Oleh REZNIK,
PhD in Psychology, Associate Professor,
Firearms Training Department,
Bohdan Khmelnytskyi National Academy
of the State Border Guard Service of Ukraine,
Khmelnytskyi, Ukraine

https://orcid.org/0000-0001-7630-7509
e-mail: aleg05021982@gmail.com

Oleh KUSTYNSKY,
Senior lecturer,
General Military Training Department,
Bohdan Khmelnytskyi National Academy
of the State Border Guard Service of Ukraine,
Khmelnytskyi, Ukraine

https://orcid.org/0000-0001-7403-5423
e-mail: kustos@ukr.net

Petro HORPYNYCH,
Senior lecturer,
Firearms Training Department,
Bohdan Khmelnytskyi National Academy
of the State Border Guard Service of Ukraine
Khmelnytskyi, Ukraine

https://orcid.org/0000-0001-6621-8289
e-mail: gorpynychpetro@gmail.com

Volodymyr ALEKSANDROVYCH,
Holder of the third (educational and scientific) level of higher education,
in the specialty "011 — Educational, pedagogical sciences",
Ternopil Volodymyr Hnatiuk National Pedagogical University ,
Ternopil, Ukraine

https://orcid.org/0009-0002-3794-354X
e-mail: aleksandrovichvv@ukr.net

ANALYSIS OF EXPERIENCE OF USING SMALL UAVs IN THE BATTLEFIELD: TRAINING ENHANCEMENT PERSPECTIVES

The article analyzes the experience of the State Border Guard Service units to fight russian occupying forces inflicting the fire damage with the help of small UAVs and describes the ways to use the acquired experience to develop a training course for the border guard UAV operators. The authors state that nowadays, in the conditions of the of full-scale invasion to Ukraine, active using of unmanned aerial vehicles (hereinafter — UAVs) proved their ability to perform combat tasks, making them one of the new and effective types of weapons in modern military conflicts. It is impossible to imagine a contemporary army without UAVs, as today they perform multiple roles: adjusting artillery fire, pointing and tracking targets, transmitting intelligence information to the headquarters, delivering fire strikes, and most importantly — they can help save the lives of soldiers. Analysis of a year and a half term of full-scale invasion to Ukraine showed that the use of UAVs is several times more effective than the use of traditional types of weapons. In the first days of the war, a huge number of the russian battalion tactical groups (hereinafter — BTGs) were concentrated on the borders of Ukraine, and that significantly outweighed the forces and means of military formations of Ukraine. Analysis also proves that the main striking force during the offensive, according to the governing documents, were armored fighting vehicles, infantry fighting vehicles, amphibious assault vehicles, armored personnel carriers. And it was possible to stop enemy columns only with the help of artillery, aviation, and anti-tank missile systems. Therefore, in modern conditions, it is necessary to create fire damage to enemy armored vehicle groups with the help of attack UAVs of the border guard units. The article considers the effectiveness of such a unit, taking into account the tasks, organizational structure, forces and means necessary to respond to modern challenges and threats on the state border. The authors used the acquired experience of the Border Guard units to develop a training course for the UAV operators of the border guard units. The developers of the course took into account the combat experience and the best European practices in UAV operators training. The learning strategy of the course is based on a student-centred learning approach. It is designed to provide learners with theoretical knowledge and practical skills on the operators of the UAV crews deployed in border surveillance and combat operations. The course is divided in three phases: Independent Learning Phase (online), Contact Learning Phase (offline) and Experiential Learning Phase (at the border guard units).

Keywords: *border guard unit, unmanned aerial vehicles, anti-tank vehicle, professional training.*

Problem statement

An analysis of combat operations during the eight months of Ukraine's war with the russian federation showed that, both in the first days and later, the enemy widely used armored combat vehicles. Units of the State Border Guard Service of Ukraine (hereinafter — *SBGSU*), repelling the first blow, were forced to retreat due to the significant advantage of the enemy, both in personnel and tanks, armored fighting vehicles (hereinafter — *AFV*), and armored personnel carriers. Taking into account the available anti-tank weapons, which are in service with the border guard division, we can conclude that their number must be increased for the high-quality performance of combat missions.

Successful execution of combat and operational-service tasks by units of the SBGSU is impossible without appropriate knowledge of the tactics of actions, tactical and technical characteristics of the enemy's AFV, without studying the experience of forms and methods of combating armored objects and hence — effective professional training system of the required specialists. Using the comparative-historical method, we obtain such data that make it possible to synthesize proposals regarding the tactics of actions of border units when performing combat tasks. The comparative-historical method, as a method of research, makes it possible to establish by comparison the similarities and differences between the historical phenomena being studied, to obtain the maximum result of the study of the issue considered in this article (Katerynchuk et al., 2018).

In the future, we hope to obtain the results necessary to elaborate proposals for changes in the organizational structure of the border guard units and enhance the training system of the border guard UAV operators in order to create units that will effectively destroy enemy forces and means with the help of small unmanned aerial vehicles.

Analysis of recent research and publications

In the conditions of war and violation of the territorial integrity of Ukraine, sufficient attention nowadays is paid in the scientific literature to various forms, methods of conducting armed combat and ensuring military security of Ukraine (Reznik et al., 2020). It is especially important to study the experience of using UAVs.

With the beginning of the armed aggression of Ukraine in 2014, the SBGSU created new structural units named Rapid Response Border Command Post (hereinafter — *RRBCP*), and with the beginning of full-scale military aggression — Military Support Divisions (hereinafter — *MSD*), one of the main tasks of which is to participate in prevention of armed conflicts and other provocations on the state border of Ukraine in cooperation with units of the Armed Forces of Ukraine, relevant law enforcement agencies, and in repelling an invasion or attack on the territory of Ukraine by the armed forces of another state or group of states (Voronko et al., 2020; Hlotov et al., 2017). To combat tanks and AFVs, these units include an anti-tank unit, which, according to its combat capabilities in combating armored objects in modern conditions, should have additional anti-tank section, in which it is advisable to have modern anti-tank guided missile defense systems, and attack or FPV (First Person View) UAVs to perform the required combat tasks in the battlefield.

The purpose of the article is to analyze the experience of the State Border Guard Service units to fight russian occupying forces inflicting the fire damage with the help of small UAVs and use the acquired experience to develop a training course for the border guard UAV operators.

Research Results

At the moment, there are units within border guard command posts that are armed with unmanned aerial vehicles. They perform only the function of reconnaissance and targeting. Combat operations during the full-scale military aggression of the russian federation against Ukraine demonstrated the need not only to use UAVs on the battlefield to adjust artillery fire and gather intelligence, but also to use attack drones capable of hitting the enemy's armored vehicles and manpower.

The first stage of Ukraine's war with russia showed what a great impact the use of modern drones has in combat, both for reconnaissance, and for firing strikes using combat drones and other attack unmanned aerial vehicles. The effectiveness of the use of such UAVs as "Bayraktar" was proven by a significant number of destroyed enemy tanks and anti-aircraft missiles.

At the moment, units of the Armed Forces of Ukraine (hereinafter referred to as the AFU) have a significant number of UAVs that are used in combat operations. The russian occupiers note this fact, which is confirmed by radio intercepts of their conversations by the main intelligence department of the AFU (Krytskyi et al., 2021). At the moment, the SBGSU continues to increase the number of UAVs for combat missions. First of all, the drones are supplied to the units engaged in combat with the enemy. It is necessary to plan the creation and use of a full-time UAV unit to perform operational combat tasks both during the war and after our victory (Katerynchuk et al., 2021). In order to calculate the forces and means of the anti-tank unit of the SBGSU, we need to consider the possible actions of the enemy. In modern conditions, the invading troops operate as part of the BTG. This unit does not have a permanent staff structure. It is formed depending on the units' tasks. As a rule, a tank BTG is created for the offensive, and a motorized infantry BTG — for operations in the depth of the enemy's defenses and in the defense (Katerynchuk et al., 2021).

It is necessary to take into account that the russian formation must conduct an offensive, and to compensate for losses, it will keep in reserve 30–40 % of tanks. It should also be taken into account that usually a combined military regiment is staffed by contract personnel, as well as the best and serviceable fighting vehicles (Zgurets, 2022).

In the course of hostilities, an analysis of the tactics of the BTG actions was carried out. The strengths of russian BTG are:

• the organization of the BTG is adapted to the offensive, subordinated to the rapid achievement of advantages in battle and the purpose of the operation;

• the relatively small size of the BTG ensures high mobility in the absence of a continuous front line, gaps in the defense and the presence of a network of roads;

• high effectiveness of BTG in case of positional defense of the enemy, thanks to the possibility of concentrating support fire.

Weaknesses of russian BTG:

• a relatively small number of infantry units in the BTG, which does not allow effective protection of the flanks and the rear area;

• low effectiveness of BTG in the maneuverable defense of dispersed groups and in actions in the city;

• high sensitivity of BTG to losses, as a result of which it quickly loses;

• effectiveness due to a decrease in combat potential (which requires its restoration);

• the difficulty of managing a large number of BTG units, a small battalion headquarters, albeit reinforced;

• a small number of BMPs in some tank BTG from tank regiments, which does not allow to protect tanks from infantry with RPGs on the march and in battle;

• the presence in most of the newly created BTG of outdated anti-tank weapons or AFV with weaker armor (Yarovy, 2022).

In the course of hostilities against the Border Guard Service Division, as a rule, is involved a company tactical group (hereinafter — *CTGr*), consisting of 1 motorized infantry company, up to 2 tank platoons, an artillery division, anti-tank, anti-aircraft units, combat and rear support groups. So, to stop the advance of the CTGr, the border guard unit needs to destroy or disable up to 3 tanks and 7 AFVs.

For further research, it is advisable to use the experience of combating AFVs in modern conditions with the help of UAVs.

In recent years, the world has been actively developing and using unmanned aerial attack systems, which are capable of effectively hitting enemy ground targets. The world's leading countries and economies are actively working in this direction (see *Table 1*).

Ukraine is not far behind and is also in the flow of modern trends regarding using different types of UAVs (Bursala et al., 2019). A number of modern strike drones have been created in the country, both in cooperation and independently.

After the full-scale invasion of russia, as part of international aid from the governments of the USA and EU countries, Ukraine received various types of UAVs, including kamikaze drones.

Table 1

COMPARATIVE CHARACTERISTICS OF UAVS

Characteristics	UAVs				
	Furiia	AQ 400 Scythe	Cobra	Leleka	RAM II UAV
Country of production	Ukraine	Ukraine	Ukraine	Ukraine	Ukraine
Type	reconnaissance	kamikaze drones	kamikaze drones	reconnaissance	kamikaze drones
Weight, kg	5,5	100	up to 40	5	8
Operating range, km	up to 200	up to 750	up to 300	100	up to 30
Flight duration, min.	up to 180	up to 210	up to 180	90–240	55
Cruising speed, km/h.	65, мах. 130	144	150	60–70, мах. 120	70
Weight of the warhead, kg	–	32	12	–	3
Practical ceiling (m)	2500	–	–	1500	–

In particular, in the beginning of the war, Phoenix Ghost kamikaze drones arrived in Ukraine as part of a package of military aid from the United States. Ukraine received more than 120 of such drones. It is known that they belong to the category of barrage munitions, that is, kamikaze drones. Unmanned aerial systems, depending on the technology, can cost tens or millions of dollars and these kamikaze drones are still cheaper than the possible targets for them (Bilous, 2016).

The next drone, that is capable of performing border guard tasks in the battlefield is the RAM UAV which can destroy ground (surface) armored targets and air defense systems. Technically, the UAV is

equipped with a multi-purpose warhead, which, when a target is detected, can neutralize it with a direct hit (Yarovy, 2022).

UAV A1-S Furia is a multi-purpose unmanned aerial vehicle designed for day and night aerial reconnaissance, determination of target coordinates, adjustment of artillery fire, convoying.

Leleka-100 (Ciconia) is a Ukrainian unmanned aerial vehicle designed for reconnaissance. The UAV is equipped with special anti-EW system DeViRo, which automatically recognizes the environment of intentional blocking of GPS/GLONASS signaling; launch: manual or from catapult (Mykytiuk, 2018)

The company Terminal Autonomy provided the Defense Forces of Ukraine with a batch of long-range kamikaze drones called AQ 400 Scythe. The range of the AQ 400 Scythe is declared as about 750 km, which allows, under the condition of production of hundreds of drones per month, to regularly strike targets on the territory of the russian federation.

The Ukrainian drone «Cobra» with a cost of only $2,000 is a short- and medium-range drone (up to 300 km) cannot be used at the conditions of a battlefield, because there is a high density of electronic warfare systems, but can be effectively utilized for strikes on the enemy's close rear areas.

In our opinion, the following models are the most promising UAVs of Ukrainian production to be used by the SBGSU. The unmanned ST-35 «Grim» complex of the private enterprise Athlon-Avia can hit targets in closed positions and can be used by various combat units. Types of combat units - thermobaric, cumulative, high-explosive fragmentation.

Summarizing considered UAV systems used by the border guard units, the following conclusions can be drawn:

The vertical take-off copter can be used to perform tasks of the State Border Guard Service, such as surveillance, quick survey of the area, tracking of a certain object, at speeds up to 50 km/h. Devices of this type are suitable for short, fast flights, in good weather conditions and good visibility, during the day, when the wind speed reaches about 10 m/s. The quality of their day camera is very good, which provides an excellent overview of the area in "search" tasks.

The wing-type UAV is suitable for performing all border guard tasks (surveying the terrain, tracking objects, flying over water, border patrolling in the border zone) in day and night conditions. The flight height above the ground level can reach 400 m. The UAV can fly with a considerable wind speed and the flight time can reach 90 minutes. The day and night sensor allows you to perfectly track the location, recognize objects, and identify them in real time on the monitor. The operator requires more complex training to start using the UAV. Both pre-flight training, flight planning, and the flight itself are more complex than flying on helicopter-type aircraft. This

type of UAV can be used to carry out tasks of the State Border Guard Service, such as: patrolling, searching, tracking, these types of aircraft bring quite effectively. Each device, depending on its type: a copter or a fixed-wing UAV, has its own advantages.

These UAV devices should become a key type of technical means of the units dislocated both at the front and along other state border sectors in order to strengthen border control and perform combat missions. They allow to save resources and speed up the response to signals. UAVs can also be used as preventive measures to prevent future border violations.

Speaking about the reorganization of the border guard units for performing combat tasks, we think the anti-tank unit of the border guard division and should have up to 13 personnel, 3 small UAVs, 3 vehicles, which makes it possible to destroy up to 9 enemy tanks and AFVs with one drone launch. For RRBCP, it is desirable to have at least three of the above-mentioned units in its organizational structure. Destroying so many armored objects of the enemy will force it to stop its actions for a while. Which, in turn, gives the border guard division and the RRBCP an opportunity to regroup for further combat missions.

The new organizational structures within the SBGSU require additional specific training for the UAV border guard operators. So, over the past two years, different types of UAVs, including the First-Person View drones have become one of the key factors on the battlefield in the war between russia and Ukraine. This technology is constantly progressing and scaling. Therefore, the training of bord guard UAV operators appeared among the new training programs in the border guard agency.

Training courses in the border guard educational institutions are organized in two stages. Everything starts with a theoretical course, followed by work on special simulators that simulate the flight of the UAV. When the first stage is completed, the border guards move on to practical training in the field.

Practical flights are the main task for future drone pilots before starting combat missions. During the flight, the operator must perform certain exercises and hit a conditional target. The drone is controlled using a remote control and special glasses that provide the pilot with images from the drone's camera in real time. Among the main advantages of this drone is its relatively low cost, although one such UAV can be used by the border guards to destroy a tank or other equipment worth several million. Therefore, the modern drones can also be used as kamikaze drones, but they can still be engaged for reconnaissance and drop tasks.

In order to use a UAV, a border guard must be trained as a UAV operator, know the capabilities of the aircraft and use them when performing the assigned tasks. The skills of the operator must be

recognized and known to the head of the unit in order to correctly formulate and set tasks for the border guards, foresee their interaction, ensure the collection and transfer of information to the management of the SBGSU division and other structural units.

When going to the combat mission, the border guard UAV operator have to know the following mission properties (Katerynchuk et al., 2021):

1. Tasks for the mission.
2. The amount of time allocated to the task.
3. Type of aircraft used in the mission.
4. Aircraft capabilities (flight time in the air, distance from the operator, sensors, the ability to transmit a video signal).
5. Place of flight (near the state border, mountainous or forested area).
6. Meteorological conditions.
7. How information can be transferred to other border guards and the initiator of the task.

Therefore, based on the analysis of combat missions and best world practices in the field, a typical program of the basic UAV operator training course conducted at the border guard departmental training institutions includes the following topics (modules):

1. General provisions of UAV flights organization.
2. Key components and standard operating procedures of UAV missions.
3. Repairing and maintenance of UAVs. Pre-flight and post-flight checks.
4. Typical UAV malfunctions.
5. Meteorology and aerodynamics.
6. Working with digital cards.
7. UAV software.
8. Procedure for processing, transfer and storage of air monitoring materials (registration, flight reports).
9. Training using flight simulator.
10. Training flights in the daytime.
11. Training flights using the target load in the daytime.
12. Training flights at night.
13. Training flights using the target load in the daytime.
14. Assessment session.

The aim of the UAV operator training course is to enhance the capacity for interoperability of the border guard UAV crew members in border surveillance and establish common training standards, thereby strengthening the opportunities for operational cooperation between units.

Each UAV operator employs a range of technics, tactics and procedures of the air crew operations and it is necessary that all crew members, regardless of their professional role can recognize and adapt their individual contribution to the implementation of the mission. Further, the course aims to enable an appreciation of different operational approaches employed across the border guard units and thus contribute to the development of good practice.

Learning strategy is based on a student-centred learning approach. The course is designed to provide learners with theoretical knowledge and practical skills on the common operational activities carried out by UAV crew members deployed in border surveillance operations.

The course is divided in three phases: Independent Learning Phase (online), Contact Learning Phase (offline) and Experiential Learning Phase (at the border guard units).

At the beginning of the independent learning phase all learners will be requested to successfully complete the Basic on-line pre-deployment training for UAV crew members, which is a basic pre-deployment training for all members of the Border Guard units, accessible via Moodle based Learning Platform. Only at the end of the independent learning phasee learners will have access to the specifics of UAV crew preparation for border surveillance operations.

During ILP learners are expected to dedicate at least 40 hours for independent study of learning material related to border surveillance functions (legal documents, synopsis, videos, case studies, etc.) which can be found in Moodle platform. The ILP is interactive and continuously facilitated by the trainers, allowing learners to clarify and ask questions to the trainers before the CLP starts. ILP must be successfully completed prior to the admission to the CLP by passing an evaluation.

The contact phase is carried out in or at a short distance from an airport, using the available equipment in theoretical and practical exercises. As an added value, a Rescue Coordination Centre in the vicinity and the availability of mission simulators should be available. The purpose of the CLP is to further strength the knowledge obtained in ILP and gained from the experience already achieved at learners' work place, to develop common understanding of the standards and the procedures in border surveillance operations. This stage of the course mainly focuses on procedures applied in border surveillance related to border and coast guard activities; learners are invited to actively attend discussions, case study activities and practical tasks. Trainers can give lectures on topics related to border surveillance, focusing on UAV crew duties, adopting learning by doing method together with peers and trainers. To that extent feedback will be utilized in order to achieve learning goals.

The training material is used in an authentic learning environment to stimulate strategic and critical thinking of learners and to enhance cooperation and team working skills through group working tasks. The CLP has 40 learning hours divided in 80 % practical and 20 % lectures.

During the ELP learners have 20 hours for further develop their critical evaluation and analytical skills drawing on experiences from their working environment. Learners individually apply the competences acquired during the course in a case

Educological Discourse

study exercise designed by the course trainers. The ELP is facilitated by the trainers who provide guidance to the participant's feedback in order to meet the objectives. Solving the case study support the participants in adapting the individual response to situations in accordance with the operational plan and relevant legislation.

After the completion of such intensive training, the border guards are positioned to units where they perform special combat tasks using different types of UAVs, destroy the enemy and its equipment.

Conclusions

Taking into account the large number of AFVs of the russian federation armed forces across the frontline and their use during hostilities against Ukraine, the authors believe that it is necessary to create anti-tank and anti-aircraft units in the units of the border guard agency. Although, the fight against AFV is not a function of the units of the SBGSU, but the presence of such units will help to postpone the enemy movements and provide the opportunity for the border guard unit to maneuver to certain areas and carry out required operational and combat tasks. The development and equipping of the State Border Guard Service of Ukraine with unmanned aircraft systems of various purposes will allow to significantly improve the methods of conducting operational and service actions at various sections of the border and in the combat zone, will ensure a significant reduction in the level of human losses.

Based on the analysis of combat missions and best world practices of using UAVs for completing law-enforcement and military tasks, a typical program of the basic UAV operator training course was elaborated and is delivered at the border guard departmental training institutions. The authors used the acquired experience of the Border Guard units to develop a training course for the UAV operators of the border guard units. The developers of the course took into account the combat experience and the best European practices in UAV operators training. The learning strategy of the course is based on a student-centred learning approach. It is designed to provide learners with theoretical knowledge and practical skills on the operators of the UAV crews deployed in border surveillance and combat operations. The course is divided in three phases: Independent Learning Phase (online), Contact Learning Phase (offline) and Experiential Learning Phase (at the border guard units). The further research may encompass development of recommendations regarding the staffing of the UAV unit as part of the border guard division.

REFERENCES

Mykytiuk, M. (2018). Rol ta mistse bezpilotnykh litalnykh aparativ u zabezpechenni bezpeky lyudey pid chas masovykh zakhodiv [Role and the Place of Unmanned Aerial Vehicles in Ensuring the Safety of Persons during Mass Events]. *Scientific Notes of Lviv University of Business and Law,* 41–47 [in Ukrainian].
https://nzlubp.org.ua/index.phbp/journal/article/view/33

Katerynchuk, I., Shynkaruk, O., & Balytskyi, I. (2018). Definition of Approaches to the Assessment of Tactical Unmanned Aerial Vehicles Effective Use in the State Border Guard Body. *TCSET-2018: 14th IEEE International Conference on Advanced Trends in Radioelectronics, Telecommunications and Computer Engineering*, (pp. 1255–1259) [in English].
https://doi.org/10.1109/TCSET.2018.8336422

Reznik, O., & Kustynskiy, O., & Havryliuk, V. (2020). Combat Capabilities Improvement of the State Border Protection Units to Fight Armored Combat Vehicles. *Zsbirnyk naukovykh prats Natsionalnoi akademii Derzhavnoi prykordonnoi sluzhby Ukrainy, Seriia: Viyskovi ta tekhnichni nauky*, Khmelnytskyi: Vyd-vo NADPSU, Vol. 1, No 82, pp. 156–167 [in Ukrainian].

Ministerstvo oborony Ukrainy (2023). official website. (2023). [in Ukrainian]. https://www.mil.gov.ua/news//vtrati-rosijskih-okupantiv-generalnij-shtab-zsu/

Voronko I., & Voronko,V. (2020). Oblasti zastosuvannia bezpilotnykh litalnykh aparativ [Fields of Application of Unmanned Aerial Vehicles]. In *Suchasnyi stan provedennia naukovykh doslidzhen u IT-tekhnolohiiakh, haluziakh elektroniky, inzhenerii, nanotekhnolohiiakh ta transportnii sferi [The Current State of Scientific Research in IT Technologies, Electronics, Engineering, Nanotechnology and Transport],* (pp.1–160) [in Ukrainian].

Hlotov, V. O., Hunina, A., & Teleshchuk, Yu. (2017). Analiz mozhlyvostei zastosuvannia bezpilotnykh litalnykh aparativ dlia viiskovykh tsilei [Analysis of the Possibilities of Using Unmanned Aerial Vehicles for Military Purposes]. *Suchasni dosyagnennia geodezychnoyi nauky ta vyrobnytstva NU «Lvivska politekhnika» [Contemporary Achievements of Geodesic Science and Production], 1*(33), 139–146 [in Ukrainian].

Kritskiy, D., Yashyn, S., & Koba, S. (2020). Unmanned Aerial Vehicle Mass Model Peculiarities. *Mathematical Modeling and Simulation of Systems (MODS'2020)].* Advances in intelligent systems and Computing, Vol. 1265. Springer [in English].
https://doi.org/10.1007/978-3-030-58124-4_29

Katerynchuk, I., Balendr, A., Komarnytska, O., Islamova, O., Ordynska, I., & Chubina, T. (2021*).* Training of Remotely Piloted Aircraft Operators for Border Surveillance in Ukraine based on the European Union Standards. *Revista Romaneasca Pentru Educatie Multidimensionala,* Vol. 13, No. 3, pp. 134–150 [in English]. https://doi.org/10.18662/rrem/13.3/444

Zgurets, S. (2022). Russian Battalion Tactical Groups in Action: Strengths and weaknesses (analysis)]. *Defense Express* [in Ukrainian].

https://defence-ua.com/army_and_war/rosijski_bataljonni_taktichni_ grupi_u_diji_ silni_ta_ slabki_istsja_analiz-6425.html

Yarovy, O. (2022). How Many Armored Vehicles and Artillery are in Battalion Groups of the Russian Federation near the Borders of Ukraine. *Defense Express* [in Ukrainian].

https://www. Ukr.defense.news@gmail.com

Bursala, O., Horoshko, D., Kulba, P., & Chupryna, V. (2019). Bezpilotni litalni aparaty povitrianoho boiu [Air Combat Unmanned Arial Vehicles]. *Zbirnyk naukovykh prats Derzhavnoho naukovo-doslidnoho instytutu vyprobuvan i sertyfikatsii ozbroiennia ta viiskovoi tekhniky [Scientific Works of State Scientific Research Institute of Armament and Military Equipment Testing and Certification], 1*(1), 50–57 [in Ukrainian].

https://dndivsovt.com/index.php/journal/article/view/184

Bilous, V. (2016). Klasyfikatsiia bezpilotnykh litalnykh aparativ ta yii znachennia dlia kryminalistychnoi praktyky [Classification of Unmanned Aerial Vehicles and Its Significance for Criminalistic Practice]. *Teoriia ta praktyka sudovoi ekspertyzy i kryminalistyky* (16), 47–57 [in Ukrainian].

Олег РЄЗНІК,
доцент кафедри навчання стрільбі з вогнепальної зброї
Національної академії імені Богдана Хмельницького
Державної прикордонної служби України,
кандидат психологічних наук,
м. Хмельницький, Україна
https://orcid.org/0000-0001-7630-7509
e-mail: aleg05021982@gmail.com

Олег КУСТИНСЬКИЙ,
старший лектор кафедри загальновійськової підготовки
Національної академії імені Богдана Хмельницького
Державної прикордонної служби України,
м. Хмельницький, Україна
https://orcid.org/0000-0001-7403-5423
e-mail: kustos@ukr.net

Петро ГОРПИНИЧ,
старший лектор кафедри навчання стрільбі з вогнепальної зброї
Національної академії імені Богдана Хмельницького
Державної прикордонної служби України,
м. Хмельницький, Україна
https://orcid.org/0000-0001-6621-8289
e-mail: gorpynychpetro@gmail.com

Володимир АЛЕКСАНДРОВИЧ,
здобувач третього (освітньо-наукового) рівня вищої освіти
за спеціальністю «011 — Освітні, педагогічні науки»
Тернопільського національного педагогічного університету
імені Володимира Гнатюка,
м. Тернопіль, Україна
https://orcid.org/0009-0002-3794-354X
e-mail: aleksandrovichvv@ukr.net

АНАЛІЗ ДОСВІДУ ВИКОРИСТАННЯ МАЛИХ БПЛА НА ПОЛІ БОЮ: ПЕРСПЕКТИВИ УДОСКОНАЛЕННЯ ПРОФЕСІЙНОЇ ПІДГОТОВКИ

У зв'язку з повномасштабним вторгненням росії в Україну, змінами в оперативно-бойовій діяльності підрозділів правоохоронних органів виникла необхідність у використанні маломірних безпілотних літальних апаратів (далі — БпЛА) підрозділами охорони кордону. Встановлено, що успіх застосування БпЛА залежить не тільки від моделі апарата, а й від ефективності підготовки операторів БпЛА, дотримання умов експлуатації, проведення регламентного обслуговування, створення необхідних умов для зберігання та забезпечення мобільності екіпажу БпЛА. Розвиток та оснащення підрозділів Державної прикордонної служби України безпілотними авіаційними комплексами різного призначення дасть змогу суттєво вдосконалити методику ведення оперативно-службових дій на різних ділянках кордону та в зоні бойових дій, забезпечить значне скорочення рівня людських втрат.
У дослідженні запропоновано шляхи вдосконалення підготовки операторів БпЛА ДПСУ на основі розробленого базового курсу підготовки, що охоплює базові знання та навички, необхідні для прикордонників. Враховуючи велику кількість підрозділів збройних сил рф на лінії фронту та особливості їх використання під час бойових дій проти України, автори вважають за необхідне створити у підрозділах прикордонного відомства підрозділи, оснащені БпЛА різного типу для боротьби з бойовою броньованою технікою противника. Зважаючи на те, що боротьба з такими технічними засобами не є функцією підрозділів ДПСУ, однак їх наявність допоможе затримати просування підрозділів противника та дасть змогу прикордонникам відійти на підготовленні рубежі й продовжити виконувати поставлені оперативно-бойові завдання.

На основі аналізу виконання бойових завдань та передового світового досвіду використання БпЛА для виконання завдань правоохоронних та військових підрозділів розроблено типову програму базового курсу підготовки операторів БпЛА, яка проходить у відомчих навчальних закладах Державної прикордонної служби. Програма курсу охоплює базові знання та навички, якими має володіти оператор БпЛА прикордонного підрозділу, що виконує завдання з охорони протяжних ділянок кордону або в умовах ведення бойових дій. Подальші дослідження можуть включати розробку рекомендацій щодо комплектування підрозділу БпЛА у складі підрозділу охорони кордону.

Ключові слова: *прикордонний підрозділ, безпілотні літальні апарати, протитанковий засіб, професійна підготовка.*