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TRANSFORMATION OF WORLD EXPERIENCE AND TACTICS OF UNMANNED AERIAL VEHICLE COMBAT APPLICATION DURING THE ANTI-TERRORIST OPERATION (2014–2018)

The combat experience gained by military units and formations of the Armed Forces of Ukraine in the anti-terrorist operation still attracts attention and requires in-depth study. The article provides a retrospective analysis of the use of unmanned aerial vehicles in past wars and armed conflicts. In addition, the author attempts to analyze the tactics of using robotic technology in the Armed Forces of Ukraine during the conduct of the anti-terrorist operation. The main factors influencing changes in the tactics of using Ukrainian unmanned aerial vehicles are considered.

Keywords: *anti-terrorist operation, unmanned aerial vehicle, war, drone, Armed Forces of Ukraine, armed conflict.*

Formulation of the problem. The undeclared attack by the Russian Federation on Ukraine in 2014, the occupation of Crimea, and the outbreak of hostilities in the east of our country in April 2014 became a tangible reality. Russian aggression in the form of the so-called «hybrid war» proved to be a severe test of combat readiness for the Armed Forces of Ukraine. Primarily because for over thirty years, the national armed forces did not have combat experience, except for some relatively small units used as part of peacekeeping contingents. Furthermore, the constant reduction of troops, especially combat units, and the criminal activities of certain politicians and military leaders had a negative impact on the combat capabilities of military units and formations. This primarily applies to the Ground Forces of the Armed Forces of Ukraine, which bore the brunt of the Russian occupation forces in 2014.

At the beginning of the anti-terrorist operation, the state of the main branch of the Armed Forces of Ukraine was characterized by a low level of training of personnel, predominantly outdated weaponry and military equipment, the absence of an effective system for their repair and restoration, and so on.

This prompted the search for new forms and methods of effectively responding to territorial encroachments by the Russian Federation and providing an asymmetric response to the aggressor.

One of the prominent examples of using new combat techniques, in the author's opinion, is the use of unmanned aerial vehicles during the Russian-Ukrainian armed conflict. A thorough analysis of the experience of using robotic technology by the Ground Forces of the Armed Forces of Ukraine during the conduct of the anti-terrorist operation could be the key to victory over the superior forces of the enemy.

Historiography. After the large-scale invasion of the Russian Federation into Ukraine in February 2022, the question of the tactics of military units and formations of the Armed Forces of Ukraine in countering Russian armed aggression during the conduct of the anti-terrorist operation has once again attracted attention. The scientific community's interest lies primarily in studying the latest methods of asymmetric warfare.

At present, there are many works related to research in the field of unmanned technologies. It is worth noting the significant scientific contribution

of Ukrainian military researchers, including A. Volkov, K. Ivakhnenko, S. Korsunov, H. Levaghin, O. Lezik, and O. Yanovsky, who explored the main issues of using unmanned aerial vehicles in the Armenian-Azerbaijani armed conflict (Volkov, A.F., Ivakhnenko, K.V., Korsunov, S.I., Levaghin, G.A., Lezik, O.V. & Yanovsky, O.V. 2020, pp. 7–17). Furthermore, A. Volkov and S. Korsunov, together with V. Gurtovenko, M. Oboronov, S. Orehov, and S. Fedchenko, considered the transformation of unmanned aviation tasks in modern military conflicts (Volkov, A.F., Gurtovenko, V.V., Korsunov, S.I., Oboronov, M.I., Orehov, S.V. & Fedchenko, S.I. 2021, pp. 66–81). However, these works examine the use of drones in the context of increasing the effectiveness of the Air Defense units (hereinafter — AD).

At the same time, researchers from the National Defense University of Ukraine, O. Olexenko, O. Avramenko, A. Fedorov, V. Snitsarenko, and O. Chernavina, conducted significant work on studying and summarizing the experience of using unmanned aerial vehicles by the armed forces of the Russian Federation during the large-scale invasion of the territory of Ukraine. Although the work mainly concerns the years 2022–2023, the authors also address the issue of drone usage during the First and Second Chechen Wars (1994–1996 and 1999–2003), military operations in Georgia in 2008, and Syria during the period of 2015–2017, as well as in eastern Ukraine starting from 2014 (Olexenko, O.O., Avramenko, O.V., Fedorov, A.V., Snitsarenko, V.V & Chernavina, O.Ye. 2022, pp. 37–42).

Researchers O. Koshets and V. Horbenko studied directly the methods and specifics of unmanned aerial vehicles' actions by the armed forces of the Russian Federation and the unmanned aviation of the Armed Forces of Ukraine. They conducted a comparative analysis of the methods of application, tactical techniques, and capabilities of unmanned aviation complexes based on the experience of local wars and armed conflicts, as well as in the conditions of the Russian-Ukrainian war since 2014. The problematic issues of combating enemy unmanned aerial vehicles are also highlighted (Korshets, O.A. & Horbenko, V.M. 2023, pp. 9–17).

The experience of using unmanned aerial systems was also studied by researchers at the National Academy of the National Guard of Ukraine. In particular, O. Holovan and K. Hrydina investigated the prospective directions of drone usage by the law enforcement units of our state and foreign countries to determine the expediency of their application during the performance of special tasks (Holovan, O.M. &

Hrydina, K.O. 2023, pp. 146–149). Although their work only touches on the issues of using unmanned aerial vehicles during the repulsion of Russian aggression, they can be interesting in terms of studying the strategic directions of forming and implementing state policy in the military sphere, defense, and military construction.

Among the Russian researchers of aerial technologies, we can identify S. Ganin, O. Karpenko, V. Kolnogorov, and G. Petrov (Ganin, S.M., Karpenko, A.V., Kolnogorov, V.V., & Petrov, G.F. 1999, 176 p.). Of course, the authors overlook the experience of using unmanned aerial vehicles during the anti-terrorist operation of the Armed Forces of Ukraine. However, they meticulously analyzed the experience of using drones during the hostilities between Armenia and Azerbaijan in Nagorno-Karabakh. Particularly interesting for us could be the examples of the destruction of the Armenian air defense systems, which were supplied by the Russian Federation.

Among Western authors, Martin Dogerty should be noted, who in his work «Drones: the first illustrated guide to UAVs» considers the history of creation and evolution of unmanned aerial vehicles, demonstrating the basic principles of their operation, tactics of use in combat, and prospective directions of their improvement (Martin Dogerty. 2017, 224 p.).

Simultaneously, Ulrike Franke researched the use of unmanned aerial vehicles in the Russian-Ukrainian armed conflict. In her publication, she emphasizes that the most intensive use of drones occurred during the hostilities in Ukraine, marking a change in tactics and technologies in modern warfare. In her view, the most natural use of drones is for observation and reconnaissance. Although she considers the time period from 2022 to the present, her publication identifies the main trends in the use of unmanned aerial vehicles in modern wars and armed conflicts (Ulrike Franke. 2023).

However, it should be noted that changes in attitudes towards the use of unmanned aerial vehicles by the Armed Forces of Ukraine from 2014 to 2018 were practically not studied by foreign authors.

The purpose of the article is to identify the essence of the transformation of world experience in tactics of combat application of unmanned aerial vehicles under the influence of the experience of the participation of the Armed Forces of Ukraine in the anti-terrorist operation in the Eastern part of the country during the period 2014–2018.

Main results of research. According to the definition approved by the Assembly of the International Civil Aviation Organization (ICAO), "an unmanned aerial vehicle (drone) is an aircraft without a pilot on board that is maneuvered either by remote control from the ground, onboard another aircraft, spacecraft, or it operates autonomously under programmed instructions".

However, unmanned aerial vehicles (UAVs) did not appear suddenly and unexpectedly. Even during the First World War, experiments were conducted by participating countries to create aircraft that could be controlled without a pilot. Between 1915 and 1918, the company "Siemens & Halske", commissioned by the Military Department of Germany, produced over 100 remotely controlled gliders capable of carrying torpedoes or bomb payloads of up to 1000 kg. In 1916, in the United States, the "Dayton-Wright" company developed the "Kettering Bug", a clockwork-controlled "kamikaze aircraft" designed to destroy enemy positions (Unmanned Aerial Vehicle. 2023). However, these were practically not utilized, despite the strong interest in the development of UAVs, especially during the transition to "trench warfare".

The end of the war did not halt the development of UAVs. In the 1920s, the military and political leadership of leading countries, particularly the United Kingdom and the United States, recognized that combat aviation could pose a significant threat to their military and naval fleets. Therefore, in 1933, the first multi-use UAV-target, the "Queen Bee", was developed in the UK. Three years later, captain 3 rank Delmar Farney, who headed the radio-controlled aviation project for the US Navy, introduced the term "drone" for the first time as an alternative to the term "UAV". This term referred to an unmanned flying target used in the training of the US Navy in 1938.

It is worth noting that experiments were also conducted in the Soviet Union from 1930 to 1940 to develop a "special purpose glider" that could be launched from the heavy bomber TB-3 and carry an one torpedo.

During the Second World War, both sides continued the development and production of UAVs. It is known that the first successful mission of the US Navy's UAV "TDR-1" was the attack on the Japanese merchant ship "Yamazuki Maru", which took place at the end of the war on July 30, 1944. In the USSR during the war, experiments in the field of UAVs were definitively terminated after the unsuccessful use of the experimental remote-controlled bomber TB-3 in 1942. However, they did not receive mass implementation. German scientists also developed UAVs, namely gliding bombs "Henschel Hs 293",

Drawing 1. "V-1 model in the Peenemünde museum"

"Fritz X", and rockets "V-1", "V-2". The latter were even used against Britain from the end of 1944 to the beginning of 1945. Each Faust-1 contained over 600 kg of explosives and could cause significant damage. However, since it was unguided weaponry, it rarely hit specific targets (Cliff Lethbridge, History of Rocketry. 2023). Therefore, out of 10,500 rockets launched at London, only 2,419 reached their target.

Gradually, the interest in UAVs took a back seat compared to research in missile technology and nuclear weapons. It was only in 1960, during the escalation of the so-called "Cold War" period, that due to a series of mistakes and related political incidents, the US leadership was forced to pay attention to the development of reconnaissance drones. At the same time, to combat Soviet strategic submarines, the "Gyrodyne QH-50 DASH" helicopter-UAV was developed, equipped with Mark-44 torpedoes or Mark-17 depth charges (Unmanned Aerial Vehicle, 2023).

UAVs began to be widely used in the US war against Vietnam, in the Middle East during the Arab-Israeli wars of 1967–1970 and 1973, and then during the Persian Gulf War in the 1990s. Furthermore, UAVs were successfully used by UN forces in the Kosovo War (1999), in Afghanistan (2001), and during the Iraq War (2003). In the Russian Federation, until the Russian-Georgian war of 2008, sufficient attention was not given to the development of UAVs. The significant use of UAVs in the post-Soviet space was observed in 2020 during the Second Nagorno-Karabakh War.

Thus, despite numerous developments in previous years, UAVs only became widely used at the end of the 20th and beginning of the 21st centuries. In the author's opinion, this was first due to the lack of necessary technologies for their mass production at that time, and second, due to the significant cost and time required for their creation. In 2008, during the war in Georgia, the military command of the armed forces of the Russian Federation understood the significance of UAVs. They also realized how their UAVs were inferior to the Georgian systems purchased in Israel. In order to quickly restore parity, the Russian Federation purchased a batch of Israeli drones, including the Bird Eye 400 and Searcher Mk II (Briefly about the main Russian UAVs. 2020), and also began production of its own UAV models.

In the lead-up to the invasion of Ukraine, the following types of UAVs were adopted by the armed forces of the Russian Federation: "Granat", "Zastava", "Leer", "Orlan-10", and "Forpost". Their technical characteristics are provided in the table (*Table 1*).

Table 1. **Technical Characteristics of UAVs produced by the Russian Federation**

UAV name	Flight duration, h	Operating radius, km	Mass, kg		Practical ceiling, м	Maximum flight speed, km/h	Engine type
			maximum take off weight	payload weight			
"Granat"	1,2	25	4	1,1	3500	100	electric
"Zastava"	1	10	5	1,2	3000	110	electric
"Leer"	1,5	20	3,8	1,3	4000	80	electric
" Orlan-10"	1	10, 15, 25	4	1	3500	60	electric
"Forpost"	16	600	14	3	7000	150	gasoline

At the same time, the UAV complexes "Orlan-10", "Zastava", "Granat", and "Leer" were used as part of the reconnaissance and special units of the 58th Army of the Southern Military District of the Armed Forces of the Russian Federation. In 2014, the first unit of the "Forpost" UAV was formed in the Pacific Fleet (Unmanned Aerial Vehicle, 2023). UAV units were actively used to assess the effectiveness of targeting and to adjust the fire of artillery and tank units, as well as for reconnaissance purposes during tactical exercises in 2013–2014. Moreover, unlike the Armed Forces of Ukraine, the Russian military already had some combat experience in using UAVs.

At the same time, as of 2014, the Armed Forces of Ukraine did not have established production of their own drones, nor did they have training centers

for UAV operators. Even the unmanned aerial vehicles used by the Ukrainian side were mostly represented by civilian tactical mini-UAVs such as the DJI Mavic or DJI Spark, purchased by volunteers, which had relatively short operational ranges and were used in tactical zones, or reconnaissance UAVs of Soviet production with turbojet engines like "Stryzh" and "Reys", which could conduct reconnaissance up to 60–70 km (Briefly about the main Russian UAVs. 2020). However, they were morally obsolete, as the equipment used for gathering information required a significant amount of time for decryption, during which the obtained information lost its relevance, therefore making their aerial reconnaissance missions inefficient. Unfortunately, this situation persisted practically until 2022.

Therefore, it can be stated that in 2014, for a number of reasons, Ukraine was not prepared to effectively resist the aggression from the Russian Federation. Firstly, this was due to the extremely low level of domestic defense potential and its low quality, including in the sphere of construction and use of UAVs, and secondly, due to the lack of combat experience among the personnel of the Armed Forces of Ukraine in comparison with units of Russian occupation forces and military formations such as private military companies "Wagner", "Redoubt", and others.

At the beginning of the anti-terrorist operation, the unmanned aviation of both opposing sides was primarily used for aerial reconnaissance tasks and adjusting artillery fire in the struggle for fire superiority in battle (Korshets, O.A. & Horbenko, V.M. 2023, p. 9). This was primarily due to the widespread use of artillery and aviation in the theater of military operations, which relegated UAVs to a secondary role. Therefore, the enemy's advantage in the use of UAVs was not so critical as to pose a threat to Ukraine on the battlefield. However, already in 2015, after the signing of the "Second Minsk Agreement", which required the withdrawal of heavy artillery and imposed a ban on the use of combat aviation, the situation with the use of drones gradually began to change, but the tactics of their use did not undergo fundamental changes.

The enemy, attacking in various areas and directions, aimed to identify weak spots in the defense of the units of the Armed Forces of Ukraine, significantly increased the use of reconnaissance UAVs[1]. At the same time, they most often used them in pairs for more reliable

control of their units. The acquisition of an armed conflict in the years 2016–2018 of a positional nature only continued the trend of using UAVs as scouts and fire adjusters. During the period of 2016–2018, the role of reconnaissance units increased, which more frequently began to use unmanned aviation to perform their tasks[2]. Starting from 2016, in each brigade (regiment) of the armed forces of the Russian Federation, the formation of UAV platoons began[3]. At the same time, there was an increased use of enemy electronic warfare assets at the battalion level to suppress the control channels of Ukrainian UAVs.

In this context, it should be noted that although UAVs are relatively easy targets because they usually cannot evade air defense systems and are vulnerable to electronic warfare, combating drones remains challenging. Intercepting UAVs requires advanced electronic equipment and trained operators, while shooting them down with missiles is financially costly. The use of other means to destroy enemy UAVs also poses low feasibility.

When using the MANPADS "Stinger" against the "Orlan-10" type UAV, which was most frequently used by Russian units, its low effectiveness was noted. Additionally, when using outdated MANPADS «Igla» (manufactured in 1985), no launches were observed at all due to technical malfunctions. The use of the SAM "Strela-10" was ineffective due to poor air space observation from the operator's position, and the ZSU-23-2 was also ineffective due to its short range. The use of the "Tunguska" ADMS was ineffective due to its short detection range and active electromagnetic emission, making it a primary target for the enemy.

This prompted the Armed Forces of Ukraine to take adequate action. Therefore, starting in 2015, there was a focus on increasing the number of reconnaissance drones used by Ukrainian units. Almost all battalion-level units began to receive UAVs such as "Furiia", "Leleka", PD-1, and others, significantly enhancing their reconnaissance capabilities.

Conclusions. The Russian-Ukrainian armed conflict in 2014 was not the first in which UAVs played an important role, and not the first in which both warring sides used them. However, never before had so many unmanned aerial vehicles

[1] HDA MOU. F. №516. Op. А4П(с)-16. Spr. 9 (Donesennia). Ark.118

[2] HDA MOU. F. №516. Op. А4П(с)-16. Spr. 18 (Donesennia). Ark.3

[3] HDA MOU. F. №516. Op. А4П(с)-16. Spr. 18 (Donesennia). Ark.2

been used in a military confrontation as during the conduct of the anti-terrorist operation. Moreover, the diversity lay not only in the design features and technical characteristics of the drones but also in the scope of their use — from reconnaissance drones to combat drones. It should also be added that it was during the fighting in Ukraine that a visible transformation of views on the tactics of using UAVs took place.

At the beginning of the anti-terrorist operation, the most natural use of drones was for observation and reconnaissance. Practically all UAVs were equipped with photo, video, and other data collection sensors, allowing Ukrainian units to determine the location of enemy military bases, observe troop movements, document attacks, and adjust artillery fire. However, as combat experience accumulated, changes in the military leadership's views on the use of drones in combat operations occurred. Starting from the end of 2017, drones began to be used to assist in targeting and directly conducting strikes. However, the widespread use of UAVs as combat drones occurred much later — during the large-scale invasion of Russian occupation forces into Ukrainian territory.

Thus, during the conduct of the anti-terrorist operation, changes occurred in the military leadership's views on the use of UAVs in modern combat conditions, placing them at the forefront of the battle. Gradually, from reconnaissance and guidance roles, UAVs transformed into a powerful striking force, vividly demonstrating further developments in 2022.

Unfortunately, unmanned aviation in the Armed Forces of Ukraine is not sufficiently developed as of today. Therefore, the development of new technologies in the field of UAVs and the training of highly qualified personnel to ensure the proper execution of combat tasks of varying complexity is a top priority. At the same time, equipping the power structures of Ukraine with unmanned aerial complexes will significantly impact the execution of complex tasks in the combat zone and greatly reduce the level of human casualties.

Currently, as the use of UAVs becomes a separate area of activity for troops in modern warfare and armed conflicts, the author considers it appropriate to focus efforts on a series of organizational measures. Specifically:

- form UAV units within each military unit up to the company level (including separate platoons);
- provide more attention to the training of operators and junior commanders in reconnaissance and fire management (adjusting the fire of artillery units) using UAVs;
- incorporate UAV utilization into the training program of every serviceman of the Armed Forces of Ukraine, including in combat conditions;
- arrange the supply of combat and reconnaissance drones to all combat units of the Armed Forces of Ukraine.

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ТРАНСФОРМАЦІЯ СВІТОВОГО ДОСВІДУ ТАКТИКИ БОЙОВОГО ЗАСТОСУВАННЯ БЕЗПІЛОТНОЇ АВІАЦІЇ У ХОДІ АНТИТЕРОРИСТИЧНОЇ ОПЕРАЦІЇ (2014–2018 рр.)

Стаття присвячена теоретичним та практичним аспектам дослідження застосування безпілотних літальних апаратів у сучасних війнах та збройних конфліктах, зокрема в антитерористичній операції 2014–2018 років. На основі аналізу різних документів та архівних матеріалів виявлено головні тактичні прийоми використання дронів та розглянуто трансформацію поглядів на їх застосування під час ведення бойових дій.

Зроблено висновок, що, незважаючи на достатню кількість праць, присвячених боротьбі з БпЛА, дослідження саме досвіду застосування БпЛА в українській історичній науці має певні наукові прогалини.

У ході проведеного дослідження встановлено, що у сучасних реаліях сфера використання БпЛА не є достатньо розвиненою, оскільки в Україні відсутні новітні технології із виготовлення роботизованої техніки, ще не налагоджене їх масоване виробництво та, водночас, недостатньо уваги приділяється питанням підготовки висококваліфікованих кадрів. Поруч із цим, автори спробували проаналізувати трансформацію поглядів на використання БпЛА у війнах і збройних конфліктах, зокрема під час проведення антитерористичної операції, а також розглянули основні чинники, що впливали на зміни у тактиці застосування безпілотної авіації. Надано пропозиції щодо низки організаційних заходів, спрямованих на збільшення частки застосування роботизованої техніки, насамперед БпЛА, та покращення їх вражаючих здібностей при відсічі російської збройної агресії.

Ключові слова: *антитерористична операція, безпілотний літальний апарат, війна, дрон, Збройні Сили України, збройний конфлікт.*