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MILITARI TACTICS AND TRAINING OF MILITARI PERSONNEL

EXPERIENCE IN THE USE OF ARMY GROUND AIRCRAFT IN THE JOINT FORCES OPERATION (ANTI-TERRORIST OPERATION)

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An analysis and assessment of the current military and political situation in the world leads to the conclusion that the threat of unleashing of war and carrying out open aggression against Ukraine and other countries is a topical one. The covert aggression by the Russian Federation in eastern Ukraine is proof of this. Experience in recent years has shown that there is not a single local war or armed conflict of our time where army air force (AAF) is not involved.

Army Air Forces of the Ground Forces of the Armed Forces of Ukraine began to be used in the ATO from the first days. AAF conducted various tasks: carrying out aerial reconnaissance along the State border, transporting personnel and cargo. When the conflict became armed, the tasks became more complex and combative. The attack helicopters provided air support to the troops, attacked enemy personnel and equipment, evacuated the sick and wounded, and disembarked special forces and paratroopers.

The nature of the war in eastern Ukraine had its peculiarities to be reckoned with:

– the conflict passes without a clearly defined line of combat contact. Terrorists use weapons from densely populated settlements and have the opportunity to move around the territory controlled by the power structures of Ukraine and militants.

– illegal armed groups are equipped by the Russian Federation with the latest weapons and anti-aircraft defence systems.

At the first stage of the armed conflict, tasks were carried out at altitudes of 50-300 meters, without anti-tank and anti-aircraft maneuvers. And the lack of modern means of protecting helicopters and the enemy's use of the latest means of destroying air targets led to personnel losses. Aviation equipment also suffered significant losses, because during the active phase of hostilities 41 helicopters were lost and damaged.

After that, the AAF command took into account the features of the armed conflict in eastern Ukraine and the experience gained. In order to prevent further losses of personnel and equipment, they identified new approaches to the implementation and planning of operations using combat helicopters. Crews:

– prohibited flights with on-board aircraft technicians on helicopters Mi-24 during missions;

– it is recommended to introduce into the flight crew training program mandatory additional classes with crew members and medical personnel according to the rules of medical care both on the ground and on board the helicopter;

– allowed to use weapons immediately by decision of the crew commander at the detected firing position;

– on helicopters flying in the ATO zone, the latest protection systems against MANPADS of Ukrainian production are installed.

During missions Mi-24 it has been decided to include in the team a helicopter Mi-8 with a search and rescue team on board, so that, if necessary, it is possible to quickly assist the crew in distress.

The following are recommended to the flight and management personnel:

– perform flights with constant change of direction, altitude and flight speed;

– avoid flights along roads and over settlements as much as possible;

– perform landing (takeoff) with various magnetic courses without pattern and repetition;

– organize the development of a coding network for aviation within the areas of responsibility;

– not to fly over places of large crowds of people, over forests and forest belts in order to prevent concealed use of small arms and MANPADS by helicopter;

– use weapons from maximum distances without entering the zone of destruction of anti-aircraft defense systems;

– establish effective interaction between commanders, aviation and ground units, in the interests of which aviation support is carried out;

– provide maps of a single scale to flight crews and air observers, etc.

Taking into account the recommendations reduced the likelihood of helicopter damage, but still the problem remained.

Summing up, we can say that the war in eastern Ukraine pointed to shortcomings, made it possible to understand the importance of the use of army aviation and prompted awareness of the further development of the helicopter industry in the state as a whole. The experience of ATO helped to determine ways to modernize regular helicopters.

For any peaceful civilized country, the neutralization of armed conflict is an essential area of stability and national security. The experience of Ukraine has shown that for this it is necessary to have well-trained and equipped with modern weapons Armed Forces. At the same time, one of the main roles in them is played by army air force.

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COORDINATE SYSTEM IN SPACE NAVIGATION SYSTEM. COORGINATE SYSTEM PZ-90 and WGS-84

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The problem of determining the exact geographical coordinates of the area has been relevant since ancient times. In the 60s of the 20th century, with the release of man into space, there was a practical possibility of developing global positioning systems that use the principle of calculating the geographical coordinates of the object based on measuring distances to satellites in space.

Satellite navigation system is one of the promising areas of applied astronautics. It provides a qualitatively new level of coordinate and temporal support for land, sea, air and space consumers [1].

Today we are witnessing a significant increase in the intensity of intercontinental and transoceanic traffic. Sea and air transport continue to improve, and the size of sea and air vessels is gradually increasing. All this puts on the agenda increased requirements for navigation technology.

The first space navigation systems GLONASS (USSR, since 1991 - Russia) and NAVSTAR (US GPS) were developed as exclusively military. However, the realities of today have shown not only the economic benefits of using these satellite systems to address national traffic control problems, but also revealed the political aspects that integrate the international community efforts to progressively develop space navigation without losing sight of Russian and US national security.

GNSS - Global Navigation Satellite System - a comprehensive electronic system consisting of a set of ground and space equipment and designed for positioning in space (location in the geographical coordinate system) and time, as well as determining the parameters of movement (speed, direction, etc.) for land, water and air objects [1].

Regarding the general elements of the satellite navigation system, it is worth noting the following points, namely:

– Orbital group consisting of several (from 2 to 30) artificial satellites of the Earth, which emit special radio signals;

– Ground-based control and monitoring system, which contains units for measuring the current position of the satellites and transmitting the received data to them to adjust the information about their orbits;

– Ground beacon system, which can significantly increase the accuracy of coordinates; [2].

The coordinate system PZ-90 as the basis of geodetic support of the GLONASS system, is also the main element of the System of geodetic parameters of

the Earth (further SGPZ) "Parameters of the Earth" (called "system PZ-90"). In general, PZ-90 is designed for geodetic support of space navigation, geodetic and cartographic complexes and systems, including satellite navigation systems, topographic complexes, air, sea and ground means, weapons and command and control systems,. Coordinate system The parameters of the Earth in 1990 P3-90 were determined by the Topographic Service of the Armed Forces of.

Parameters of PZ-90 include:

– fundamental astronomical and geodetic aspects;

– characteristics of the coordinate basis (parameters of the terrestrial ellipsoid, coordinates of the points fixing the system, communication parameters with other coordinate systems);

– models of normal and anomalous gravitational fields of the Earth [2];

WGS84 (World Geodetic System 1984) - in geodesy, a three-dimensional coordinate system for determining the location on the Earth's surface. WGS84 is an improvement on previous versions of the WGS72, WGS64 and WGS60 systems [1].

The world system WGS-84 is an astronomical-geodetic-gravimetric frame of reference, inscribed in the shape of the Earth

Such parameters in the reference system WGS 84 include:

– geocentric rectangular coordinate system with the beginning at the point of the geometric center of mass of the Earth;

– mathematical basis, for which the form of an ellipsoid of rotation with specific geometric and physical quantities is adopted;

– gravitational model of the Earth, with certain values and their values for a specific date.

Analyzing all the above, we can conclude that the satellite navigation system is one of the promising areas of astronautics. It provides a qualitatively new level of coordinate and temporal support for land, sea, air and space consumers. Therefore, the disclosure of questions about the satellite navigation system and coordinate systems PZ-90 and WGS-84 which are designed for positioning in space (location in the geographical coordinate system) and time, as well as determining the parameters of movement (speed, direction, etc.) for ground, water and air facilities are relevant today.

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ANALYSIS OF THE EVENTS OF THE BEGINNING OF THE ANTI-TERRORIST OPERATIONS (ATO) IN SECTOR "A"

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It can be noted that the events taking place on the territory of Ukraine during the anti-terrorist operation differ in form from the classic anti-terrorist operation (hereinafter ATO), and in content resemble an armed conflict within the state and a border armed conflict with elements of security and defense of Ukraine. stabilization, anti-sabotage and even defense operations [1].

These factors give grounds to assert that the events in eastern Ukraine are showing signs of the so-called "hybrid war" - a new form of action in the armed struggle of the XXI century. The study of this form of action is a priority of military science, which emphasizes the relevance of issues that will be considered in scientific work, the purpose of which is:

1) research of the organization of occupation by troops of sector "A" at the beginning of carrying out anti-terrorist operation;

2) analysis of problematic issues of defense of sector "A";

3) draw conclusions on the use of joint forces in sector "A";

4) on the basis of the above, provide recommendations to commanders on the use of units in a "hybrid war".

To achieve this goal, it is proposed to consider the following issues.

1. General characteristics of sector A.

2. Return of settlements of Luhansk region under the control of the Armed Forces.

3. Problematic issues and ways to solve them.

On April 13, 2014, the National Security and Defense Council of Ukraine announced the beginning of an anti-terrorist operation in the eastern part of Ukraine [2].

The decision was made in response to pro-Russian riots in the cities of Donetsk and Luhansk oblasts, including attempts by illegal armed groups (NPFs) to seize administrative buildings and security forces [2-3].

The problem is that the use of new - hybrid combat tactics by the NZF forces requires their careful analysis and development of proposals that will form the basis of the provisions of the combat statutes of the branches of the Armed Forces of Ukraine (AFU).

In mid-May 2014, the ATO headquarters moved several units from the northeastern regions of Ukraine to the north of Luhansk region to strengthen the Ukrainian group in this sector. All units were reduced to the tactical group "Sloboda"

(it became the predecessor of the future sector "A"). At the end of May, according to the ATO headquarters plan, the Sloboda tactical group was reorganized into Sector A. In the spring of 2014, units of mechanized and airmobile brigades began advancing to the border. At that time, the border service could no longer carry out border control due to lack of forces and means. The separatists, armed with small arms, grenade launchers and armored vehicles, crossed the state border towards Russia, and military vehicles, mainly manpower trucks, armored personnel carriers and infantry fighting vehicles, entered Ukraine. Ammunition, weapons and equipment were supplied to the separatists across the borders of Luhansk and Donetsk oblasts. At the same time, a stream of Russian volunteers was trained in Russia and came to fight in Ukraine, joining the Russian-backed NPF. Luhansk airport on July 13-20 [4-5].

The supplies needed for long-term hostilities were missing at Luhansk airport, and it was impossible to deliver them to the units by air. At the same time, the situation around Luhansk worsened. In view of the above, the anti-terrorist operation headquarters decided to strengthen the group in the LAP. On July 13, Sector A Squad was consolidated. These measures only partially and for a short time solved the problem of providing units at the airport. The fighters ran out of food and water (up to 35-40 ° C in summer), as well as ammunition for D-30 artillery systems. The command of the sector decided to create a security corridor to Luhansk airport and to provide the necessary units at the airport with everything necessary.[6]

Thus, the results of the analysis of anti-terrorist operation events presented in the work allow to draw conclusions about that. that the methods of warfare have undergone significant changes and units of the Armed Forces have faced the need to improve and, in many cases, revise the main provisions of the statutes and guidelines. The main changes are due to the fact that there is no solid line of defense or offensive. A significant proportion of tasks are performed by units autonomously, which means that lower-level commanders must make key decisions independently, depending on the situation.

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POST-TRAUMATIC STRESS DISORDER AND SIGNS IN SERVICE MEMBERS

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In extreme cases (such as after untimely assistance in the case of physical injury), servicemen who are in a mentally tense situation and do not know how to help themselves or have not received psychological help can have negative consequences of varying duration. In order to understand the origins, to trace the manifestations of disorders associated with mental trauma (psychotrauma), and to prevent the risk of PTSD in servicemen, it is necessary to consider what mechanisms cause its development.

Post-traumatic stress disorder occurs after being in extreme situations (catastrophes, fighting, torture, rape, etc.). PTSD is characterized by recurrent episodes of experiencing the circumstances of a particular situation, decreased emotional response and arousal. For PTSD to occur, a person needs to feel the effects of a stressor that goes beyond normal human experience and the ability to cause stress. Such stressors include serious threats to life or physical integrity, serious physical injury (injury), death or injury to a colleague, and so on [1].

If a person has experienced a traumatic situation, it is quite normal that he feels anxious, confused. The person sleeps poorly, wakes up from terrible dreams, feels fear, and can not stop thinking about what happened, being in the grip of constant experiences, dangers, and painful memories. In most people, these manifestations are short-lived, eventually, disappear on their own. This is a normal reaction to abnormal conditions. But, if the reaction does not weaken within a few days or even mud, it may be a manifestation of PTSD.

General symptoms of PTSD. Symptoms can divide into three groups: symptoms of re-experiencing; avoidance and numbness; inability to relax. A person doesn't need to experience all these symptoms at the same time. Also, the manifestations of PTSD can change their intensity over time [2].

Symptoms of re-experiencing are typical of people who experience a traumatic event over and over again. Symptoms of re-experiencing include: repeated repetition of memories of a traumatic event; flashbacks (strong unwanted memories of a traumatic event); night terrors or bad dreams; strong emotional reactions to the reminder of a traumatic event; strong physical reactions (rapid heartbeat, cold sweat).

Avoidance and numbness. People with PTSD tend to avoid traumatic event reminders because of these reminders "trigger" unpleasant emotions and memories. Avoidance may be limited to the location of the traumatic event or other reminders of it. This phenomenon resembles a "trigger" mechanism that works when the symptoms become too severe.

Inability to relax. PTSD complicates the inability to relax. The person is constantly in a state of "combat readiness", anticipating the probable danger, which makes it difficult to get used to a normal life. Inability to relax has the following symptoms: difficulty falling asleep and maintaining sleep; irritability or outbursts of anger; inability to concentrate; constant readiness for danger; excessive starting reaction [3].

At least two-thirds of people with PTSD also experience concomitant problems. The most common of these are depression, alcohol, and drug abuse, anger towards yourself and others, poor physical condition.

Traumatic memories differ from ordinary ones in that they are often heterogeneous and inconsistent, and important fragments of events can erase from memory. They are often very lively and easily "trigger" a large number of reminders, and there is no time to distinguish thoughts from feelings.

When the event is over, it is worth thinking about what happened, from the standpoint of its significance in our lives, as well as choosing what will remain in the memory.

Interpretation of events and phenomena is key in how we treat them. People with PTSD tend to interpret the traumatic event, its consequences, and symptoms in a way that causes them great fear [4].

The key step is the analysis of interpretations and their awareness, verification of conclusions for usefulness and validity.

Thus, consideration of PTSD and its symptoms helps to understand the mental health problems of those servicemen who find themselves in severe stress. The most common signs of PTSD are also considered, the prevention of which will help to return to normal life, to believe in recovery without medical intervention.

Thus, in case of symptoms of PTSD, specialists should refer such persons to specialists in the appropriate phase. It is with a professional approach during the provision of psychological care that you can detect severe mental disorders and prevent their strong manifestations.

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ON EFFICIENCY ASSESSMENT OF OPTIONS FOR DEPLOYMENT OF FORCES AND FACILITIES FOR STATE BORDER PROTECTION

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Strategic approaches to the process of reforming the state border management system of Ukraine are laid down in the Strategy of Integrated Border Management for the period up to 2025 of July 24, 2019 No.687-r, aimed at optimizing border control procedures to ensure an adequate level of security, providing rapid response to offences at the state border beyond border crossing points [1], as well as protecting Ukraine's sovereign rights, which reveal the need to find new, scientifically grounded approaches to building the protection of the state border of Ukraine.

Determining the most effective options for building the protection of the state border, taking into account the use of human and logistical resources to provide them with, is one of the main tasks to be solved by the management of border guard units.

The complexity of solving the problem of measuring the effectiveness and formation of a rational organization of operational and service activities is outlined in scientific papers (for example, **[** 1 – 4], etc.), but despite the large number of publications on this topic, it is obvious that the scientific and methodological apparatus available does not fully meet the modern requirements to executing tasks by the State Border Guard Service of Ukraine (hereinafter – SBGS) as a subject providing national security of Ukraine.

The efficiency of performing tasks assigned to SBGS units is associated with many features that define options for the use of forces and facilities (mountainous and forested areas, river area, sea area, the military and political situation in the area of responsibility, etc.).

According to Art. 1 of the Law of Ukraine "On SBGS" [5], the agency is tasked with ensuring the inviolability of the state border and protection of the sovereign rights of Ukraine in its adjacent zone and the exclusive (maritime) economic zone. Semantic analysis of the concepts of 'inviolability' and 'guarantee' defines 'inviolability' as a guarantee against any encroachment by anyone, and 'guarantee' as ensuring (military, technical, operational, etc.) realization of something. Therefore, the guarantee can be considered as *probability measure*, as the level of guarantee varies between the probability limits (from 0 to 1).

Therefore, it is advisable to use the term of 'guarantee of inviolability of the state border' Q – (*Quality*) as a criterion ('measure') for assessing the quality of organization of the state border protection.

This approach enables to fulfil the conditions of Article 1 of the Law of Ukraine "On SBGS", namely, ensuring the inviolability of the state border and protection of the sovereign rights of Ukraine in its adjacent zone and the exclusive

(maritime) economic zone, to be presented as a criterion:

$$Q \rightarrow 1, \quad (1)$$

where 1 – the maximum value of probability that the event will occur – is the maximum quality of the state border protection, which meets the requirements of the 'guarantee of inviolability' of the State Border of Ukraine (SBU).

It should be noted that this criterion can be used in any area of responsibility of the SBU.

The conditions (peculiarities) of service (*geographical, logistical, geopolitical, etc.*) influence the fulfilling of the criterion requirement (achievement of its limit value). These are the conditions that determine the ways to ensure and implement the guarantee for inviolability of SBU.

Based on the above, it is an objective fact that distribution of the service conditions (peculiarities) and formation of ways to ensure the guarantee of SBU inviolability in these conditions, which in the complex should guarantee the quality of SBU protection – 'guarantees of state border inviolability' ($Q = 1$) is advisable.

In order to implement such an approach, it is necessary to form appropriate quality indicators for building the SBU security and methods of service, which must also meet the established requirements for indicators and have a probabilistic nature ($0<Q_v\leq1$, $0<Q_{tz}\leq1$, $0<Q_{ord}\leq1$, etc.).

The calculation of a composite indicator of the current quality state of building the protection of the SBU sector, which has a certain peculiarity of service is as follows:

In other words, the complex indicator Q_{cur} at each area of responsibility of a *BGD*, taking into account its characteristics (elevation angle, descent angle, flat area, river sector, tree density, etc.) through the use of methods to ensure the guarantee of inviolability, should strive to meet the criterion ($Q = 1$).

The value of Q_{cur} is calculated as:

$$Q_{cur}=lg/la \quad (3)$$

where *lg* – sum of sector lengths (from English *'guard'* – protection), which are blocked with the available forces and facilities for the SBU protection, which is guaranteed to provide information (signal) of intent to violate the SBU; *la* – the total length of the area (from English *'area'* - sector, plot) of responsibility.

Thus, it is possible to build the most appropriate protection of areas of responsibility by the cluster method depending on the available forces, facilities and terrain peculiarities of the area, as well as to determine the required quality composition of forces and facilities for protection of the state border.

In addition, it is necessary to form the indicator of 'reaction of the counteraction forces to the alarm' (Q_r). Its physical essence is to assess the adequacy of response of the available forces and facilities to the signal of offence, taking into account the operational efficiency, which should provide a guarantee of counteraction to offences and prevent violation of the SBU 'line'.

That is, upon receipt of an alarm signal about violation of the state border protection line, the reaction of the forces (their actions) is guaranteed to lead to the

termination of the offence. The criterion for evaluation may be measured by:

$$Q_r \rightarrow 1, \quad (4)$$

where 1 – the maximum value of probability that the event will occur, that is the maximum quality of reaction to a violation, which meets the requirements of the 'guarantee' of inviolability of the SBU 'line'.

As a result, it becomes possible to determine a comprehensive indicator of the organization quality of the state border protection in the sector: $Q_{SBP}=Q_{cur}\times Q_r$. (5)

The criterion for assessing the quality of use of forces and facilities for the state border protection may be the condition of a composite quality indicator of the state border protection in the area of responsibility of a BGD going to the highest limit of the criterion of 'guarantee of state border inviolability', namely, $Q_{SBP}\rightarrow Q$. (6)

Thus, the proposed expressions (1-6) provide an opportunity to assess the inviolability of the state border and the protection of the sovereign rights of Ukraine in the area of responsibility of a separate border guard unit and in particular the entire state border of Ukraine.

Prospects for further research are to take into account the considered scientific and methodological apparatus during the distribution of service formation elements in areas of responsibility, which have their own peculiarities of service and formation of appropriate logical and functional tables of capabilities of forces and facilities as to the SBU protection and counteraction to violations of legislation on border issues.

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LOGISTIC OF THE ARMED FORCES OF UKRAINE

ANALYSIS OF PROSPECTIVE TECHNOLOGIES OF OXYGEN AIRCRAFT SUPPLYING

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Any army is modern and capable of "adequate speed", response and mobility in the allocation of resources, if it has advanced logistics. In any war, in any of the theaters after the first blows, the further fate of the war depends on how efficiently military logistics works. Therefore, the logistics of troops - the key and basis for success in hostilities.

Aviation has always been, is and will be the fastest and most effective means of accurate destruction of the enemy. As the history of the wars shows: in the Persian Gulf, the Bosnian war, the war in Iraq, the one who dominates the air - rules everywhere, or just ends the war after few days or even hours. Therefore, the logistics of the Air Force is one of the most important and most difficult to ensure the smooth execution of combat missions [1].

The main substance without which no aircraft can take off is oxygen. At high altitudes, where the O_2 content is much lower, and with the overloads received by pilots during the tasks, its consumption increases many times over. Currently, in Ukrainian aircraft, oxygen is stored in special cylinders in compressed form and supplied to the pilot in an oxygen mask. It is clear that we do not have to talk about any autonomy. Moreover, the aircraft is supplied with oxygen by the automobile oxygen production station (AOPS – 70M) [2]. This is a versatile, multifunctional machine that can perform various tasks. However, maintenance and logistics operations involving it are too cumbersome and expensive. According to many experts, this approach, when oxygen is produced on the ground and then pumped into aircraft cylinders, is very obsolete.

The panacea for this problem is the on-board oxygen generation system (OBOGS). This autonomous system generates an unlimited amount of oxygen-enriched air to meet all the physiological needs of one or two pilots for any long and complex mission [3]. The on-board oxygen generation system produces oxygen by separating the engine airflow. Currently, OBOGS based on a molecular sieve is installed on aircraft. This technology is that oxygen is not transmitted in the form of oxygen molecules, but through oxygen ions; since gases other than oxygen ions cannot pass through the membrane, the oxygen concentration can reach 99.5% or even higher. This technology is much newer and more promising than the method of deep cooling used in the Armed Forces of Ukraine.

The main advantages of using this technology are:

– reduction of logistical support;

– significant reduction in the cost of aircraft and ground equipment maintenance;

– the possibility of carrying out maintenance and repair of systems directly at the location of aircraft parts

– the need for less qualified personnel;

– increasing the operational reliability of the aircraft (unlimited flight range - oxygen is no longer a limiting factor for flight range);

– increase flight safety;

These advantages are undeniable, as you no longer need to service AOPS-70M, which consists of 4 cars and highly qualified personnel of 14 people. The experience of the anti-terrorist operation in the east of Ukraine has shown that the main method of transporting military equipment is rail transportation, and therefore the economic feasibility of onboard oxygen generation systems is growing many times over [4].

International experience has shown that (OBOGS) can be installed not only in state-of-the-art fifth-generation aircraft, but also in Ukrainian MiG-29s or Su-30s. Thus, in 2015, India announced the creation of its own system that can be successfully integrated into the above aircraft.

The OBOGS system is a new technology that needs improvement. Thus, on November 17, 2010, the US Air Force lost the F-22 Raptor, and the F-35 of the Japanese Air Force crashed in 2019. Currently, the version associated with OBOGS problems is considered basic.

Despite these incidents and the imperfection of the system, in no case can we abandon such a promising technology of the future. Therefore, Ukraine together with its international partners and allies should work on the development and integration of on-board oxygen generation systems in its own aircraft to modernize its own fleet and reduce.

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CURRENT PROBLEMS OF STRUCTURING THE LOGISTICS OF THE ARMED FORCES OF UKRAINE ACCORDING TO NATO STANDARTS

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Within the logistics system of the Armed Forces, its main function is realized - logistical support of the Armed Forces. Logistics support of the Armed Forces is a function performed by the authorities management, logistics units and equipment for the benefit of troops and is expressed in the implementation logistics (supply), technical support, transportation and operation of infrastructure, as well as selected aspects of medical care [1].

Logistics support of the Armed Forces is a set of closely related procedures, as well as the activities of logistics bodies and units that aim to properly organize the functioning of the logistics system, effective use of the transport network and vehicles, as well as provision troops of all that is necessary for them to live and conduct operations of various types during peace, crisis and war.

The purpose of the logistical support of the Armed Forces is to meet the needs troops in the means they need to live and conduct military and extra-military operations, and to ensure the capacity of human resources [2].

The doctrine of the NATO Armed Forces very clearly imposes on all NATO member states and bodies general (union) responsibility for efficient logistics of multinationals military operations of NATO forces. Logistics as a science of planning and implementation contains theoretical elements (planning) and practical measures (implementation). Therefore, in the structure of NATO logistics, which, incidentally, is responsible for the content of stream structuring, acts:

- logistics planning, which belongs to the socio-political processes, strategic planning, logistics planning and logistics management (information flows);

- **process logistics**, also called executive logistics, is related to physical movements of materials, goods, services, as well as information and finance, the military operations of the NATO Armed Forces, which constitute comprehensive logistics (physical flows).

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ORGANIZATION OF MILITARY TRANSPORTATION OF AUTOMOTIVE EQUIPMENT AND PROPERTY BY AIR TRANSPORT

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A very important problem today is the need of hauling military equipment and property to the combat zone promptly and fast. That is why air transport becomes increasingly important, as the use of other types of transport for long-distance transportation requires more time .

The issue of air transportation and the use of airspace of Ukraine is regulated by the Air Code of Ukraine and other acts of legislation. According to the provisions of this Code, the transportation of military vehicles and property belongs to the state aviation, which uses aircraft to perform the functions of national security and defense and protection of the population, which are entrusted to the Armed Forces of Ukraine, other military formations that are formed in accordance. to the Ukraine laws [1].

Attention should be paid for aerodromes (sites) for such transportation, which includes the choice of aircraft parking place, based on safe and convenient access to weapons and military equipment; providing means of mechanization of loading and unloading operations; marking the routes of movement of military teams. [2] .

The final preparation of equipment for transportation by air and its placement on aircraft is carried out at the source area (at the airport). Requirements for the content and design of these documents are contained in the Regulations of military transportation by rail, sea, river and air transport, approved by the order of the Ministry of Defense of Ukraine from 05.09.2013 [3] .

Thus, summarizing all the above, can be concluded that the transportation of military equipment and property by air allows to transfer them quickly for long distances in any direction and in areas virtually inaccessible to other types of transport, through areas of infection, areas of destruction, fires and floods. The use of air transport contributes to the preservation of motor resources of military equipment, significantly reduces the cost of material resources and delivers the necessary equipment to a certain area of the army in high combat readiness, if compare it to the movement on its own and in the short term.

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DEVELOPMENT, MODERNIZATION AND OPERATION OF COMBAT AIRCRAFT COMPLEXES AND MILITARY AIRCRAFT

ANALISIS OF THE USE OF CATAPULT SEATS ON HELICOPTERS

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During the fighting, when the aircraft was confronted with a powerful air defense, and even more so - with portable anti-aircraft missile systems, the question of rescuing the crews of downed vehicles became acute. The case was complicated by the fact that when leaving the downed helicopter, about half of the pilots died under the untwisted propeller. It was considered that this was an insurmountable problem that could not be solved.

In the seventies of the last century extensive researches as a result of which the scheme of the most acceptable variant of emergency leaving of the helicopter - by ejection of pilots upwards by means of the towing rocket engine with preliminary firing of propeller blades was carried out.[1]

The system worked as follows: in the event of a threat to the life of the pilot, the pilot pulls up his legs and, taking hold of the catapult, vigorously pulls them up. At this point, special pyrocartridges are triggered, which literally interrupt all the blades of the propeller. In a split second, the blades fly away from the helicopter, freeing up space above the pilot's head. The sensors determine the height, speed and spatial orientation of the chair, after which the rescue parachute is activated. The K-37-800 missile and parachute system provides rescue of the pilot in the range of heights from 0 meters to 4 kilometers and at a helicopter speed from 0 to 350 km / h.

The seat was first installed on a working helicopter in the late eighties - on the experimental machine Ka-50, which became the world's first serial combat helicopter with a catapult rescue system.[2]

The use of catapult seats provides rescue for the pilot in the event of an emergency, in the event of an enemy projectile hitting the propeller and for evacuating the crew in an emergency. The system of providing helicopters with catapult seats has many advantages, but there are also many disadvantages, such as: high cost; complexity of operation; not security.

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ANALYSIS OF THE USE OF AIRCRAFT FLY-BY-WIRE CONTROL SYSTEMS

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During the development of aircraft, the flight control systems were constantly being improved, which enabled the pilot to more confidently perform take-off, landing, and maneuvering the aircraft. The control systems used control surfaces as elevator, rudder, ailerons that moved with help of muscular strength of the pilot through mechanical rods.

With the increaseing of speed, size and weight of the aircraft, it became necessary to use complex controls: full-rotary stabilizers, trimmers, flaps with electrical control and schemes with partial removal of loads from the controls.[1]

Fly-by-wire control systems replaced hydromechanical one. Such systems were lighter and less vulnerable to combat damage. The inclusion in the control circuit of electronic computing devices significantly increased the reliability of systems, provided protection against unplanned flight modes and made it possible to block the pilot's actions in violation of constructional and aerodynamic limits.

In Fly-by-wire control systems, electrical wiring replace mechanical rods that went from controls to control surfaces and began to use wiring, which also reduced weight and increased combat survivability. [2] Further weight reduction was achieved by replacing bulky hydraulic drives with electric and electrohydraulic ones.

The use of light remote and fiber optic remote control systems is promising. In such systems, the wiring is replaced by LEDs. Light pulses are used to transmit control signals. Such systems have less weight and higher reliability. [3]

For given period of development of fly-by-wire control systems the promising methods of their development will be the following:

- improving the materials of the wires in the control system of aircraft;
- Improvement to onboard computer software;
- Improve the performance of the onboard computer.

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MODERN STATE OF OPTICAL-ELECTRONIC HIGH-PRECISION WEAPONS

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For the effective use of controlled aircraft weaponary (CAW), their guidance systems must be all-weather and round-the-clock and have protection from both natural interference (fog, snow, rain, sandstorms, etc.) and from interference created by the enemy like: false laser targets, aerosol curtains, heat traps, etc. In the arsenal of Ukranian air defense systems to perform the tasks there is a full range of CAW: air-to-surface missiles X-29, X38, adjustable aircraft bombs (AAB) of various calibers with laser, television and satellite guidance systems.

Despite these shortcomings, SALHH, due to the ease of manufacture and relative cheapness (according to foreign press data, about 10-15 thousands of dollars) are the most massive guidance systems. Television guidance systems ensure the combat use of the CAW in the visible and near-infrared range with an illumination of 0.1–0.3 lux on the ground (cloudless moonlight night). At the same time, the target detection / acquisition range in daytime conditions for typical targets is 10-15 km with a pointing accuracy of 3-5 m. as well as low contrast (visibility) of the target against the background of the terrain. In this case, the TVG system cannot capture the masked object. [1]

In the process of improving the photodetector matrices, it is possible to increase the sensitivity of the TVGS (thermal vision guiding systems), which will ensure the combat use of the UASP at an illumination of 10–3 lx on the ground (starry moonless night), which, most likely, is the limit of the capabilities of the TVGS. Thermal imaging systems provide round-the-clock combat use of the controled aircrat weaponary. Thermal homing heads operating in the far-infrared range, in conditions of atmospheric haze, dust and battle smoke, may function unstably. [1]

The main advantage of thermal homin missiles is the possibility of their use in adverse weather conditions and at night. Due to the high cost of IR receivers, the cost of TVHH is higher than that of TVHH. At the initial stage in autonomous flight missile is controlled by signals from an inertial navigation system (INS). Correction from the satellite navigation system increases the accuracy of guidance to the target. Thus, the main directions of development of information technologies in the CAW should provide a significant increase in the effectiveness of the use of high-precision weapon systems when it used against military equipment and infrastructure facilities of the enemy in various conditions, including active information and electronic countermeasures.

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PROSPECTS FOR THE DEVELOPMENT OF OPTICAL-ELECTRONIC GUIDANCE SYSTEMS FOR HIGH-PRECISION WEAPONS

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Annotation - the tasks, prospects and purpose of electronic high-precision weapons guidance systems are considered. Analysis of promising developments in the field of high-precision airborne weapons of the leading world powers (USA, Great Britain, France, Israel, South Africa, etc.) showed that work is underway to create guided aircraft weapons (GBU - Guided Unit Bombs).) are equipped with multi-mode (combined) guidance systems with increased noise immunity. Under unfavorable meteorological conditions, it can switch guidance at the end of the trajectory from laser to radar, which allows a bomb with high-precision guidance to hit stationary or moving targets [1].

Firm MBDA (USA) received funding for the study of future concepts under the high-precision weapons program SPEAR (Selective Precision Effect at Range) Capability, which involves the development of a high-precision multipurpose GUB for hitting targets at long ranges. The project of the weapon, known as 100V, with a mass of 100 kg, was completed. Project 100V, equipped with a turbojet engine with a multi-mode HH, a two-way data transmission line (i.e., a data transmission and reception line) and a multi-mode warhead, is intended to be placed in the internal compartment of the F-35 strike fighter. [2]

Only with close interaction between representatives of these scientific communities, it is possible to achieve high results in the development of information technology in GUB. Thus, the general trends in the development of information technologies in the GUB are determined by: the complication of the background target and jamming environment, expanding the range of calibers of aviation weapons equipped with guidance systems, including those for army and unmanned aircraft; the need to increase the efficiency of the GUB application through the use of promptly updated databases on targets and pre-prepared standards; increasing the range of the GUB, and ensuring the use of ammunition from areas outside the operation of the object air defense; increasing the accuracy of hitting the target, including providing guidance to the vulnerable area of small armored targets. [2]

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ORGANIZATION OF THE REAR OF THE GROUND FORCES

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Logistics of the Armed Forces is organized and carried out in all types of operational, combat and daily activities of troops (forces) in order to maintain them in combat readiness, to create favorable conditions for the implementation of tasks. The necessary material resources are transferred directly to the troops through the rear authorities.

The main tasks of the rear of the Armed Forces include:

- determining the needs of troops (forces) in material resources for the rear services, placing orders through the executive bodies of state power for their production by enterprises, institutions, organizations of all forms of ownership of the national economy, their receipt and delivery to associations, compounds, parts (institutions, units and servicemen):
- accumulation, maintenance of stocks of material resources for the rear services and providing them with troops (forces);
- ensuring the base of aviation and the Navy;
- carrying out a set of measures to ensure the survivability of the rear, its protection, defense, protection and camouflage;
- transportation of all types of material means and implementation of military transportation;
- implementation of measures of trade and household, apartment-operational and financial support;
- preparation, operation, technical cover, restoration of roads and transport in conjunction with the bodies of the Ministry of Transport of Ukraine;
- implementation of technical support measures for troops (forces) in the rear services.

The ground Forces of Ukraine are subordinated to the Command of the Land Forces of the Armed Forces of Ukraine [1]. The land territory of Ukraine is divided into four military-land zones, which are the areas of responsibility of the operational commands "West", "North", "East" and "South" and a separate military-land area. Military units are also divided by type of troops. A separate military-land district is the land territory of the Autonomous Republic of Crimea and the city of Sevastopol (belongs to the area of responsibility of the operational command "South" taking into account the features defined by the Law of Ukraine "On Ensuring the Rights and Freedoms of Citizens and Legal Regime in the Temporarily Occupied Territory of Ukraine").

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ENCRYPTION INFORMATION FOR SIGNAL TRANSMISSION IN UNMANNED AERIAL SYSTEMS USING CRYPTOGRAPHIC METHODS

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Abstract - the work describes the main methods of protecting information using the method of cryptographic transformation, which are used in unmanned aircraft systems.

Key words - unmanned aerial systems, cryptographic analysis.

I. Introduction

The rapid development of unmanned aerial vehicles (UAVs) systems and the development of radio electronics force us to constantly revise the requirements for the communication channel between the UAV and the ground control complex [1].

Today it is possible to perform pilot flights with an autopilot without communication between the aircraft deck and the ground control complex. In addition, sometimes it becomes necessary to adjust the parameters of the UAV flight.

II. Task Specification

An urgent task is also the transmission of data from the aircraft's combat load to the ground control complex. In this case, it is necessary to ensure the transmission of a large amount of data with specified requirements for bandwidth, bit error probability, etc [2].

III. Main part

The main types of encryption are encryption and encryption of protected data.

IV. Conclusions

The modern communication system between the low-voltage control module and the UAV at the signal processing level should be implemented in the form of a software-configurable radio system, which, depending on the conditions of signal transmission along the route of the BLPA - ground control complex, adaptively change the types of modulation, transmitter output power, types of signal coding channel, signal spectrum, extension parameters, data transmission rate, ratio of transmission and reception times for half-duplex communication channels, encryption parameters of transmitted data [3]. At the same time, small UAVs can be used as signal repeaters to ensure stable communication with remote UAVs.

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