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JUSTIFICATION OF THE FORCES AND EQUIPMENT OF THE NATIONAL GUARD OF UKRAINE INVOLVED IN PERFORMING THE TASKS OF PROTECTING CRITICAL INFRASTRUCTURE AGAINST AIR TARGETS

An analysis of critical infrastructure objects, which have different levels of criticality categories, and the importance of assigning individual units to destroy air targets, was carried out. The existing objects of critical infrastructure, which are subject to protection and defense by the National Guard of Ukraine in the conditions of resistance to the armed aggression of the Russian Federation, and the areas of responsibility of operational-territorial associations and military units under direct control, which carry out the protection and defense of the specified objects, were studied. The need for components of the defense system for the protection of critical infrastructure objects by military units (units) of the National Guard of Ukraine, which perform the task of destroying enemy air targets, is considered. The organization of interaction in the general air target detection system, which is connected to the network of the Air Force of the Armed Forces of Ukraine, air defense units and aims to detect enemy air targets aimed at destroying the country's critical infrastructure facilities protected by the National Guard of Ukraine, is analyzed. It is proposed to define the defense sectors of the critical infrastructure object to form the necessary type and quantity of weapons and equipment necessary for the destruction of air targets both in the approaches to the object and in the distance from it.

Keywords: *National Guard of Ukraine, air targets, critical infrastructure object, fire group, mobile group, separate units for the destruction of air targets.*

Statement of the problem. As a result of constant shelling of the territory of Ukraine by the Russian Federation, there is an urgent need to grant the right to mobile fire groups to independently make decisions on the destruction of air targets. However, today there are certain problems that require attention and solutions from the leadership of the National Guard of Ukraine (NGU), namely: improving the system of early detection and monitoring of air threats; professional development and training of personnel on combating air threats, as well as modernization and development of technical means to protect critical infrastructure from air targets.

At this time, the forces of NGU faced various air threats, such as drones, airplanes, helicopters, etc. These threats are usually of a military or terrorist nature.

Regarding the early detection and tracking of air targets, there is a problem caused by technical limitations and deficiencies in air defense systems (ADS). The military management bodies of the NGU should have access to modern systems of early detection and tracking of air targets, but currently there are limitations that make it impossible to implement effective protection against air threats.

The next problem is the insufficient number of training programs and training for the personnel of NGU, which are designed to respond to air threats.

In addition, there is a need for a financial aspect for the modernization of air defense infrastructure and means, which involves the purchase of modern detection systems, missiles, means of combating air targets.

In addition to domestic policy, it is important to increase the level of international cooperation in the field of air defense for additional information exchange, the possibility of joint training with partners of other countries in order to ensure more effective protection against air threats.

Analysis of recent research and publications. The scientific work [1] revealed the theoretical foundations of the functioning of critical infrastructure objects, within which the main attention was paid to the critical analysis of the content of the concepts "critical infrastructure" and "critical infrastructure security". Concepts in the field of critical infrastructure and its security, which are expedient to use in relevant regulatory documents, are proposed and substantiated. The main factors that must be

considered when organizing the safety of critical infrastructure objects are given.

The publication [2] provides recommendations for corrections to advance in the case of firing at the Shahed-136 kamikaze drone, which differ significantly in advance and verification of small arms. Recommendations are given for corrections to advance during the use of small arms, which are in service with the Armed Forces of Ukraine (AFU), considering the ballistic function. Proposals have been made to improve the machine gun installation, which is successfully used by the military personnel of the NGU, and to create a promising sighting system for it.

The scientific work [3] analyzed the legal acts regulating the protection of critical infrastructure objects in foreign countries, such as the United States of America, Great Britain, Germany, France, Poland, and Slovakia. It is also additionally mentioned about scientific studies of foreign experience on certain issues of protection of critical infrastructure objects, which showed that the protection of critical infrastructure objects has reached a pan-European or even intercontinental format. In the UN Global Counter-Terrorism Strategy, under Chapter II "Measures to Combat and Prevent Terrorism", Member States decided to intensify all efforts to increase the security and protection of particularly vulnerable objects, such as infrastructure and public places, as well as to respond to terrorist attacks. Attention is drawn to the aggravation of the foreign and domestic political situation of Ukraine in modern conditions, which, for its part, actualized the issue of developing the concept of creating a state system for the protection of critical infrastructure objects.

The authors of the study [4] emphasized that it is impossible to fully form a state policy in the field of protection of critical infrastructure objects, to determine the legal basis of such activity, to adopt relevant normative legal acts, the provisions of which would determine all aspects of the functioning of this sphere of social relations, without proper scientific processing of each of the specified measures. It has been found that the determination of the state of research of the problems of protection of critical infrastructure objects will make it possible to: identify such issues that have received the least attention; comprehensively determine the level of scientific development of the indicated sphere of social relations, which should positively affect the comprehensiveness of the submitted scientific research; to form directions for possible further scientific research in this area. Scientific studies that to a certain extent touched or were supposed to touch the issues of critical infrastructure protection, the object of which were public relations in the field of ensuring the protection of information security of the state or a separate region, were analyzed. It is emphasized that the protection of critical infrastructure objects is mentioned rather superficially, within the scope of consideration of other legal issues.

These studies provide justification for:

– the content of the terms "critical infrastructure" and "security of critical infrastructure";

– normative legal acts regulating the protection of critical infrastructure objects in foreign countries;

– recommendations for corrections for preemption during firing at the Shahed-136 kamikaze drone, which differ significantly according to the data;

– scientific research that to a certain extent touched or was supposed to touch the issues of critical infrastructure protection, the object of which was public relations in the field of ensuring the protection of information security of the state or a separate region.

The purpose of the article is to substantiate the forces and means of the National Guard of Ukraine, involved in the performance of tasks for the protection of critical infrastructure from air targets, and to conduct an overview of the current state of critical infrastructure in Ukraine.

Summary of the main material. The military aggression of the Russian Federation against Ukraine, which began on February 24, 2022, became a challenge to the very existence of our state, its sovereignty and universality. In this situation, protection of critical infrastructure, especially from strategic air-to-ground cruise missiles (X-101, X-555, X-55), air-based anti-ship missiles, became a significant challenge for the security and defense sector of the state, and in particular for NGU long-range (X-22, X-32), aeroballistic missiles (X-47M2 "Kinjal"), cruise missiles ("Kalibre", "Iskander-K"), ballistic missiles (S-300, S-400, "Iskander-M"), medium-range air-to-surface tactical guided missiles (X-31, X31P), barrage ammunition, drones and aircraft. Every day, the enemy tries to destroy civilian objects, transport intersections, military objects and critical infrastructure objects that ensure the country's defense capability, with the aim of instilling terror in the population, making them fearful, intimidating them, sowing fear, horror, panic. The destruction of numerous infrastructure facilities throughout the territory of Ukraine – all this determines the modern realities in which Ukraine exists today and in which the safety of its citizens, society and the state must be ensured.

The reasons for the destruction of critical objects can be different. Among them, it is worth

highlighting terrorist acts, military actions, cyber-attacks and natural disasters. The methods of shelling Ukraine are diverse, including missile attacks, artillery fire, cybernetic attacks, etc. It is obvious that the protection and defense of Ukraine's critical infrastructure need fundamental reformation, which should take place in view of the world experience regarding the terrorist threats of the Russian Federation around the world, which uses the latest types of weapons and equipment.

The problem of the world has become a terrorist country, so our partners have started work on the transfer of air defense equipment, but the main complexes armed with Ukrainian air defense are anti-aircraft guided missiles. S-300, S-200, Buk-M1, TOR, OSA anti-missile defense systems work against strategic missile launches, which can shoot down both aircraft and cruise missiles. It should be noted that the foreign complexes that have a greater range for shooting down targets are the German IRIS-T and the Norwegian NASAMS. There are few of them in Ukraine, besides, they were not created for ballistics work. The Patriot and FSAF SAMP/T systems are more effective in combating ballistics and protecting critical infrastructure near the borders and the contact line, but their range of hitting ballistic targets is only about 40 km. To shoot down cruise missiles and drones of various types in the near areas of critical infrastructure objects, samples of Western weapons are used – these are portable anti-aircraft missile complexes (MANPADS) Stinger and Starstreak. Also, in 2023, the American AN/TWQ-1 Avenger short-range anti-aircraft guns began to be in service with Ukraine.

Against the background of a shortage of modern SAMP/T, Patriot complexes and ammunition for air defense systems in order to fight against an air attack, air defense units began active countermeasures by means of electronic warfare ("Bukovel-AD", "Enclave", "Polonese", "Khmara", "Khortytsia-M" and "Nota").

In the National Guard of Ukraine, mobile groups have been created to fight against strike drones, which have various types of weapons and equipment, equipped with detection means of various effectiveness (searchlights, laser pointers, thermal imagers, night detection devices, tablets, etc.). The commanders of different levels independently made decisions regarding the equipment of the designated mobile groups with different tactical and technical characteristics (TTC) weapons, detection means and equipment of Soviet and foreign models. However, they do not have a structured, scientifically based composition.

Among the main problems are technical limitations and shortcomings in air defense systems. The National Guard of Ukraine must have access to modern systems, but existing obstacles may limit its ability to effectively detect, track and protect against aerial threats.

Another key problem is the insufficient number of training programs for the personnel of NGU, designed to respond to air threats. It is important to regularly train to ensure high readiness and effectiveness in the face of threats.

There is also the problem of large investments in the modernization of infrastructure and means of air defense. This involves the purchase of modern detection systems, missiles and means of combating air targets.

In addition to internal measures, it is also important to increase the level of international cooperation in the field of air defense. The exchange of information, training and joint exercises with partners from other countries will contribute to ensuring more effective protection against air threats.

After February 24, 2022, the protection of critical infrastructure from enemy air targets became an urgent problem for the entire security and defense sector. Every day, the Russian Federation strikes with strategic and tactical aircraft and kamikaze drones of various types.

Consider the concept of critical infrastructure: it is a set of critical infrastructure objects, and the critical infrastructure object itself is an infrastructure object, systems, their parts and their totality, which are important for the economy, national security and defense, the disruption of which can harm vital national interests [5].

Considering the spatial location of critical infrastructure facilities, NGU subdivisions are divided into five parts (operational-territorial associations) (Figure 1).

Figure 1 – Areas of responsibility of operational commands National Guard of Ukraine

In order to generalize information on the defense security of critical infrastructure facilities, an analysis of the spatial placement of NGU forces, which perform the task of protecting specified facilities from air targets, was carried out.

The Western operational-territorial unit of NGU is located in eight regions (Zakarpattia, Ivano-Frankivsk, Lviv, Volyn, Chernivtsi, Rivne, Khmelnytsky, Vinnytsia). The area of responsibility of the Western Operational Territorial Association includes: 3 thermal power plants, 5 thermal power plants, 2 nuclear power plants, 4 hydroelectric power plants, 2 solar power plants, 8 regional state administrations, 1 particularly important state object, 2 oil refineries, 5 gas storage facilities, health care facilities (multi-specialty, single-specialty, specialized, special type, ambulatory polyclinic facilities, blood transfusion, emergency and emergency medical care facilities, sanatorium-resort facilities).

The southern operational-territorial command of NGU is located in four regions (Odesa, Mykolaiv, Kherson, Zaporizhzhya). The area of responsibility of the Southern Operational Territorial Association includes: 1 thermal power plant, 4 thermal power plants, 2 nuclear power plants, 1 nuclear thermal power plant, 3 hydroelectric power plants, 9 wind power plants, 4 regional state administrations, 10 solar power plants, 2 oil refineries.

The Northern Operational Territorial Command of NGU is located in four regions (Zhytomyr, Kyiv, Cherkasy, Chernihiv). The area of responsibility of the Northern Operational Territorial Association includes: 1 thermal power plant, 7 thermal power plants, 1 nuclear power plant, 3 hydroelectric power plants, 2 solar power plants, 2 particularly important state objects, 4 regional state administrations, 10 bridges of military significance, 4 gas storage facilities, health care facilities (multi-specialty, single-specialty, specialized, special type, outpatient polyclinic facilities, blood transfusion, emergency and emergency medical care facilities, sanatorium-resort facilities).

The eastern operational-territorial command of NGU is located in four regions (Sumy, Kharkiv, Luhansk, Donetsk). The area of responsibility of the Eastern Operational Territorial Association includes: 8 thermal power plants, 10 thermal power plants, 1 nuclear thermal power plant, 2 wind power plants, 3 particularly important state facilities, 4 regional state administrations, 47 bridges of military significance, 2 gas storage facilities, health care facilities (multi-specialty, single-specialty, specialized, special type, outpatient polyclinic facilities, blood transfusion, emergency and emergency medical care facilities, sanatorium-resort facilities).

The central operational-territorial command of NGU is located in three regions (Kirovohrad, Dniprovska, Poltava). In the area of responsibility of the Central Operational Territorial Command there are: 2 thermal power plants, 3 thermal power plants, 2 hydroelectric power plants, 3 solar power plants, 4 particularly important state objects, 3 regional state administrations, 7 bridges of military significance, 2 gas storage facilities, security facilities health (multi-specialty, single-specialty, specialized, special type, ambulatory polyclinic facilities, blood transfusion facilities, emergency and emergency medical care facilities, sanatorium-resort facilities).

Given the number of critical infrastructure facilities that are under the protection and defense of the NGU, it can be concluded that many military units do not have air target destruction units that threaten critical infrastructure facilities. Armament in military units is of an outdated type (5,45-mm AK, AKS, AKSU, RPK) or even older versions (7,62-mm AK, AKM, RPK). The maximum that can be in the specified units is the armament installed on the armored personnel carrier (7,62-mm PKT or 14,5-mm KPVT), which has a very low hit rate against air targets due to its characteristics. Therefore, units of the NGU during the response to air targets mostly rely on air defense units of the Air Force of the Armed Forces of Ukraine, which is not the norm that the NGU needs at this time. According to the authors of the article, one of the effective options for fighting air targets can be mobile fire groups.

Let's consider positive examples of the actions of mobile fire groups.

Shahed drones on November 25, 2023, with which Russia attacked Ukraine that night, were shot down by mobile fire groups [63]. Today, up to 40 % are downed by mobile fire groups.

On the night of December 18, 2023, the Russian occupiers attacked with five UAVs of the Shahed type from the area of the Russian Federation [7]. Air targets were shot down by mobile fire groups of the Air Force and the Defense Forces of Ukraine within Mykolaiv, Dnipropetrovsk, Vinnytsia and Khmelnytsky regions. All targets were directed at critical infrastructure objects.

Most of the Russian Shahed drones are currently shooting down mobile fire groups in Ukraine [8]. Good results of the work of Ukrainian defenders of the sky on the night of December 21, 2023: 34 out of 35 kamikaze drones launched by the enemy were shot down. Mobile fire groups shoot down enemy drones with ZU-23-2 anti-aircraft guns and large-caliber machine guns. It is worth noting that mobile fire groups are equipped with various additional equipment that contributes to the achievement of the result that we see every day. These are both thermal

imagers and night vision devices that are added to those large-caliber machine guns.

Six mobile fire groups work in the voluntary formation of the territorial community in Cherkasy region [9]. Their task is to shoot down Russian "shahedy" and other aerial targets over the sky of the region. An equipped pick-up truck with a machine gun (Soviet-style PKM), a sight and a searchlight, this is the configuration in which members of the volunteer formation go on a hunt for Russian drones. "Shakhed" exhaust our air defense system, and therefore, the more they are shot down with a machine gun, the less missiles will be spent on it later.

On December 28, 2023, fighter aircraft were shot down by units, mobile fire groups of the Air Force and the Defense Forces of Ukraine within the Dnipropetrovsk, Kirovohrad, and Zaporizhia regions [10].

Thanks to the actions of mobile fire groups on January 2, 2024, 8 out of 17 UAVs and 11 out of 48 missiles were destroyed in the northern operational zone [11]. Fire mobile groups destroyed enemy targets in the Ukrainian sky with Gepard, Browning, anti-aircraft self-propelled guns and MANPADS Stinger.

11 rockets and 8 "shaheeds" were shot down around Kyiv by mobile air defense groups during a massive attack on January 3, 2024 by the Russian Federation [12]. The threat was neutralized with the help of the German anti-aircraft gun Gepard. The portable anti-aircraft missile complex was equipped with a sight that allows tracking the movement of the object 6 km away. It shot down four cruise missiles.

In addition, it was possible to land the cruise missile with shots from a large-caliber Browning machine gun of American production.

On January 22, 2024 at night the enemy attacked with eight attack UAVs of the "Shahed-136/131" type from the area of the Russian city of Primorsko-Akhtarsk. All eight "shaheds" were destroyed by anti-aircraft missile units and mobile fire groups of the Air Force and Defense Forces of Ukraine [13]. According to the Ukrainian military, the air defense system operated within Mykolaiv, Kherson, Dnipropetrovsk, and Kirovohrad regions.

On the night of February 3, 2024, mobile fire groups of the Air Force and the Defense Forces of Ukraine destroyed 9 enemy UAVs in the Dnipropetrovsk, Odesa, Mykolaiv, and Zhytomyr regions [14]. The enemy directed a significant part of the Shahed drones at energy infrastructure facilities in the Dnipropetrovsk region.

In Odesa, mobile fire groups of the National Guard of Ukraine defend the sky from drones. Each crew is equipped with an American Browning M2 machine gun, which is used to shoot down aerial targets. A searchlight helps to detect them at night, the light beam of which reaches several kilometers [15].

With the Soviet portable anti-aircraft missile complex "Igla", a soldier of NGU turned into scrap metal two Russian missiles that were fired by the enemy at the critical infrastructure of Kyiv [16]. Air defense means, such as the ZU-22 and MANPADS, are different: they are both former Soviet, and adopted Polish Piorun and American Stinger. That is, it is a portable, light weapon used by anti-aircraft gunners of mobile fire groups.

Having considered positive examples of the work of mobile fire groups, it is worth noting that their composition lacks uniformity in the types of small arms, technical means of identifying targets and equipment. In order to further continue the creation and effective use of mobile fire groups as part of the NGU, it is additionally proposed: to work out the staff and armament of units for the destruction of enemy air targets; staff them with trained personnel; provide laser, lighting devices for capturing and destroying targets at night; provide weapons [especially the newest (large-caliber) models, MANPADS of the "ground – air" class] and equipment (mobile complexes based on an SUV) with an air target detection system, which, in turn, will be connected to the network of air defense units of the Air Force Armed Forces

Conclusions

1. Today, the state of protection of critical infrastructure from air targets does not allow to fully protect the specified objects, which requires increasing the effectiveness of protection of critical infrastructure from air targets, including cooperation with other military and law enforcement formations.

2. The state of critical infrastructure objects that are subject to protection and defense has infinite variability in its composition depending on the spatial indicators of the location of these objects, their importance for the state's defense capability and the degree of protection. A problem has been identified in the components of the defense system and the protection of critical infrastructure objects from enemy air targets. Proposals have been submitted for the organization of cooperation with air defense units of the Air Force of the Armed Forces of Ukraine to detect enemy air targets aimed at destroying critical state infrastructure facilities protected by the National Guard of Ukraine.

3. It is proposed to define the defense sectors of critical infrastructure objects, formed on the necessary types and types of weapons and equipment, which are necessary for the destruction of air targets. The formation of defense sectors of critical infrastructure facilities should be based on the effectiveness of combating air targets based on game theory.

Further scientific research will make it possible to determine the need for separately formed units, which will be scientifically justified, to be part of military units (units) for the protection of critical infrastructure objects for the destruction of air targets. The conducted analysis will make it possible to solve the problem regarding the number of fire groups (mobile groups), which will be created in the future in units that ensure the destruction of air targets.

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ОБҐРУНТУВАННЯ СИЛ І ЗАСОБІВ НАЦІОНАЛЬНОЇ ГВАРДІЇ УКРАЇНИ, ЗАЛУЧЕНИХ ДО ВИКОНАННЯ ЗАВДАНЬ ІЗ ЗАХИСТУ КРИТИЧНОЇ ІНФРАСТРУКТУРИ ВІД ПОВІТРЯНИХ ЦІЛЕЙ

Проведено аналіз об'єктів критичної інфраструктури, які мають різні ступені категорії критичності, важливості призначення окремих підрозділів для знищення повітряних цілей.

Досліджено наявні об'єкти критичної інфраструктури, які підлягають охороні та обороні Національною гвардією України в умовах протистояння збройній агресії російської федерації, та зони відповідальності оперативно-територіальних об'єднань і військових частин безпосереднього підпорядкування, які здійснюють охорону та оборону визначених об'єктів.

Розглянуто потребу в складових системи оборони із захисту об'єктів критичної інфраструктури військовими частинами (підрозділами) Національної гвардії України, що виконують завдання зі знищення повітряних цілей противника.

Проаналізовано організацію взаємодії у загальній системі виявлення повітряних цілей, яка з'єднана з мережею Повітряних Сил Збройних Сил України, підрозділів протиповітряної оборони і має на меті виявлення повітряних цілей противника, спрямованих на руйнацію об'єктів критичної інфраструктури країни, що охороняються Національною гвардією України.

Пропонується шляхом визначення секторів оборони об'єкта критичної інфраструктури сформувати необхідний тип та кількість озброєння і техніки, що необхідні для знищення повітряних цілей як у підступах до об'єкта, так і у віддаленні від нього.

Ключові слова: *Національна гвардія України, повітряні цілі, об'єкти критичної інфраструктури, вогнева група, мобільна група, окремі підрозділи зі знищення повітряних цілей.*

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