challenges were faced by the Israeli Air Force. After a painful confrontation with Soviet anti-aircraft systems during the so-called wars of exhaustion and Yom Kippur, Israel was looking for a solution to the problem of the S-75 (SA-2) and S-125 (SA-3) ground-based anti-aircraft missile systems, mobile 2K12 Kub (SA-6) and artillery, short range missile systems and very short range air defence. The evolution of technology and doctrine used by the Soviet anti-aircraft systems and their exports to Egypt and Syria meant that the use of anti-radar missiles and other previously used means,

[2] P. Bukowski, G. Szala, "Bezzałogowe statki powietrzne – geneza, teraźniejszość i przyszłość", *Postępy w Inżynierii Mechanicznej. Czasopismo naukowo-techniczne Wydziału Inżynierii Mechanicznej UTP w Bydgoszczy*, vol. 11, no. 6 (2018), pp. 5-19; M.J. Dougherty, *Drony. Ilustrowany przewodnik po bezzałogowych pojazdach powietrznych i podwodnych*, transl. by J. Majszczyk, Warszawa 2017, pp. 12-15.

similar to those used by the U.S. air forces in Vietnam to attack fixed anti-aircraft installations, posed too great threat to aircrafts breaching air defence and their perfectly trained and experienced pilots. A new SEAD doctrine was implemented with great success in 1982 during Operation 'Mole Cricket 19' against the Syrian air defence in the Bekaa Valley. The Israelis used a variety of unmanned aerial vehicles to break through air defence. UAVs were used to excite and recognize anti-aircraft defence, which were then destroyed by anti-radar missiles. The idea of using UAVs was to place relatively cheap means of reconnaissance and destruction in the places of potential deployment of anti-aircraft defence means and immediate attack as soon as an element of the anti-aircraft system becomes visible. This combines the use of an unmanned aerial vehicle as a decoy with the possibility of kinetic interaction via one small and relatively cheap platform compared to 'Wild Weasel' – a piloted SEAD plane.[3]

Unmanned reconnaissance systems were developed also in the Soviet Union during the 1960s. They included unmanned jets developing high cruising speeds and intended for carrying out reconnaissance missions for the operational level of command.[4]

Twenty years later, the use of UASs in the U.S.-led global war on terror (GWOT) introduced UAVs to the mass media, was followed by journalists, specialists and NGOs. RQ/MQ-1 Predator of the MALE class (medium-altitude, long-endurance), brought into service in 1995, became a sort of hype accompanying modern armed conflicts. The next step in the development of these UAVs came with the adoption by the United States of 'selective elimination' policies in the armed conflicts in Afghanistan, Iraq, Yemen, Pakistan and Syria. The United States implemented a 'targeted killing' policy shortly after the September 11, 2001 attacks, and it became an important tool in the global war on terrorism.[5]

The armed conflicts in Nagorno-Karabakh and the wars following the Arab Spring in Libya and Syria have increasingly coupled flying drones with the image of an armed conflict. UAVs play no lesser role in the Russian-Ukrainian conflict, although this aspect is less exposed in the image created by the news media for the period from the annexation of Crimea in 2014 to the Russian aggression against Ukraine in February 2022.

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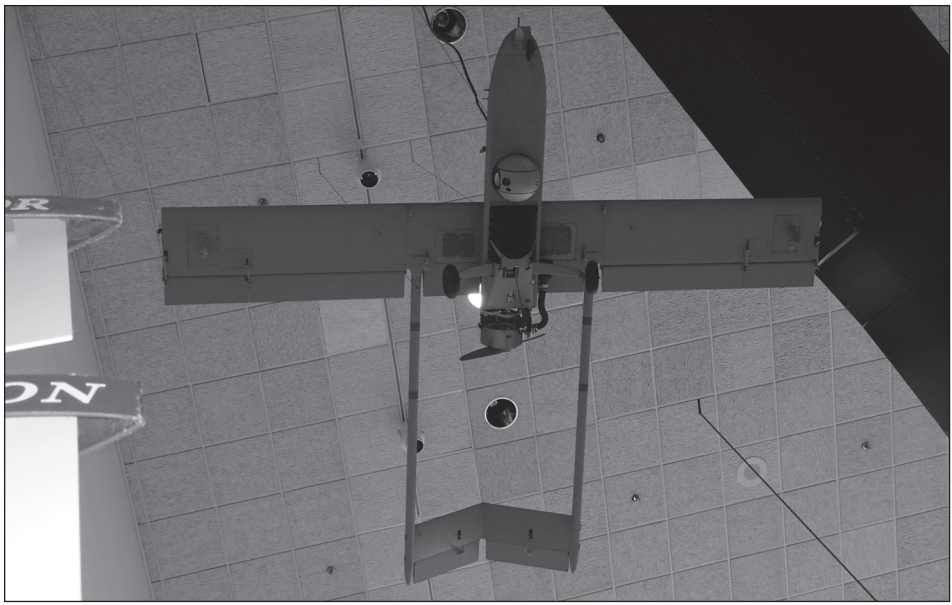
[3] M. Finkel, *On Flexibility: Recovery from Technological and Doctrinal Surprise on the Battlefield*, Stanford 2011, pp. 164-178; K. Kubiak, Ł.M. Nadolski, *Ogień na pustyni. Konflikt izraelsko-arabski w latach 1967-1973*, Zabrze–Tarnowskie Góry 2017, pp. 8-93; Ł. Przybyło, *Doktryny wojenne. Historia i ocena*, Warszawa 2018, pp. 193-219; R. Whittle, *Predator: The Secret Origins of the Drone Revolution*, New York 2014, pp. 7-28.

[4] R. Ciechanowski, "Rosyjskie bezzałogowe statki powietrzne – stan obecny i perspektywy rozwoju", *Nowa Technika Wojskowa*, no. 6 (2016), pp. 76-85; M. Dąbrowski, „Bezzałogowce w armii Rosji [raport]", Defence24, 24 March 2019, at https://defence24.pl/bezzalogowce-w-armii-rosji-raport, 3 March 2022.

[5] P. Alston, *Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions. Addendum: Study on Targeted Killings A/HRC/14/24/Add.6*, United Nations General Assembly, New York, 28 May 2010; Ł. Piątkowski, "Zarys stosowania polityki celowanego zabijania przez Izrael i Stany Zjednoczone", *Studia Erasmiana Wratislaviensia*, vol. 7 (2013), pp. 241-257.



Picture 2. One of the priority tasks to be performed by UAVs is reconnaissance. UAV RQ-2A Pioneer provides field commanders with real-time reconnaissance, surveillance, target acquisition, and battle damage information. U.S. Army, Navy, and Marine units began using RQ-2As in the late 1980s, were used operationally during the 1991 Gulf War (photo by the Author)

Picture 3. The arming of UAVs with guided missiles allowed for the creation of a relatively cheap flying support device for troops fighting on the ground and for performing precise air strikes. Armed with Hellfire-C UAV missiles MQ-1L Predator A has become the symbol of GWOT and the so-called targeted killing (photo by the Author)

UNMANNED AERIAL VEHICLES IN THE ARMED CONFLICTS IN SYRIA, LIBYA AND NAGORNO-KARABAKH – A HANDFUL OF INSIGHTS

With regard to the armed conflicts in Syria and Libya, I will focus on the use of UAVs by the Turkish forces. Turkey, developing its own UAVs, has joined the group of countries that are perceived as having the technology to build their own UASs and the experience of using them in real combat conditions, i.e. Israel, the United States, China, Iran, now also Poland.[6]

In the Syrian conflict, the use of UAVs by the Turkish forces was not only an element of intelligence, surveillance and reconnaissance, but to a large extent a combat instrument, fully integrated with the operational strategy. In Syria, the Russians experienced the importance of the role of UASs and the importance of countermeasures. The combination of electronic warfare (EW) systems and tactical capabilities offered by UAVs into one complex allowed the Turkish forces to implement their intentions, despite the closure of the airspace over Idlib by Russia and Syria in 2020.

The Turks used UAVs on a larger scale earlier during Operation 'Olive Branch' in 2018. At that time, the entry of Turkish troops into Syria was aimed at creating a 20-mile-deep buffer zone around the Syrian city of Afrin and displacing thousands of US-backed Kurdish fighters (Peshmerga) from this area. The Peshmerga supported the United States forces in the fight against terrorists from the so-called Islamic State.[7] However, the Idlib Governorate campaign – Operation 'Spring Shield' – was the first time Turkey used UAVs on a large scale and against a neighbouring state whose government was backed by Russia. During the first night of the operation on February 27/28, 2020, the Turks destroyed more than 200 targets including: 5 helicopters, 23 tanks, 23 Buk and Pantsir anti-aircraft systems.[8] During Operation 'Spring Shield', Turkish UAVs operated almost everywhere in the Idlib area and beyond. Turkish UAVs have been sighted in Hama and Aleppo, territories then under the control of the Syrian government.

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6 The unmanned aerial vehicles produced by the WB Group have passed the test in the full-scale armed conflict in Ukraine. For example, you can find the following videos: NV, "Pomitili vorožij ZRK Tor. Kontrrozvidka pokazala, âk bezpilotnik Fly Eye dopomagaє niŝiti okupantiv" [НВ, "Помітили ворожий ЗРК Тор. Контррозвідка показала, як безпілотник Fly Eye допомагає нищити окупантів"], YouTube, 1 August 2022, at https://www.youtube.com/watch?v=w_p6Nltflx4&t=2s, 20 October 2022; ССО України/SOF UA, "Run, Vanya, run!", YouTube, at https://www.youtube.com/watch?v=r19aWnlS_0Q&t=1s, 20 October 2022.

7 K. Wasilewski, P. Sasnal, "Turkish Military Operation Olive Branch in Syria", The Polish Institute of International Affairs, 22 January 2018, at https://pism.pl/publications/Turkish_Military_Operation_Olive_Branch_in_Syria, 16 February 2022.

8 B. Nikolov, "Turkey Has Destroyed Missile Systems, Dozens of Tanks and Five Helicopters in Idlib", BulgarianMilitary.com, 28 February 2020, at https://bulgarianmilitary.com/2020/02/28/turkey-has-destroyed-missile-systems-dozens-of-tanks-and-five-helicopters-in-idlib/, 14 February 2022.

In Idlib, the Turkish army used the new UAVs for the first time in combat, testing the Bayraktar-TB2 manufactured by Baykar and Anka-S produced by Turkish Aerospace Industries. In addition to traditional reconnaissance and strike roles, UAVs were used to carry out missions to eliminate specific groups and targeted individuals. Two Syrian generals, a colonel and foreign fighters from Hezbollah and Iran are reportedly eliminated with the help of UAVs in an attack on Syrian headquarters at Az-Zarba, south of Aleppo. TB2s operated in the grouping of UAVs Anka. UAVs Anka ensured imaging and radio-electronic intelligence and reconnaissance, and acted as retranslation tool to control TB2. The combat use of the Bayraktar TB2 included two main types of missions: reconnaissance and strike. As a result of the military confrontation in Syria, Turkey has developed a tactic of 'mass' use of Bayraktar TB2. They were operated in groups, under the cover of larger Anka UAVs equipped with a radar, electronic reconnaissance devices, EW and communication range extenders. The purpose of the operation was mainly to overpower air defence and attack regular troops.

According to media reports, about 20 Bayraktar TB2s and Anka UAVs were shot down during the operation of Turkish troops in Syria in the period from September 2019 to September 2020. During this time, eight Pantsir-S1s self-propelled anti-aircraft artillery and missile systems, which were the main threat to the Turkish UAVs in Syria, were destroyed. According to more conservative and reliable estimates, 10 Bayraktar TB2s and Ankas were shot down and two Pantsir-S1 systems were destroyed. In sum, loss estimates give the result of five unmanned aerial vehicles destroyed per one anti-aircraft system. According to the Russians, this confirms the insufficient level of combat survivability of anti-aircraft defence.[9] On the other hand, the number of unmanned aerial vehicles shot down may seem significant, but their price compared to a manned multi-role combat aircraft is small. Most importantly, no pilot was lost.

In the case of Libya, Turkey has successfully achieved its strategic political goals, as in Syria. The use of the UASs and troops was not similar to the situation in Syria, where significant resources of the Turkish armed forces were used. Turkey sent soldiers of special operations forces, UAV operators, air defence and EW means to Libya, without escalating its presence and Russian reaction. In Libya and Syria, the use of the UASs

[9] I.E. Afonin et al., "Analiz opyta boevogo primeneniâ grupp bespilotnyh letatelnyh apparatov dlâ poraženiâ zenitno-raketnyh kompleksov sistemy protivovozdušnoj oborony v voennyh konfliktah v Sirii, v Livii i v Nagornom Karabahe", *Sistemy upravleniâ, svâzi i bezopasnosti*, no. 4 (2020) [И.Е. Афонин et al., "Анализ опыта боевого применения групп беспилотных летательных аппаратов для поражения зенитно-ракетных комплексов системы противовоздушной обороны в военных конфликтах в Сирии, в Ливии и в Нагорном Карабахе", *Системы управления, связи и безопасности*, no. 4 (2020)], pp. 165-169, 173-175; M. Gawęda, "Pancyry w Syrii", *Wojsko i Technika*, no. 6 (2020), pp. 38-43; A.M. Maciejewski, "Bayraktar TB2 jako system operacyjny", *Wojsko i Technika*, no. 6 (2021), pp. 18-24; R.B. Urcosta, "The Revolution in Drone Warfare. The Lessons from the Idlib De-Escalation Zone", *Journal of European, Middle Eastern, & African Affairs*, vol. 2, no. 3 (2020), pp. 50-65; A. Bakeer, "The Fight for Syria's Skies: Turkey Challenges Russia with New Drone Doctrine", Middle East Institute, 26 March 2020, at https://www.mei.edu/publications/fight-syrias-skies-turkey-challenges-russia-new-drone-doctrine, 10 March 2022.

allowed Turkey to influence the fighting on land. The UN Special Representative to Libya, Ghassan Salamé, called the Libyan conflict *the greatest drone war in the world* – with nearly 1,000 air strikes by UAVs (United Nations Political and Peacebuilding Affairs 2019).[10] The Libyan National Army (LNA) – a faction backed by Egypt, France, the United Arab Emirates and Russia led by Field Marshal Khalifa Belqasim Haftar – also had UAVs. These were the Chinese Chengdu Pterodactyl I (Wing Loong) MALE class UAVs successfully used in the Battle of Tripoli. The Chinese UAVs were operated by pilots from the United Arab Emirates, taking off from Al-Khadim air base in eastern Libya. The combat range of 1,500 km allowed the use of precision guided missiles and bombs anywhere in the country.

The first Turkish UAVs Bayraktar TB2 were delivered to the forces of the National Unity Government that fought against Khalifa Haftar in the summer of 2019. The Government of National Unity was supported by Turkey, Italy and Qatar. The use of Turkish UASs in Libya was one of the most important factors guaranteeing an advantage to the troops of the government of national unity and also played a large role in the decisive battle of Tripoli. The terrain in Libya is flat and desert, allowing for relatively easy target spotting. Libya is also sparsely populated. That makes it more rational to use UAVs with long-term airborne capabilities for reconnaissance, surveillance and observation missions, than for manned aircrafts or ground forces. In Libya, UAVs allowed for constant patrolling, which made manoeuvring the troops much more difficult for the enemy.

Turkey created an air defence umbrella around the capital city of Tripoli, deployed in the Mitiga air base, where not only air defence systems (MIM-23 Hawk, Hisar, KORKUT) are stationed, but also the KORAL electronic warfare systems utilized in Syria. KORAL is capable of interfering with Pantsir-S1 and disrupting communications to control Chinese UAVs within a 200-km radius. Turkish UAV operations were conducted from operational centers in Ankara and the Hatay Province of Turkey.

On the ground, the main opponents of the Turkish UAVs were also the Russian Pantsir-S1 anti-aircraft systems. According to media reports, from May 2019 to June 2020, Haftar's forces were to lose 15 Pantsir-S1 sets destroyed by Turkish UAVs. As many as 78 Turkish UAVs were lost. According to other estimates, 22 to 26 TB2s were shot down, with a loss of 9 to 12 Pantsir-S1s. Such greater losses in air defence were due to the fact that, on the one hand, Turkey was able to provide its own and allied forces with information from satellite reconnaissance and, on the other hand, the Pantsir-S1 crews were not properly trained. They were often attacked while moving or after firing ammunition after being provoked by smaller UAVs to open fire. In turn, the losses of Bayraktar TB2s were the result of using them not only to overpower air defence, but also to support the troops fighting on the ground.[11]

[10] United Nations Political and Peacebuilding Affairs, "Interview with UN Special Representative for Libya Ghassan Salamé", YouTube, 2019, at https://www.youtube.com/watch?v=IB3jie4i7SI, 16 February 2022.

[11] I.E. Afonin et al., "Analiz opyta boevogo...", pp. 175-177; R.B. Urcosta, "The Revolution in...", pp. 56-57.

In the fall of 2020, another round of the armed conflict between Armenia and Azerbaijan began in Nagorno-Karabakh. A distinctive feature in comparison to previous episodes was the massive use of UASs by Azerbaijan to destroy Armenia's weapons and personnel. Azerbaijan used Turkish UAVs Bayraktar TB2, Israeli Heron TP and Hermes 4507, the Sky Striker, Harop, Orbiter-1K and Orbiter-3 loitering ammunition, and Krunk light reconnaissance UAVs. Armenian forces were armed with various air defence systems of Soviet and Russian production, but the Armenian air defence systems were appropriate for the tasks related to fighting with traditional manned aviation, not with UAVs.

With the start of hostilities in Nagorno-Karabakh, the armed forces of Azerbaijan, with the support of Turkish and Israeli military specialists, began to utilize unmanned aerial vehicles *en masse*. Azerbaijan, even after gaining air superiority, used manned aircrafts to a very limited extent. Armenia turned out to be completely unprepared to counteract the massive use of UASs.

The result of the use of the Bayraktar TB2 UAV groups, together with the Sky Striker, Harop and Orbiter loitering ammunition, was almost complete elimination of Armenian anti-aircraft systems located in Nagorno-Karabakh already in the first days of the conflict.

On the first day of the war, an attack was made on the positions of the air defence systems, which deprived the defence of up to 80 per cent of assets. Six Osa sets and three Striela-10 sets were destroyed with a loss of four UAVs. In addition, as a result of a well-planned operation using drones, two launchers and two S-300PS radars were destroyed. It was also interesting to use An-2 aircraft as apparent targets for enemy air defence and as re-translators for communication with UAVs.[12]

Azerbaijani forces also used, like the United States and Israel, unmanned aerial vehicles for the so-called targeted killing. On October 27, 2020, the Azerbaijani media presented recordings of the combat UAV showing the attack on the Defence Minister and the Commander of the Armed Forces of the Nagorno-Karabakh Republic. The politicians travelled in a convoy that was most likely attacked by Bayraktar TB2. The car in which the target was traveling was hit by a MAM-L missile. The vehicle caught fire – according to Azerbaijan authorities, the Defence Minister was injured in the attack and the Commander of the Nagorno-Karabakh army was killed. The authorities of the republic, recognized by Armenia, announced that the top officials of the armed forces of Nagorno-Karabakh survived the attack and were hospitalized, and their tasks were taken over by deputies.[13]

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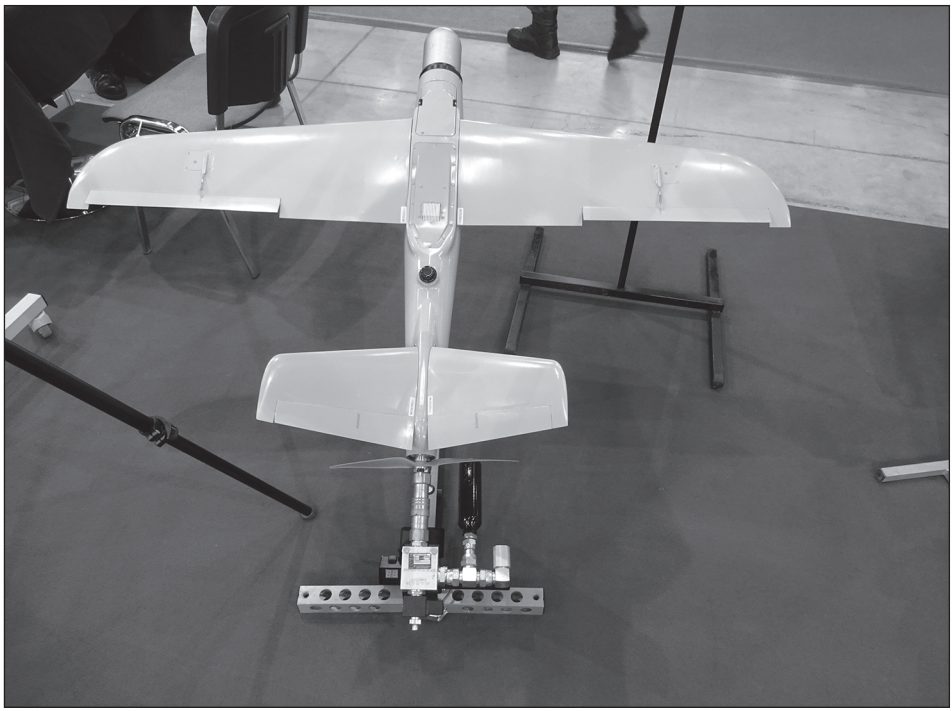
[12] I.E. Afonin et al., "Analiz opyta boevogo...", pp. 177-179; R.B. Urcosta, "The Revolution in...", pp. 56-57; M. Gawęda, "Nowa odsłona wojny w Górskim Karabachu cz. 1", *Wojsko i Technika*, no. 10 (2020), pp. 30-36; idem, "Wojna w Górskim Karabachu cz. 2", *Wojsko i Technika*, no. 11 (2020), pp. 40-46.

[13] Ł. Pacholski, "Azerowie polują na dowódców przeciwnika", Zespół Badań i Analiz Militarnych, 28 October 2020, at https://zbiam.pl/azerowie-poluja-na-dowodcow-przeciwnika/, 16 February 2022.



Picture 4. Loitering munition. Once can see in the photo WARMATE munition, used, among others, by the Polish Territorial Defence Forces[14] (photo by the Author)

UNMANNED AERIAL VEHICLES ON THE FRONTLINE OF THE UKRAINIAN-RUSSIAN CONFLICT 2014-2021

Unmanned flying systems were used in the conflict in eastern Ukraine, in the Donbas region, from the very beginning. UAVs were used by all parties of the conflict. Both post-Soviet heavy unmanned jets and small mini-drones from the civilian market flew over the Donbas.

Before the conflict broke out in 2014, various UAVs had been developed in Ukraine, but none were commissioned by the Ukrainian military. At the time of the launch of the Anti-Terrorist Operation (ATO), it turned out that drones of various types and purposes were needed. The Ukrainian army used the old post-Soviet WR-3 Riejs unmanned complexes with the Tu-143 unmanned reconnaissance aircraft and the WS-2 Striż with the Tu-141 reconnaissance drone. Unmanned aerial vehicles were part of the

[14] Loitering munition is a category of weapon systems based on an unmanned aerial vehicle with a warhead that circulates around the target area for a specified period of time, seeks targets and attacks them. Loitering munition known since the 1980s finds more and more applications from the important tool of suppression of air defense to 'pocket artillery' of special operations forces, and is an increasingly important, cost-effective supplement to the used arsenal.

Ukrainian Air Forces' 383rd Separate UAV Regiment based in Hmelnitskiy. They performed photographic operational and strategic reconnaissance tasks for the ATO staff in Kramatorsk. The systems were used intensively in the first months of ATO, which resulted not so much from their usefulness as from necessity, due to the lack of other means of unmanned aerial reconnaissance.

Only in December 2014, over 250-300 thousand hectares of land were under observation and information on over 300 objects were collected after making about 60 reconnaissance flights. In order to increase the range and effectiveness of reconnaissance (quick description of the photos), mobile groups operating UAVs were put on the front line, and on some days there were several flights a day. At the same time, on the tactical scale, especially in new special and voluntary formations, small drones started to be used, often acquired on the civilian market and subject to modifications. Deliveries of this type of equipment for selected units were handled by volunteers and private companies. For example, the reconnaissance unit of the UAV included the 'Dnipro-1' battalion. Small civilian UAVs performed close reconnaissance tasks.

It quickly turned out that the Ukrainian armed forces and services do not have a sufficient number of UAVs with the appropriate parameters. This caused many small and larger Ukrainian companies and construction offices start working on small tactical UAVs. The Ukrainian army tested many drones, including those of foreign origins. When it comes to domestic drones, the UAV AS-1 Furia of the NPP 'Anton Avia' from Kiev should be mentioned. The Ukrainian army became interested in this UAV at the end of 2014. After a series of tests, Furia was first adopted by the National Guard of Ukraine, being a military formation under the Ministry of the Interior, and then by the Armed Forces of Ukraine. Furia was used almost from the beginning of the ATO, and the battalion 'Donbas' was the first unit equipped with this type of unmanned aerial vehicle. In an improvised way, attempts were made to use Furia and civilian UAVs to direct fire of Ukraine's own artillery. Over time, experience was gained and the rules of the use of UAVs were systematized. During the first two years of the conflict, several dozen Furia drones were delivered. In its first variant, the Furia system consisted of one ground control station and one flying apparatus, then one ground station and three drones.[15]

The Ukrainian industry has great competences for the design, development and construction of aircrafts; hence more ambitious projects were launched over time. For example, in 2021, the Pivdiennie Design Office presented a project of a strike UAV with precision ammunition. Also in 2021, the UkrJet company presented the UJ-32 Airborne unmanned systems during the Arms and Security 2021 exhibition in Kiev along with two variants of armament of cheap, proven and commonly used unguided ammunition.[16]

[15] M. Gawęda, "Bezzałogowce w konflikcie na Ukrainie [analiza]", Defence24, 11 December 2016, at https://defence24.pl/bezzalogowce-w-konflikcie-na-ukrainie-analiza, 3 March 2022.

[16] J. Sabak, "AS 2021: Bezzałogowy 'bombowiec' UkrJet Airoborne", Defence24, 18 June 2021, at https://defence24.pl/technologie/as-2021-bezzalogowy-bombowiec-ukrjet-airoborne-foto, 16 February 2022; idem, "Ukraina: Nowy dron uderzeniowy z amunicją precyzyjną", Defence24, 14 January 2022, at https://defence24.pl/technologie/ukraina-nowy-dron-uderzeniowy-z-amunicja-precyzyjna-wideo, 16 February 2022.

The acquisition of the UAVs AeroVironment RQ-11B Raven from the U.S, was undoubtedly an important step in the use of UAVs, and in building Ukraine's own experimental and training facilities. In July 2016, the U.S. handed over 24 RQ-11B Raven sets to the Ukrainian side (each set includes three cameras, two control stations and spare parts) and trained several dozen Ukrainian soldiers in the United States. Ravens were donated as part of the military aid. Ukraine also received UAS Silent Falcon – an unmanned modular flying vehicle based on solar technology, powered by solar photovoltaic cells.[17]

In March 2015, FlyEye UAVs manufactured by the Polish group WB were delivered to Ukraine. The FlyEye UAVs were used in the combat zone in the Donbas and turned out to be not only easy to use, but also difficult to detect and resistant to damage, including shelling. This determined the purchase of additional UAVs. At the turn of 2020 and 2021, the Ukrainian forces had 18 FlyEye 2.0 UAVs at their disposal.[18]

Just like the Ukrainian side, the so-called 'separatists' also appreciated the need for UAVs at the tactical level which could increase close reconnaissance capabilities. On the side of the separatists, sub-units equipped with armaments supplied by various organizations and volunteers, but mainly getting the support (equipment and specialists) from the Armed Forces of the Russian Federation, also emerged in the zone of conflict. The Armed Forces of the Russian Federation used various types of unmanned aerial vehicles during the conflict, the most common were Orlan-10 UAVs, the serial production of which was launched in 2011.

UAVs were used by the 1st Army Corps of the Donetsk People's Republic (DPR), which included the 'Grenada' unmanned systems unit located in Donetsk. Separatists were trained to operate drones in camps in Russia, e.g. in the Rostov Oblast. Some units, such as the 'Somali' DPR battalion, also had drones from the civilian market at their disposal in the first months of the conflict. Data collected by the Ukrainian military intelligence confirm that elements of an electronic warfare company and a Russian company operating Orlan-10 UAVs, conducting reconnaissance in the Luhansk direction, were deployed in the Topaz Zavod area in Donetsk. Some of the subunits were identified as units of the Armed Forces of the Russian Federation. The Russians also used their UAVs to cooperate with artillery.

In the summer of 2014, in the early phase of ATO, UAVs began the mission from the territory of the Russian Federation, and while flying along the border, possibly only slightly crossing it, conducted reconnaissance, or directed their own artillery fire in the border zone. Along with the increasing involvement in the territory of the Donbas, there were also sub-units of Russian UAVs separated from individual mechanized brigades. Ukrainian reports on the early phase of ATO mentioned most often such drones as Orlan-10, Zastava and Grusha. The Ukrainians shot down many Russian

[17] M. Gawęda, "Bezzałogowce w konflikcie...".

[18] V. Râbih, "FlyEye 3.0: udoskonalenij bezpilotnij boєc' Ukraïns'ka p'âtirička pol's'kogo BPLA" [В. Рябих, "FlyEye 3.0: удосконалений безпілотний боєць Українська п'ятирічка польського БПЛА"], *Defense Express*, March-April 2021, pp. 20-23.

UAVs, especially the Orlan-10 type. For example, on August 1st, 2014, the Orlan-10 apparatus was supposed to be shot down with a missile of the Striela-10 system. According to the Ukrainian side, Orlan-10 flew at an altitude of approximately two thousand meters over the Ukrainian positions, transmitting the image in real time (on-line) from optoelectronic sensors.[19]

UAVs were used by both sides of the conflict, not only for guiding artillery strikes, but also for monitoring compliance with the ceasefire or for electronic reconnaissance and intelligence. Ukraine also decided to purchase several dozen TB2 Bayraktar UAVs. In January 2019, a contract was made for six UAVs and three ground control stations, and in November 2020, another 20 TB2s and additional ground control stations were purchased for the Ukrainian Air Force. In July 2021, the Ukrainian Navy made a decision about the acquisition of another four TB2s kits.[20] On October 26th, 2021 Ukraine used a Bayraktar TB2 for the first time during a counter-battery mission in the Donbas. The separatists opened fire from a D-30 howitzer battery (122 mm caliber) on the lines occupied by the Ukrainian army. The Ukrainian commanders then decided to use armed unmanned aerial vehicles purchased in Turkey. The apparatus was supposed to neutralize the fire unit used by the separatists with the help of a guided bomb. Ukrainian commanders noticed that with the TB2 attack, the shelling of Ukrainian positions ceased in its entirety, stopping after all the threat to life and limb of not only the military themselves, but also civilian population in the areas near the front lines. UAVs were guided not to cross the border with the separatists during the combat flight. At the same time, the Ukrainian side was to inform a group of foreign observers about its activities.[21] Moreover, the Ukrainian Special Operations Forces were supported in terms of intelligence gathering by Bayraktar TB2s following the completion of evaluation tests in Khmelnytskyi region in March 2019.[22]

CONCLUSIONS

It can be stated with a high degree of certainty that as the tactics of group operation of unmanned aerial vehicles has been improved, the tendency to increase the effectiveness of using UAVs to gain air superiority and defeat the main land armament – armoured vehicles – will intensify. On the other hand, it should also be noted that the reports

[19] M. Gawęda, "Bezzałogowce w konflikcie...".

[20] J. Raubo, "Ukraina broni użycia drona bojowego w Donbasie", Defence24, 31 October 2021, at https://defence24.pl/sily-zbrojne/ukraina-broni-uzycia-drona-bojowego-w-donbasie, 16 February 2022.

[21] Ibid.; S. Cranny-Evans, T. Bullock, "Ukraine Uses Bayraktar TB2 in Anger", Janes.com, 28 October 2021, at https://www.janes.com/defence-news/air-platforms/latest/ukraine-uses-bayraktar-tb2-in-anger, 3 March 2022.

[22] A. White, "Ukraine Conflict: Ukrainian Special Operations Forces in Focus", Janes.com, 4 March 2022, at https://www.janes.com/defence-news/news-detail/ukraine-conflict-ukrainian-special-operations-forces-in-focus, 10 March 2022.

on the Nagorno-Karabakh conflict created a media vision of UAVs as being extremely difficult to be destroyed. Meanwhile, in July 2020, during the Azerbaijani-Armenian clashes at the northeastern section of the border, the Azerbaijanis lost their Israeli produced UAVs, namely Orbiter 3, Orbiter 2, SkyStriker, Hermes 900 and Harop, which were shot down by air defence or incapacitated by the use of means of electronic warfare. During four days of clashes in the Tavush province, the Armenians neutralized 13 enemy UAVs. Earlier, Armenians also intercepted UAV Hermes 180 in 2012 and Orbiter 3 in 2017. UAV TB2 is probably already known to a potential enemy. The Russians boast that they have got and are examining a TB2, which they managed to 'bring to the ground' in the fall of 2020. The Syrians declare that thanks to Russian support they destroyed about 20 Turkish UAVs with the Buk-M2E anti-aircraft systems. During the Russo-Georgian war in 2008, the Russians also successfully used Buk sets to shoot down Israeli UAVs used by Georgians.[23] UAVs used by US forces were also shot down. On June 20, 2019, the Iranians shot down the UAV RQ-4 Global Hawk over the Strait of Hormuz. On June 6 of the same year, the Americans lost over Yemen their MQ-9 Reaper shot down by Huti forces.[24]

Despite this, the UAVs proved their worth in combat operations. A bold thesis can be put forward that UAVs revolutionized the activities in airspace in the area of the most dangerous activities involving the loss of pilots and expensive manned aircrafts, such as suppression of enemy air defences (SEAD), or direct support of soldiers fighting on the ground. UAVs will play an increasingly important role on the modern battlefield, due to the fact that an UAV operator is safer than a soldier at the front edge of the battlefield.[25] This is an important argument, especially in the face of the deficit of citizens of developed countries who are capable and willing to serve in the military. Moreover, the loss of even a few UAVs is less painful financially, politically and emotionally than the loss of one F-16 and its pilot. It is also worth noting in principle that a pilot of a multi-role combat aircraft and an UAV operator can perform the same tasks, with the UAV prices still remaining significantly lower than the ever-increasing prices of advanced combat jets.

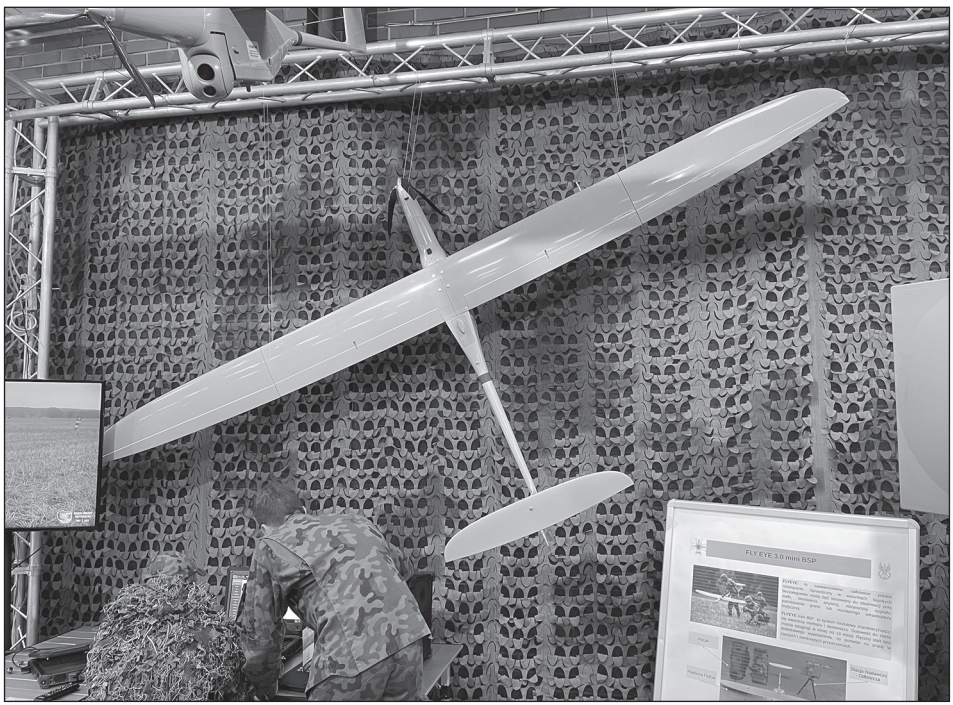
It should also be noted that no UAV, be it the MQ-9 Reaper or the Bayraktar TB2, is a lone fighter, but an element of a multi-layer system covering ground and air reconnaissance, electronic warfare, communications, means of destruction, and a control and command system. An UAV should interact and communicate with other means of

[23] I.E. Afonin et al., "Analiz opyta boevogo...", pp. 177-191; O. Faličev, "Lovuška dlâ 'Bajraktarov'. Počemu hvalenye tureckie BLA četyre dnâ ne smogli rabotat' v nebe Nagornogo Karabaha", *Russkij Obŝe-Voinskij Soûz*, [О. Фаличев, "Ловушка для «Байрактаров». Почему хваленые турецкие БЛА четыре дня не смогли работать в небе Нагорного Карабаха", *Русский Обще-Воинский Союз*], 30 April 2021, at https://vpk-news.ru/articles/61894, 3 March 2022.

[24] P. Cal, "5 Times in History Enemies Shot Down a US Drone", C4ISRNET, 23 August 2019, at https://www.c4isrnet.com/unmanned/2019/08/23/5-times-in-history-enemies-shot-down-a-us-drone/, 10 March 2022.

[25] P. Dombrowski, E. Gholz, *Buying Military Transformation: Technological Innovation and Defense Industry*, New York 2006, pp. 59-84.

ensuring reconnaissance and targeting and electronic warfare capabilities. It should also be equipped with air-to-surface weapons and be able to cooperate with other UAVs, including loitering munition. The use of UAVs before our eyes revolutionized command and control solutions by providing a better and wider view of the battlefield by combining multiple platforms and sensors into one multi-layered system with UAVs in its core. Validity of this thesis has been proved by the experiences of conflicts in Syria, Libya and Nagorno-Karabakh, and to some extent in Yemen.[26]



Picture 5. Reconnaissance UAV FlyEye[27] (photo by the Author)

Polish industry already has ready-made products or has the competence to make many elements of the system, such as loitering ammunition, reconnaissance UAVs and glide bombs, communication systems, and radar systems. An example of the Polish potential in this area is the SWARM System (formerly known as W2MPIR) reconnaissance and strike system, which allows for reconnaissance and simultaneous execution of precise strikes at high-value enemy targets. It is a combination of solutions related

[26] Ibid., pp. 59-84; S.P. Manjeet, "Unmanned Aerial Vehicles: Missions, Challenges and Strategic Implication for Small and Medium Powers", in B. Loo (ed.), *Military Transformation and Strategy: Revolutions in Military Affairs and Small States*, Abingdon 2009, pp. 101-113.

[27] FlyEye is in the arsenal of the Polish Territorial Defense Forces, SOF and the Border Guard, among others. It proved its efficiency during the crisis on the border between Belarus and Poland in 2021. It has been used intensively and successfully during the operations in Ukraine since 2015.

to the management of the battlefield and the extensive use of unmanned reconnaissance means and destruction in a system that allows to gain operational advantage on the modern battlefield, e.g. by effectively neutralizing the enemy's Anti-Access/Area Denial zones.[28] An interesting and somewhat similar solution based on Polish products was implemented in Ukraine, where the Sokol system was created, which includes six WARMATE loitering ammunition carriers, each carrying 10 drones (which gives a total of 60 machines ready for use) and one reconnaissance vehicle with UAV FlyEye. Each such vehicle also has an internal installation integrated with a control and steering station and a ground data terminal.[29] The integration of the UAV with ISR tools (reconnaissance vehicles, patrols and others) and C3 (including the battlefield management system) at the battalion, brigade and division levels, could allow for the creation of a kind of reconnaissance and strike complex. Such a systemic approach could also significantly expand the catalogue of possible actions of the Special Forces, Territorial Defence Forces and, of course, the Land Forces.

But an UAV is not a lone gunslinger. The UAV is effective, but as an element of the reconnaissance and strike system and should not remain an 'island' of technical modernization of the armed forces.

Undoubtedly, important conclusions and experiences related to the use of UAVs will be drawn from the fights in Ukraine initiated by the Russian aggression on February 24, 2022. However, at the time of writing this article, there were no precise and reliable data on this issue yet. But it can already be said today that the armed conflict in Libya is no longer 'the greatest drone war'. The war in Ukraine is an armed clash where the use of unmanned aerial vehicles is massive.

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[28] J. Gruszczyński, "W2MPIR. Wielozadaniowy Wielowarstwowy Misyjny Powietrzny Inteligentny Rój", *Lotnictwo Aviation International*, no. 10 (2021), pp. 28-30.

[29] A.M. Maciejewski, "System rozpoznawczo-uderzeniowy SWARM", *Wojsko i Technika*, no. 10 (2020), pp. 38-42.

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