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UDK 355.45.02

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Some ways to develop the capabilities of the forces (forces) for their use in the hybrid war

Resume. The article is devoted to the problem of the development of capabilities of the forces of defense and strategic direction for more effective counteraction to Russian aggression.

Keywords: capabilities, defense, security and defense, strategic defense, strategic military management.

Formulation of the problem. The defense reform that is being implemented in Ukraine, as indicated in the Roadmap for Defense Reform, aims to acquire and maintain the required level of combat readiness and ability to perform defensive tasks for defense of the state (defense capabilities) for effective response to military threats.

The main efforts of the Ministry of Defense and the General Staff are focused on fulfilling the tasks and tasks of the Armed Forces of Ukraine in the antiterrorist operation, balancing the structure, composition and number of military and military units, increasing the combat capability of the troops (forces), providing them with comprehensive support, and establishing normative -legal basis for the further development of the Armed Forces. This is set out in the 2016 White Paper.

The main road signs here, besides the ones mentioned here, should be considered the Action Plan on the Implementation of the Defense Reform in 2016-2020 (Road Map of Defense Reform), however, approved only by the Ministry of Defense of Ukraine, and not by the President of Ukraine (hereinafter - Road Map); Annual National Program under the auspices of the Ukraine-NATO Commission for 2017, as well as the Defense Planning Recommendations based on the capabilities of the Ministry of Defense of Ukraine and the Armed Forces of Ukraine, approved by the Ministry of Defense of Ukraine on June 12, 2017 (hereinafter referred to as the IA Recommendations) and some others.

The unresolved current problem here is the lack of a unified strategic leadership of the defense forces, the solution of which the Roadmap has identified as the first strategic goal of defense reform in approaching NATO principles and standards.

A significant problem identified there, and the goal of defense reform, is the development of operational (combat, special) capabilities not only of the Armed Forces, but also of the forces of defense necessary for them to effectively counteract armed aggression and the defense of the state. The problem of implementing consolidated planning for the development of all components of the defense forces, based on the ability to more effectively apply them in conditions of hybrid Russian aggression, remains an important issue here.

Analysis of recent research and publications. The problem of transition to a new format for countering aggression and development for this necessary troops (forces) of defense capabilities for their effective use in conditions of hybrid aggression of the Russian Federation is a new one. In modern literature, including the professional military, it is not sufficiently explored. General theoretical aspects of it are widely covered in a separate monograph edited by Academician V.P. Horbulina It is described in the recently published US textbook with the appropriate recommendations for troops and military personnel, which is closer to the troops on the basis of modern experience, including Ukrainian ones.

The above-mentioned problems are also investigated by specialists of the Ministry of Defense of Ukraine, as well as by the authors of this article in the monograph and other specialists. However, due to their considerable complexity, they require more detailed study and discussion and more advanced regulation.

The purpose of the article is to find and substantiate effective ways of solving the above problems in the security and defense sector of Ukraine and to develop the capabilities of the defense forces more effectively, transfer them to a new format of strategic guidance and counteract the aggressor.

Presentation of the main material. The implementation of the above-mentioned conceptual documents, as defined in the Roadmap, is considered a key to achieving the expected result from the implementation of a defense reform regarding the establishment, in accordance with the principles and standards adopted by NATO member states, of efficient, mobile, equipped with modern weapons, military and special equipment of the forces of defense a model of 2020 that can guarantee the defense of the state and adequately and flexibly respond to military threats to the national security of Ukraine, rational use of this has available potential (capabilities) and resources.

An analysis of the experience of NATO member states shows that here the focus should be on the stages of determining the principles of state policy or the needs of the capabilities of the forces (forces) and their distribution, as noted by the experts of the Ministry of Defense of Ukraine, and the development of certain basic components of the components of capabilities that are in most of the aforementioned above states are almost identical (*Fig.* 1).

Ingredient components capabilities	**USA**	**Canada**	**UK**	**Australia**	**Bulgaria**
Doctrine, concept	+	+	+		+
Command and control	+	+		+	+
Organization	+	+	+	+	
Collective training	+	+	+	+	+
Interoperability	+				+
Infrastructure	+	+	+	+	+
Information		+	+		
Armament systems	+	+	+	+	
Personnel	+	+	+	+	+
Logistics		+	+	+	+
Research		+			

Fig. 1. Components of operational capabilities of troops in foreign countries

Here, along with the doctrinal components, due attention should be paid to the creation of a new format of the system of strategic guidance by the defense forces, that is, strategic military management and a united system of strategic guidance by the forces of defense, that is, command and control.

Considering these components (components) of the capabilities of the forces of defense, especially strategic management of defense forces and strategic military management, it is necessary first of all to delimit them. In the legislation they are not specified and not demarcated. But the object of strategic military management, in our opinion, should be not only the Armed Forces (AP), but the defense forces as a whole.

One of the main conditions for the establishment of a defense system based on NATO principles and standards, as evidenced by the personal experience of one of the authors of this article, acquired in the respective posts in the troops, should be the reestablishment of the Joint Operational Command (JOC) as a management and operational strategic force group, as well as army corps as operational-tactical associations. And the Commander-in-Chief of the Armed Forces must lead the strategic military command with all defense forces. He should be directly subordinated to the Commander of the OSC, Commanders of the Armed Forces, Airborne Forces and Military Intelligence. The JS commander, through the Joint Operational Headquarters (JOH), must manage the grouping intended to defend the state from the aggressor.

According to the experience of conducting wars and military conflicts, including in the ATO, for the direct control of the defense forces it is expedient to establish both the Chief of Staff of the Commander-in-Chief of the Armed Forces, as in the NATO member states where the basis of the organization of military management is the Joint staff.

The analysis of the nature of military threats and the latest methods of preparation and conduct of hybrid wars, as well as the experience of conducting military operations in the ATO, confirm the need for the integration of management efforts of leadership in all areas of Ukraine's security and defense into a new system of strategic direction of the security and defense sector of a new format in accordance with modern conditions and needs. This approach will be in line with NATO's basic principles for distributing and delegating responsibility when formulating and implementing decisions across the entire administration, from military-political leadership to a separate unit.

The foreign experience of solving similar problems and the experience of conducting

military operations in the ATO is confirmed by the lack of readiness of the components of the security and defense sector of Ukraine, including its strategic leadership and defense forces, to adequately counteract Russian aggression. The false oversight of the past threats of the war on the part of the Russian Federation undermined the necessity to create operational-strategic and mobile tactical armies in Ukraine, which became the main argument for the organization of its defense on the territorial principle, that is, by the forces of the Brigades in the Operational Command (OC)

The basis for the formation of the above capabilities of the troops (forces) should be the requirements for the preparation and application of military command units, types / families of troops (forces) and their comprehensive provision, as defined by relevant regulatory normative (*doctrinal or conceptual*) documents (martial statutes, manuals, regulations, etc.), as well as the relevant NATO standards (*Allied Forces Standards*), in particular:

general force requirements (*AFS Vol. I - General force standards*);

For Land Forces (*AFS Vol. II - Standards for Land Forces*);

for Air Forces (*AFS Vol. III - Standards for Air Forces*);

For Naval Forces (*AFS Vol. IV - Standards for Maritime Forces*);

for Joint Headquarters (*AFS Vol. V - Joint Headquarters*);

for Special Operations Forces (*AFS Vol. X - Standards for Special Operations Forces*). Such recommendations are provided by the Ministry of Defense of Ukraine.

It is also permitted to apply the basic standards defined by the Ministry of Defense, the Allied Joint Publications, Allied Publications, Allied Tactical Publications, which are appropriate for the implementation in Ukraine of the same.

Taking into account the positive experience of NATO member states, the main consolidating base of the strategic direction of the security and defense sector of Ukraine, in our opinion, may be the National Security and Defense Council of Ukraine, provided that the legislative functions of its functions and organizational structure are clarified. Its main functions in this area can be:

assessment of the military-political, economic, informational, criminal and other situation and its impact on the security and defense of the state;

definition of threats to national security in all spheres of vital activity of the state;

substantiation of strategic goals, goals and main directions and tasks in all spheres of the state's operation to combat the hybrid aggression of the enemy;

the formation of comprehensive anti-aggression programs at each stage of the preparation and conduct of hybrid aggression of the enemy;

drafting of necessary legislative and other normative-legal acts on defense of the state and preparing them for submission to the Verkhovna Rada of Ukraine according to the established procedure;

coordination and control of executive bodies, and in the special period of private business, in the field of national security and defense, etc.

And in order to achieve the expected result of defense reform on the development of the necessary operational capabilities of troops (forces), it is also necessary to develop all their constituent components. In particular, this requires planning and joint training of forces (forces). To do this, the General Staff of the Armed Forces of Ukraine, in accordance with clauses 5.12 and 5.14 of the IA Recommendations, should develop a "comprehensive document on the development of capabilities of the Armed Forces", which will be approved by the Minister of Defense of Ukraine. It will also meet the requirements of the Concept of Development of the Security and Defense Sector of Ukraine, which defines the Ministry of Defense of Ukraine as responsible for the components of the security and defense sector of Ukraine for planning, responding to threats and performing their assigned tasks. More detailed ways on the content and structure of such an integrated document are provided by the authors of this article in a separate monograph.

The mentioned comprehensive document in accordance with clause 5.14 of the IO Recommendations should be developed taking into account certain components, which are given there. They relate to the scope of tasks, forms, methods and scale of the use of the Armed Forces, the parameters of their promising organizational structure; needs for its achievement and the necessary capabilities for all basic (component) components.

It seems that it is advisable to recommend these Recommendations to the Armed Forces not only to the Armed Forces but also to other components of the Defense Forces. For this purpose, it is expedient for all the components of the defense forces to develop and approve by the President of Ukraine the relevant Provision on the organization and implementation of strategic

planning in the security and defense sector with the further development and approval of the Defense Ministry on the basis of recommendations for the implementation of the above-mentioned Regulations in the modern conditions for all the components of the defense forces.

Considerable attention should be paid to the development of military education and science, the improvement of training programs for the training of competent military specialists in all professional fields and the needs of troops (forces). It is worthwhile to use foreign experience. In particular, the United States recently issued a Recommendation Manual on the Russian New Generation Warfare Handbook (Russian Asmic Warfare). It is intended to increase American military awareness of Russia's tactics in the hybrid war against Ukraine and how to oppose it. It provides good recommendations for US battalions and brigade combat groups to combat Russian methods of warfare, and it is noted that American soldiers should do the same, because as it is emphasized there: “Only fools learn from their mistakes. The wise man learns from the mistakes of others”.

Conclusions

1. The scale of modern military threats from Ukraine by the Russian Federation requires the reduction of the defense system of the state to the requirements of martial arts and world experience, namely the creation of an operational-strategic grouping of the forces of the forces of defense in the south-east of Ukraine under the sole leadership of the OIC, as well as mobile operational tactical factions in the composition of the army corps to ensure the formation of an operational-strategic grouping of the troops (forces) of the Armed Forces of Ukraine and other components of the defense forces on the territory of the south-eastern regions of the state.

2. Priority for the use of defense forces against the hybrid aggression of the RF remains the complex planning and development of the necessary capabilities.

The direction of further research. To solve the above problems, it is necessary to improve the current legislation of the security and defense sector, to define in it all the components of the defense forces and their functions, the procedure for interaction and application in the cases provided by law, the order of planning and development of the necessary capabilities, all components to ensure more effective fulfill their assigned tasks for the defense of the state from the aggressor.

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Деякі шляхи розвитку спроможностей військ (сил) для їх застосування у гібридній війні

Резюме. Стаття присвячена проблемі розвитку спроможностей складових сил оборони та стратегічного керівництва ними для більш ефективної протидії російській агресії.

Ключові слова: спроможності, сили оборони, сектор безпеки і оборони, стратегічне керівництво силами оборони, стратегічне військове управління.

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Некоторые пути развития возможностей войск (сил) для их применения в гибридной войне

Резюме. Статья посвящена проблеме развития возможностей составляющих сил обороны и стратегического руководства ими для эффективного противодействия российской агрессии.

Ключевые слова: возможности, силы обороны, сектор безопасности и обороны, стратегическое управление силами обороны, стратегическое военное управление.

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Analysis of the foundations of strategic leadership of the Armed Forces of Ukraine, other components of the defense forces

Resume. The article analyzes the existing system of **strategic management** by the armed forces of Ukraine and other components of the defense.

Keywords: strategic management, management system.

Formulation of the problem. The assessment of the state of military security carried out within the framework of the comprehensive review of the security and defense sector of Ukraine revealed a number of problems in the strategic direction of the Armed Forces and other components of the Ukrainian Defense Forces: the lack of a united defense guard ship that would be carried out in accordance with the principles and standards adopted by the members of NATO; the lack of a clear division of responsibility for the formation and use of defense forces, which negatively affects the ability of the state leadership to effectively manage the defense sector; low efficiency of the system of operational (combat) security, communication, intelligence; excessive volumes and non-relevance of the regulatory framework in the field of defense; the lack of an automated logistics management system [1-3], and the organization of an interdepartmental grouping of troops (forces) and management [4]. Analysis of existing scientific and methodological approaches, ways and mechanisms for solving these problems, improving the process of strategic guidance of the Armed Forces of Ukraine, other components of the defense forces in accordance with the principles and standards of NATO and its implementation, algorithm of interaction of its subjects, substantiation of recommendations for its further development in modern security conditions and prospects, the development and improvement of the necessary legislative framework for this remains an urgent scientific problem that needs to be solved in the most perceptively.

Analysis of basic research and publications. Problems related to the strategic direction of the Armed Forces of Ukraine, other components of the defense forces in accordance with NATO principles and standards are considered in publications by VP Bocharnikov, MM Denejkina, MM Lobka, S. M. Nechhayeva, Yu V. Pundy, I. S. Romanchenko, I. S. Rusnak, F. V. Saganyuk, S. V. Sveshnikov, V. M. Telelim, R. I. Timoshenko, V. S. Frolov and other experts. The authors of these works consider the general approaches to the existing system of public administration of the processes of formation and implementation of defense policy of Ukraine, reveal the issues of geopolitical aspects of ensuring Ukraine's defense capability, provide the conceptual foundations for ensuring the defense capability of the state, point out the need to concentrate the main efforts of scientists and practitioners on the formation of the basics of transition to NATO standards , the creation of the appropriate regulatory framework, the introduction of a new conceptual categorical apparatus, determining no list of basic military standards of NATO, which should be taken into account. At the same time, the imperfection of the legislative framework, the lack of elaboration of the methodological principles in the field of national security and defense of Ukraine predetermine the absence of general and systemic legal bases for the formation and development of the security and defense sector of Ukraine, does not ensure the maintenance of the capabilities of the forces of defense at the appropriate level, which would guarantee them high combat readiness and combat capability to repel armed aggression against Ukraine, allows ineffective use of state resources allocated to maintain combat readiness including the combat capability of the forces (forces) involved in the anti-terrorist operation (ATO).

The purpose of the article is to summarize and analyze the problems of strategic direction of the Armed Forces of Ukraine and other military formations.

Presenting main material. The system of strategic direction of the Armed Forces of Ukraine is an integral part of the system of government leadership, as defined by the Constitution and a

number of laws of Ukraine. In accordance with the Constitution of Ukraine, the President of Ukraine is the head of state and "exercises leadership in the areas of national security and defense of the state" [5]. In this context, it should be emphasized that according to Art. 106 of the Constitution of Ukraine "The President of Ukraine can not transfer his powers to other persons or bodies." This is an important provision that explains why the President of Ukraine, as the head of state, does not have a vice president or deputies, and such bodies as the National Security and Defense Council (NSDC) of Ukraine, the Stake of the Supreme Commander-in-Chief (VGK), and others are only the coordination bodies with him. The Constitution of Ukraine gives the President the right to "decide on the use of the Armed Forces of Ukraine in the event of armed aggression against Ukraine" (Article 19, Article 106) [5] as the Supreme Commander-in-Chief of the Armed Forces of Ukraine (Article 17, Article 106). The development of the provisions of the Constitution of Ukraine in a number of laws of Ukraine defines other powers of the President of Ukraine regarding the leadership of the Armed Forces of Ukraine, for example, in the Law of Ukraine "On the Armed Forces of Ukraine": "The leadership of the Armed Forces of Ukraine within the limits provided by the Constitution of Ukraine is exercised by the President of Ukraine as the Supreme Commander-in-Chief of the Armed Forces of Ukraine "(Article 7) [6]. In addition, in Art. 4 of the Law of Ukraine "On Defense of Ukraine" states: "In the event of armed aggression against Ukraine or the threat of an attack on Ukraine, the President of Ukraine decides on ... the use of the Armed Forces of Ukraine and other military formations established in accordance with the laws of Ukraine ..." [7] Ukraine, as the Supreme Commander-in-Chief of the Armed Forces of Ukraine, does not directly manage the operations (combat actions) of formed groups of forces (forces), and "makes decisions on ... the use of the Armed Forces of Ukraine and other military formations." Thus, the post of the President of Ukraine and the Supreme Commander-in-Chief of the Armed Forces of Ukraine is intended to unite the political and military leadership in the state in the event of a war and direct the use of military force to achieve political goals in defending the national interests of the state.

State defense by political, economic, social, informational and other measures contains a military component, which involves the development of a military policy to ensure military security and the repression of armed aggression against Ukraine. The management of the reflection of armed aggression is a special type of administrative activity that requires special knowledge, skills and experience and necessitates the creation of a separate governing body under the President of Ukraine with specific functions. To date, such a body has determined the rate of VGK. The WGC rate forms as the highest collegial body of the military leadership of the state defense to provide strategic guidance to the Armed Forces of Ukraine, other military formations and law enforcement agencies during a special period (in modern conditions, it is possible to talk about the strategic direction of the Armed Forces of Ukraine and other components of the defense forces) (Art. 8) [7]. According to the results of consideration at certain meetings of the Stakes of the VGC, the President of Ukraine-Supreme Commander-in-Chief of the Armed Forces of Ukraine makes the appropriate decision (in this case, no vote is taken). The decisions come into force in accordance with the directives and orders of the Supreme Commander-in-Chief of the Armed Forces of Ukraine and are binding. Thus, the WGC Stage is an important and necessary element of the state control system, the military leadership of the state defense during a special period, is intended to provide strategic guidance to the Armed Forces of Ukraine, other military formations and law enforcement agencies during a special period. The existing system of strategic guidance of the Armed Forces of Ukraine and other components of the defense forces in accordance with the current legislation is given in Fig. 1. The Cabinet of Ministers of Ukraine (CMU) is the supreme body in the system of executive power bodies (Article 113), which "directs and coordinates the work of ministries and other bodies of executive power" (Article 116). The Cabinet of Ministers of Ukraine is responsible to the President of Ukraine and the Verkhovna Rada of Ukraine, who is controlled and accountable to the Verkhovna Rada of Ukraine within the limits provided for by the Constitution of Ukraine (Article 113) [5]. The President of Ukraine, who at the same time is also the Head of the National Security and Defense Council of Ukraine, may influence the Prime Minister of Ukraine by giving him the mandate as a member of the National Security and Defense Council of Ukraine and the CMU, for which the decision of the National Security and Defense Council of Ukraine to ensure measures in the field of national security and defense is mandatory for execution.

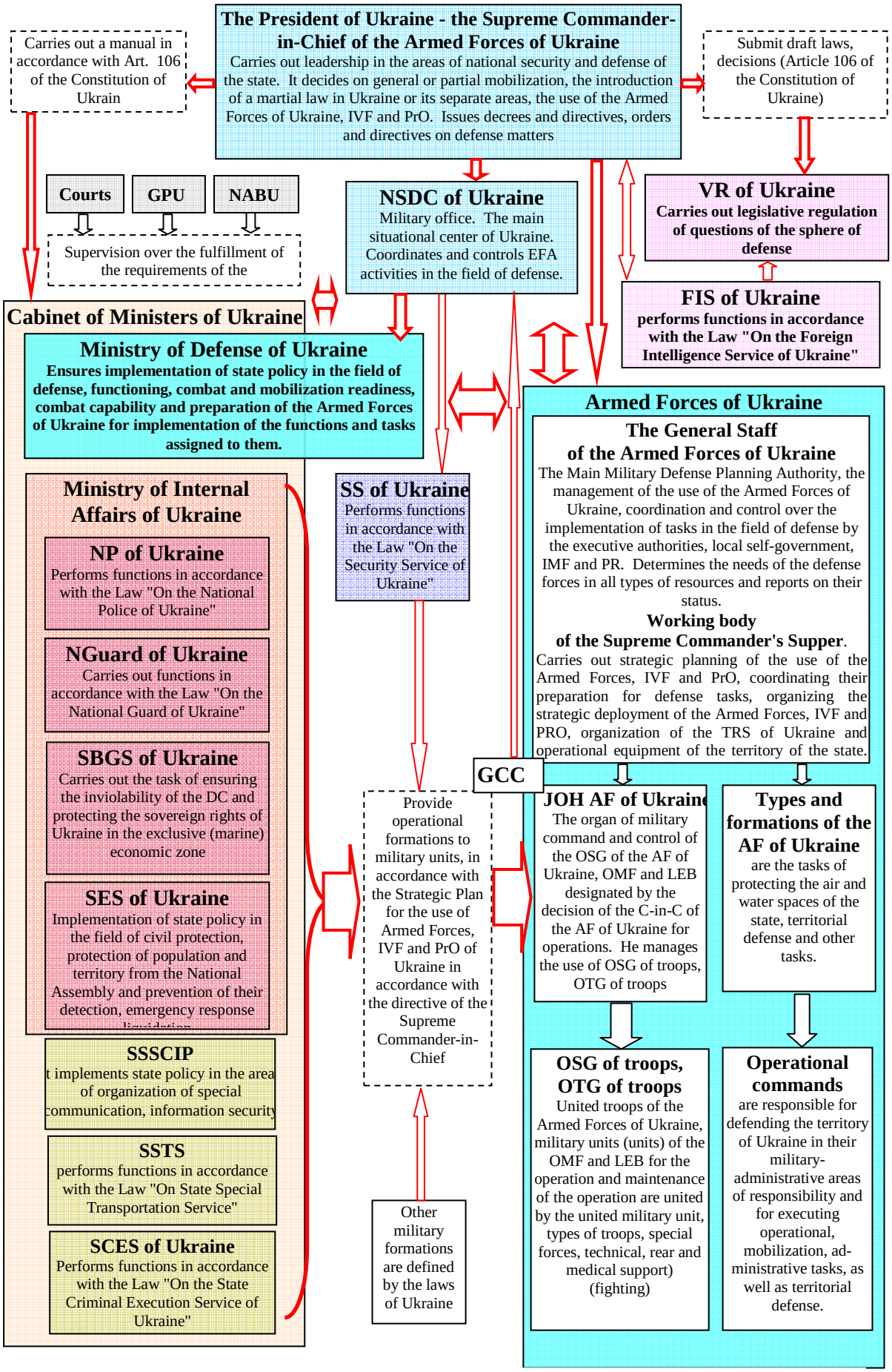

Fig. 1. Existing system of strategic command of the AF of Ukraine and other components of the defense forces

The Cabinet of Ministers of Ukraine is a collegial body headed by the Prime Minister of Ukraine. The Minister of Defense of Ukraine is a member of the CMU and is subject to the Prime Minister of Ukraine, and not to the President of Ukraine, as defined in the Strategic Defense Bulletin of Ukraine [4]. According to domestic legislation, the Minister of Defense of Ukraine is a member of the National Security and Defense Council of Ukraine, the Military Cabinet of the National Security and Defense Council of Ukraine, other state bodies, but not as a subordinate President of Ukraine, but as a member of the Cabinet of Ministers of Ukraine. At the same time, the Minister of Defense of Ukraine appoints the Verkhovna Rada of Ukraine on the proposal of the President of Ukraine. In addition, the CMU is the subject of civilian control over the Military Organization and law enforcement agencies of the state and carries out civilian control, among other things, over the Armed Forces of Ukraine (Articles 5, 6) [8]. It is worth noting such a feature that according to Clause 7 of Art. 116 of the Constitution of Ukraine, the CMU “carries out measures to ensure ... public order, fight against crime”. According to the Law of Ukraine "On the Cabinet of Ministers of Ukraine" [9] and the Regulation on the Ministry of Internal Affairs of Ukraine [10], the Ministry of Internal Affairs of Ukraine is the central executive body whose activities are directed and coordinated by the Cabinet of Ministers of Ukraine. That is why the Minister of Internal Affairs of Ukraine appoints the Verkhovna Rada of Ukraine on the proposal of the Prime Minister of Ukraine. From here, there is a conflict over the activities of the Ministry of Internal Affairs of Ukraine, which are subordinated to the National Guard of Ukraine, the National Police of Ukraine, the State Border Guard Service of Ukraine, the State Service of Ukraine for Emergencies, the State Migration Service of Ukraine, which are part of the security and defense sector of Ukraine. The Ministry of Defense of Ukraine is the central executive body under the jurisdiction of the Armed Forces of Ukraine. The Ministry of Defense of Ukraine carries out military-political and administrative management of the Armed Forces of Ukraine (Articles 3, 10) [6]. The activities of the Ministry of Defense of Ukraine are directed and coordinated by the Cabinet of Ministers of Ukraine. The main function of the ministry is to provide the needs of the Armed Forces of Ukraine at the expense of state resources available to the Cabinet of Ministers in order to acquire them the ability to fulfill the tasks specified in the Constitution and laws of Ukraine.

The Verkhovna Rada of Ukraine is the legislative body in Ukraine and does not exercise leadership over the Armed Forces of Ukraine. However, the Verkhovna Rada of Ukraine, within the limits of powers defined by the Constitution of Ukraine, legislates the issues of the sphere of defense, respectively, and the activity of the Armed Forces of Ukraine, and also "approves the decision of the President of Ukraine on the use of the Armed Forces of Ukraine in the event of armed aggression against Ukraine" (Article 9, Article 85) [5]. In addition, the Verkhovna Rada of Ukraine is the subject of civil control over the Military Organization and law enforcement agencies of the state and, among other things, exercises parliamentary control over the Armed Forces of Ukraine (Article 6) [8]. The National Security and Defense Council of Ukraine is the coordinating body for national security and defense under the President of Ukraine. However, the National Security and Defense Council of Ukraine does not have authority (in particular with regard to the strategic direction of the Armed Forces of Ukraine), and therefore its decisions come into force in accordance with the decrees of the President of Ukraine, which become obligatory for executive authorities, including The Ministry of Defense of Ukraine, and consequently the Armed Forces of Ukraine, which are under its jurisdiction. In fact, with the help of the National Security and Defense Council, the President of Ukraine, as the head of state, implements the powers conferred on him by the Constitution of Ukraine on leadership in the areas of national security and defense of the state. The military unit of the National Security and Defense Council of Ukraine is the working body of the National Security and Defense Council of Ukraine during a special period [12]. The military office increases the significance, details and specifies the powers of the National Security and Defense Council of Ukraine on armed struggle in the absence of the WGC Pledge in the conditions of the ATO, as well as defines the procedure for the formation and functioning of “structures of the security and defense sector of Ukraine”. His tasks and powers combine the tasks and powers of the National Security and Defense Council of Ukraine and the WGC Pledge. The military cabinet does not have authority, however, offers proposals to the National Security and Defense Council of Ukraine, at its meetings, and makes decisions on issues of its competence by open voting by a majority of its members. The decisions taken, drawn up by the protocols, may be sent for consideration to the central and local

executive authorities, military management bodies, law enforcement agencies, military and civilian administrations. Consequently, the Ukrainian NSDC Military Cabinet may exercise certain powers indirectly through its members - the Minister of Defense of Ukraine and the Chief of the General Staff - Chief of the Armed Forces of Ukraine.

The General Staff of the Armed Forces of Ukraine, the main military authority for planning the defense of the state, the management of the use of the Armed Forces of Ukraine, coordination and control over the implementation of tasks in the field of defense by the executive authorities, local self-government bodies, military formations established in accordance with the laws of Ukraine and law- defined by the Law of Ukraine "On the Defense of Ukraine", other laws of Ukraine and normative and legal acts of the President of Ukraine, the Verkhovna Rada of Ukraine and the Cabinet of Ministers of Ukraine. The General Staff of the Armed Forces of Ukraine during a special period is the working body of the Supreme Commander's Charge (Article 11) [7]. Chief of the General Staff The Chief of the Armed Forces of Ukraine exercises direct military command of the Armed Forces of Ukraine (Article 8) [6]. As practice has shown, the existing system of strategic guidance of the Armed Forces of Ukraine functioned in peacetime and to a certain extent provided leadership of the Armed Forces of Ukraine and the preparation of the state for defense. The strategic plan, the plan for the use of the Armed Forces of Ukraine, other military formations and law enforcement agencies, plans for mobilization, territorial defense, defense planning documents, development of the Armed Forces of Ukraine, daily activities, etc. were worked out. At the same time, as shown by the experience of Ukraine's Armed Forces participation in the ATO, the most problematic in the management of the Armed Forces of Ukraine is the combination of a significant amount of functions and tasks of daily activities and management of the use of the Armed Forces of Ukraine for the Armed Forces of Ukraine and other bodies of military command of the Armed Forces of Ukraine. In addition, the study revealed a number of problematic issues in the organization of strategic direction of the defense forces of the security and defense sector of Ukraine, in particular:

since the beginning of the military aggression of the Russian Federation against Ukraine, the system of management of all spheres of the state, including defense forces, has not been transferred to the regime of functioning in the conditions of the legal regime of the military state (a special period). This greatly complicates the research, study and analysis of the effectiveness of strategic guidance by the Ukrainian defense and security sector in practice; An analysis of the organization of the management of the forces of the forces during the ATO in the East of Ukraine shows the low efficiency of operational commands. The real threats to Russia for full-scale aggression require consideration of the expediency of the restoration of army corps and the formation of an operational-strategic group under the leadership of the commander of the combined forces in the territory of the south-eastern regions of Ukraine; the powers of the National Security and Defense Council of Ukraine, as defined by the Constitution of Ukraine and the Law of Ukraine “On the National Security and Defense Council of Ukraine”, the presence in its composition of the Military Cabinet determines the necessity of conducting additional research on the feasibility of establishing the Supreme Commander's Supplement for a special period; To study the methodological approaches and experience of reforming the system of strategic direction of the security and defense sector of Ukraine, one should take as an example the states that are similar to Ukraine according to military traditions, level of economic development, military potential, role and place in geopolitical space and existing threats in the military sphere. Together, the listed problems and disadvantages of the strategic leadership of the Ukrainian Armed Forces significantly impede the effective work of the Ministry of Defense of Ukraine and the General Staff of the Armed Forces of Ukraine and other bodies of military command of the Armed Forces of Ukraine in relation to the implementation of the assigned functions and tasks for the management of the troops (forces) of the Armed Forces of Ukraine. During the ATO, a number of deficiencies were identified in the regulatory documents, some inaccuracies or inadequate coverage of the underlying issues. As a result, there was a need to analyze the documents and further improve them, in particular regarding the definition of the Ukrainian Defense and Security Forces Defense Forces Authority, as well as the mechanism for managing them. The Military Doctrine of Ukraine (paragraph 25) [2] provides a mechanism for involving other components of the security and defense sector of Ukraine (SBA), namely: the decision on the application (involvement) of the Armed Forces of Ukraine, the State Service for Special Communications and Information Protection of Ukraine, the State the special transport service, other military units

formed in accordance with the laws of Ukraine, special forces law enforcement agencies in the event of external aggression, internal armed conflict or massive manifestations of terrorism, shall be adopted by the President of Ukraine in accordance with their powers;

the Joint Committee on Intelligence under the President of Ukraine will ensure coordination of the activities of the intelligence agencies of Ukraine in the relevant areas (paragraph 40). However, some other uncertainties arise from the other provisions of this doctrine: the material and technical basis of the management system of the SBI of Ukraine will be the Main Situation Center of Ukraine, the network of departmental situational centers, the resources of the Antiterrorist Center under the Security Service of Ukraine, the Main Control Center of the Service of the State Border Guard Service of Ukraine, similar departments of other components of the sector security and defense, which will be reformed in order to achieve a higher level of interaction (paragraph 35); it is envisaged to expand the possibilities of the Main Situation Center of Ukraine to ensure coordination and control over the activities of executive authorities, law enforcement bodies and military formations in the field of national security and defense in peacetime, in a special period, in conditions of martial law, state of emergency and in the event of crisis situations, which threaten the national security of Ukraine (paragraph 39). The question of the strategic direction of the SBU Defense Forces is added only to the provision that the material and technical basis of the management system of the security and defense sector of Ukraine will be the Main Situational Center of Ukraine and the network of departmental situational centers that are not management bodies, but only analytical structures to which the functions of coordination and control are assigned. One of the ways of solving these problems (taking into account experience in world practice) is the division of functions of the Ministry of Defense of Ukraine and the General Staff of the Armed Forces of Ukraine, which will ensure a significant increase in the level of leadership of the Armed Forces of Ukraine.

Conclusions. Thus, the article analyzes the issues of strategic direction of the Armed Forces of Ukraine, other components of the defense forces. To date, the establishment of a system of strategic guidance by the Armed Forces of Ukraine, other components of the defense forces in accordance with the principles and standards adopted in the NATO member states, has been identified as the strategic goal No. 1 of the defense reform. The system of strategic leadership is currently in the process of launch, so certain problems require further research. At the same time, no methodological approaches have been developed to improve the strategic direction of the Armed Forces of Ukraine and other components of the defense forces. Consequently, the direction of further scientific research is expedient to determine the development of methodological approaches to improving the strategic direction of the Armed Forces of Ukraine and other components of the defense forces.

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Аналіз основ стратегічного керівництва Збройними Силами України, іншими складовими сил оборони

Резюме. У статті проаналізовано існуючу систему стратегічного керівництва Збройними Силами України та іншими військовими формуваннями.

Ключові слова: стратегічне керівництво, система управління.

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Анализ основ стратегического руководства Вооруженными Силами Украины, другими составляющими сил обороны

Резюме. В статье проанализирована существующая система стратегического руководства Вооруженными Силами Украины и другими составляющими сил обороны.

Ключевые слова: стратегическое руководство, система управления.

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Analysis of NATO peacekeeping operations

Resume. This article examines military and political aspects of NATO participation in operations abroad. The chronology of NATO's participation in international operations is defined and the practical aspect of participation is presented, including the already completed missions and the ongoing ones.

Keywords: peacekeeping operations, military policy, security, armed forces, UN, NATO, EU.

Formulation of the problem. The last decade of the last century and the beginning of the present are characterized by the prevalence of new threats to human security: military-political conflicts, hybrid wars, terrorism, the proliferation of weapons of mass destruction, the spread of drugs, the instability of individual states through the existence of a crisis of state power, etc.

One of the instrument for resolving conflicts is the use of military force in the form of peacekeeping operations (hereinafter PO), which are in the stage of active development and is a relatively new phenomenon in the world community. The PO remains an effective political instrument for resolving military-political conflicts, which provides a solution to a set of tasks that can not be solved by any state separately.

The purpose of the PO is to terminate military conflicts; prevent their escalation; creating conditions conducive to the political resolution of controversies and the elimination of the possibility of a recurrence of conflict; ensuring law and order in the conflict zone; carrying out humanitarian operations; the restoration of conflicts of social and political systems. Participation in the PO becomes part of the military policy of states and international organizations and influences the formation on their military doctrines and the reform of the armed forces that meet modern requirements and will be able to ensure the realization of national interests in the military sphere.

The process of transformation of the armed forces that leads to the need for an analysis, systematization and study of the experience of NATO's PO in the face of new challenges and threats that arise far beyond the Alliance's area of responsibility.

The information base for writing the article is the materials of the Ministry of Defense of Ukraine, NATO documentation on international peacekeeping activities; information on the participation of the armed forces of NATO member countries and partner countries in the PO; works of domestic and foreign scientists, etc.

The purpose of the article. Analyze and systematize the formation of the concept of NATO peacekeeping activities and the experience of holding the Alliance's Allies in the context of a NATO reorientation of collective defense into collective security.

Presenting the main material. The primary responsibility for the maintenance of international peace and security lies with the United Nations Security Council (UN SC), which, in essence, plays a decisive role in strengthening security and stability in any region of the world. The UN SC decides to cease fire, send groups and missions to an area of armed conflict or conduct peacekeeping operations by troop contributing countries under the auspices of the UN.

There are no military units in the UN. This makes it, in certain cases, appealed to some countries or international organizations such as the European Union (EU), the African Union (AU), the North Atlantic Treaty Organization (NATO), or individual countries or coalitions of countries that express their desire to perform certain functions peacekeeping or compassionate peace, capable of implementing the Security Council’s decision.

The Alliance is a long-standing intergovernmental association formed on the basis of common ideological values. The common goal of alliance members is not so much the protection of their territories and sovereignty, but the protection of a certain type of political regime, the

common principles of building society, lifestyle and ideological orientations.

Every year there is a steady tendency to strengthen NATO's role in resolving military-political conflicts. The interest in resolving conflicts is because after the end of the Cold War and the collapse of the USSR, the need to contain the Soviet military threat was no longer necessary. The functions of conflict resolution contributed to "maintaining the Bloc, updating it and ensuring the stability of military-political ties between the European powers" [1, c.41].

In 1990, NATO for the first time in its history at the Summit of Heads of State and Government of the Alliance unveiled the London Declaration on the Transformation of the North Atlantic Alliance. In November 1991 the Roman Declaration was published, which set out a new Strategic Concept of the Alliance, which emphasized that the security of Allies remained the main task of the alliance, but in the new concept, it was combined with a specific commitment to work on improving and expanding pan-European security [2].

The new Strategic Concept of the Alliance proclaimed the "flexibility" of the functions and included regional conflicts in the list of "challenges and risks" that replaced the former "threat from the east" [3, p. 122].

The doctrinal formulation of the readiness of the Alliance to participate in peacekeeping operations under the mandates of other organizations took place:

in June 1992, at a meeting in Oslo, the NATO Council first formally declared the Alliance's willingness to participate in the OPMF on the basis of the OSCE mandate [4, c.312-320];

in December 1992, at a meeting in Brussels, the NATO Council reiterated the readiness of the alliance to take part in UNFPA in the event of a UN Secretary-General's address [4, c.320-328].

The immediate development of the doctrine of NATO PO has been linked to the development of the crisis in the former Yugoslavia (1992-1994) and the appeals of the OSCE and the UN. NATO's staff has been developed and adopted by:

MS 327 "NATO Military Planning for Peacekeeping Operations" [5];

Comprehensive Document "NATO Doctrine for Peacekeeping Operations" [6].

In April 1999, at the Washington Summit, NATO member states adopted a new Strategic Concept, which identified security risks as "multidirectional and difficult to predict" [7]. The goal of NATO remains unchanged - to protect the freedom and security of all members of the Alliance. However, the security approach in the 21st century is fundamentally different from the past; namely, the threats of the country are defined as those that may emerge far beyond its borders and on the basis of this decision to prevent conflicts and crisis management outside the Alliance's area of responsibility. That is, since 1999, NATO has moved to a new stage - from collective defense to collective security.

The implementation of this strategy has been demonstrated in NATO operations outside its treaty area in operations in the territory of Yugoslavia, as well as in the Gulf, Somalia, Haiti, Libya and Afghanistan.

NATO's Istanbul Summit in 2004 [8] answered the question - how the Alliance will ensure its stability through its active actions, namely:

building security relations with a growing number of partner countries: from the Balkans through the Caucasus to Central Asia, across the Mediterranean to the Arab world;

conducting military and other operations (where necessary) from patrolling the Mediterranean Sea area to peacekeeping operations in the Balkans in Iraq and Afghanistan.

The formulated NATO peacekeeping concept has made it possible to gain a solid result of NATO's operations - successful PO, not only in Europe but also in Asia and Africa, indicating a significant expansion of the geographical scope of missions outside the Alliance's area of responsibility. The completed NATO PO and the ongoing operations are listed in Table 1.

Table 1

NATO's involvement in peacekeeping and security operations

Period of holding	Name of mission (operation), venue	Purpose, the meaning of the operation
Completed operations		
From December 1996 to December 2004	Peacekeeping operation of the Stabilization Force (SFOR) in Bosnia and Herzegovina (hereinafter BiH).	The main objective is to create safe conditions for the civilian and political restoration of the BiH. In particular, the SFOR contingent was responsible for the containment and prevention of new hostilities, the creation of favorable conditions for the further development of the peace process, and the provision of support to the civilian

Period of holding	Name of mission (operation), venue	Purpose, the meaning of the operation
		organizations involved in this process, selectively and taking into account the available forces [9].
March 23 - June 10, 1999	NATO CAF operation in the Balkans, Serbia.	Conducted in order to persuade the leadership of Serbia and Montenegro, in particular the former president of Serbia and Montenegro, S. Milosevic, to reject the policy of violence against the Albanian population of the Serbian province of Kosovo [11, p.9].
From August 26, 2001 to March 31, 2003	In Macedonia, NATO's "Essential Harvest", “Amber Fox” and “Allied Harmony” peacekeeping operations were carried out.	The North Atlantic Council condemned the attacks of Albanian militants and adopted measures to support the government's actions; has put forward demands for constitutional reforms to strengthen the participation of ethnic Albanians in society and politics [10, p. 18-19].
February 26 - May 3, 2003	In Turkey, the "Display Deterrence" operation was conducted.	Because of the situation surrounding Iraq and the activation of Kurdish separatists in Turkey. The leadership of Turkey appealed to NATO to provide military aid to the country in connection with the threat of Iraq's aggression and the use of the latest weapons of mass destruction [10, p. 21].
From August 2 to September 29, 2004	The North Atlantic Alliance took an active part in providing security during the Olympic Games in Greece.	Were involved: aircraft DRLV E3-A "AWACS" in the mode of constant alternation in the air; battalion of radiation, chemical and biological protection; Coast Guard units and boats participating in the NATO Active Counter-Terrorism Operation in the Mediterranean Sea; police units and units of special services of the European member countries of NATO [11, p.21].
From October 2005 to February 2006.	Humanitarian mission of Pakistan	In order to overcome the consequences of an earthquake in Kashmir. involved in military transport aircraft C-17 and C-130 [10, p.20-21].
During the "Arab Spring" from March 19, 2011 to October 31, 2011, with a duration of 222 days	In Libya, an operation was conducted: Stage 1, from 19 to 31 March 2011 Operation Start of the Path. Stage 2 from March 31 to October 31, 2011 operation "United Defender".	In order to take "all necessary measures" to protect the civilian population of Libya and to introduce a zone banned from flight [11, p.12].
Ongoing operations		
Since June 11, 1999	NATO "Joint Guardian" peacekeeping operation began in Kosovo, Serbia.	A KFOR military contingent totaling 46,000 troops was put into Kosovo in order to appease the opposing sides (Albanian militants of the Kosovo Liberation Army and the Serbian Security Forces), the cessation of armed confrontation and the creation of conditions for the start of a humanitarian operation [10, p.16].
Since October 2001	The NATO “Active Endeavor” anti-terrorist operation is carried out in the Mediterranean Sea area in the territorial waters of the Mediterranean region.	The purpose of the operation is to strengthen the control of the Mediterranean Sea through the escort of commercial and passenger ships, as well as to inspect and detain suspicious vessels to prevent the illegal traffic of weapons, narcotics, people by international terrorist and criminal groups [11, p.13].
Since August 2003	Operation for maintaining security in Afghanistan by the ISAF (International Security Assistance Force), in accordance with Security Council resolutions No. 1386, 1413, 1444 and 1510.	Providing the Transitional Government and the United Nations Assistance Mission in Afghanistan to operate in the capital of Kabul in a secure environment [11, p.13-14].
Since July 30, 2004	NATO Training Mission in Iraq.	The mission was defined as a training and under

Period of holding	Name of mission (operation), venue	Purpose, the meaning of the operation
		the political control of the North Atlantic Council, which closely cooperates with the Iraqi authorities. The security and defense of the mission itself are partly multinational, partly NATO [10, p.14].
Since September 2005	NATO Humanitarian Mission in Sudan (AMIS).	With the request to mobilize Alliance resources to overcome the humanitarian catastrophe and end the violence in the Sudanese province of Darfur [10, p.13].
Since 2003	In the city of Skopje, Macedonia, NATO's governing body (headquarters) was deployed.	NATO plays an important role in coordinating efforts to rebuild the destroyed infrastructure; coordinates the activities of the political and military leadership of Macedonia in preparing the country for joining NATO [10, p.17].
December 2004	In Bosnia and Herzegovina, NATO's governing body (headquarters) was deployed.	Prior to the Alliance's aspiration, the Alliance continued to provide assistance to the BiH on the way to its formation, in particular through the creation of civilian authorities and military command, defense reform and preparation for participation in the NATO Partnership for Peace program. The headquarters also performs complementary tasks, in particular in the fight against terrorism, assistance to the International Tribunal for the Search and Detention of Persons Called for Crimes against the Peoples, exchange of intelligence with the EU, etc. [10, p.16-17].
From September 17, 2009	Operation NATO "Ocean Shield".	Based on previous NATO anti-piracy operations (Allied Provider and Allied Protector) [11, p.14].

All operations (with the exception of the air operation in the former Yugoslavia in 1999) were conducted to ensure peace and stabilize the situation in the country, the Alliance's partner countries, partners in the Partnership for Peace, provided widespread support to such operations.

The analysis of the concept of peacekeeping activities of NATO and the Allied Security Alliance in crisis-prone regions makes it possible to draw the following conclusions.

NATO is today an organization with a prevailing concept of peacekeeping and is very active in terms of operations in conflict regions. This activity also manifests itself in regions beyond NATO's "zone of responsibility", such as North Africa and the Middle East (Pakistan, Afghanistan, Iran, Iraq, Libya, Sudan, Mediterranean, off the coast of the Horn of Africa, and in Somalia and the Balkans). The expansion of stability zones has become a prerequisite for transatlantic security. Of course, the collective defense of the alliance remains its main task, however, the emergence of new challenges and threats that arise far beyond the limits of the NATO area of responsibility cannot be beyond its control. In particular, terrorism, the proliferation of weapons of mass destruction and the problem of "rogue states" are challenges that cannot be overcome, based solely on the "territorial" understanding of security. NATO's reorientation of collective defense has taken place on collective security.

At present, NATO's resources, both a military-political bloc, and the resources of member and partner countries within the Alliance's area of responsibility and beyond, are the most effective instruments for overcoming the crisis at the global level. In cooperation with NATO, the UN and the OSCE are objectively interested because the North Atlantic Bloc is an organization that has the forces ready and capable of conducting military operations on conflict prevention and resolution. Owing to a well-established communication system, the experience of conducting military actions, spent in regular exercises and maneuvers, an extensive system of information and logistics, NATO forces can quickly navigate the situation and take measures to prevent the conflict and prevent its escalation.

Further research needs to be focused on studying the security environment, the challenges and threats of the modern world of transforming the armed forces of the Allies as an instrument of the implementation of the military policy of the state. It is needed to take into account during the reforms in the Armed Forces of Ukraine in conditions of Russia's aggression against Ukraine and the foreign policy of Ukraine for integration into NATO.

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Аналіз практики проведення операцій НАТО з підтримання миру і безпеки

Резюме. У статті розглянуто воєнно-політичні аспекти участі НАТО в міжнародних операціях (місіях) за межами альянсу. Визначено хронологію участі НАТО в операціях (місіях) та представлено практичний аспект участі, включаючи завершені місії та місії, які нині проводяться.

Ключові слова: операції з підтримання миру і безпеки, воєнна політика, безпека, збройні сили, ООН, НАТО, ЄС.

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Анализ практики проведения операций НАТО по поддержанию мира и безопасности

Резюме. В статье исследованы военно-политические аспекты участия НАТО в операциях за пределами альянса. Изучена хронология участия НАТО в международных операциях(миссиях), а также представлен практический аспект участия включая завершенные миссии и миссии, которые проводятся.

Ключевые слова: операции по поддержанию мира и безопасности, военная политика, безопасность, вооруженные силы, ООН, НАТО, ЕС.

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Indicators and criteria for evaluation of effectiveness of the organization of interaction of border security subjects

Resume. The State Border Guard Service of Ukraine carries out tasks on the protection and defense of the state border. The study has substantiated the indicators for assessing the effectiveness of cooperation and the objective function has been developed for solving the problem of optimizing the choice of functional elements to perform the tasks on protection of the state border.

Keywords: interaction, state border, criterion, indicator, efficiency.

The problem statement. The protection of the state border of Ukraine and ensuring its inviolability are carried out by all the subjects of the border security ensuring: the State Border Guard Service, military formations, law enforcement agencies that carry out various types of control during the state border crossing or participate in ensuring the state border regime, the border regime and the regime at border crossing points. In accordance with the law the activities coordination of the national security subjects in the border area is entrusted to the State Border Guard Service of Ukraine.

The process of interaction of the national security ensuring subjects is a complex and dynamic process, in which there are random and determinate components as well as uncertainty regarding the behavior of both the subjects of interaction and the violators of the legislation on border issues. Under the interaction of forces we will understand the coordinated as for the tasks, directions, frontiers and time operational-service (military) actions of different forces and means involved in the state border protection in order to achieve a common goal.

As it is known, the effectiveness of any system activities is defined as the ratio of the result to the expenses. At the same time, various quantitative and qualitative indicators can be used as a result as well as expenses. For example, the result of the border crossing point operation can be: capacity, the duration of persons, vehicles and goods control. At the same time, the following indicators can be used as expenses: the cost of implementing the technological control line; the number of man-hours spent on a certain control technology. On the “green sectors” of the border, the effectiveness indicators may be the following ones: the probability of detecting a border violator, the mathematical expectation of the number of detained violators, etc. The cost indicators can be: the number of personnel per square km; the cost of resources for the control of a certain border sector, etc. In this case, the direction of increasing efficiency is the desire to maximize the specified ratio, that is, the task is to maximize the result, which falls on a unit of expenditure. By analogy it is necessary to evaluate the effectiveness of interaction according to both the effectiveness indicators and the cost indicators.

The analysis of recent researches and publications. A number of scientific works is devoted to the research of the interaction effectiveness evaluation, in particular the works by Kyrychenko I. O., Fakadei O. R., Oliferov M. V., Lytvyn M. M., Potomskyi Y. V., Chumak V. V., Mykriukov V. Y., Neklonskyi I. M. [1-7] and others, in which the methods and techniques for evaluating the interaction effectiveness are proposed. At the same time, the issue of a comprehensive evaluation of the interaction effectiveness on a set of indicators remains open.

The purpose of the article is to substantiate the indicators and criteria for evaluating the interaction effectiveness.

Presentation of the main research material. The selection of indicators and criteria for the interaction effectiveness was carried out on methodological, informational and algorithmic approaches using simulation modeling, statistical analysis, experimental and research testing of developed methods, techniques and mathematical dependencies.

The general methodology for solving the problem of structural and functional analysis of task distribution between the subjects of the border security ensuring (SBSE) is carried out in the following sequence: construction of hierarchical

structures of the SBSE; determination of functions, forms and methods of the border security ensuring by the interaction subjects; an evaluation of the functions connected with the state border protection, which will be carried out in cooperation with the SBSE; the decomposition of functions, forms and methods of the border security ensuring and the formation of an array of specific tasks for the state border protection; evaluation of the SBSE potential opportunities for performing specific tasks; calculation of the priority of the SBSE tasks; optimization of the SBSE choice for carrying out tasks on the state border protection, which are performed in interaction.

The choice of tasks and elements of operative-service construction of the system of state border protection is carried out taking into account the following factors: organizational and legal; socio-political situation in the state and in a separate region; shared task mode (peacetime, emergency, state of emergency, special period, military state); physical and geographical conditions in the areas of joint performing of tasks; the level of the situation complexity at the points of the permanent disposition of organs, subdivisions and units; possibilities of interacting structures (quantitative composition of subdivisions, armaments, equipment, special means, active defense means, etc.); the level of the conflict escalation (internal, border, military); the availability and level of the plans elaboration for coordinated use of forces and means; the availability and reliability of the communication facilities functioning, information transmission, hidden management of forces and means; the organization degree of the information exchange between the subjects of coordination; the level of resource (material and technical) provision of subjects and the possibility of restoring spent (lost) resources; the level of preparedness of the authorities, subordinated forces for the joint performing of tasks.

The authors [2; 4-6] proposed to evaluate the interaction effectiveness while performing each *i*-task, taking into account the following indicators:

θ_i – the quality of the interaction organization; Q_i – the continuity of the interaction maintenance while performing the operational task; Y_i – the efficiency of joint actions coordination by different forces; W_{ij} – the potential of combat (service-combat) capabilities of *j*-unit of different forces involved in the *i*-operational task fulfilment; G_{adp} – the degree of adaptability of the *j*-unit of different forces for the *i*-task fulfilment; Q_{apij} – is the degree of the authorities preparedness of the *j*-unit to ensure the realization of the combat potential of the forces (troops) during the joint fulfillment of *i*-task.

In the research [6] the following efficiency indicators of solving the problems of specific tasks rational distribution between the subjects of interaction have been proposed: the interaction effectiveness; resource intensity, quantity of resources, which the target effect (labor, logistical, energy, information, financial, etc.) is reached by; efficiency is defined as the time consuming required for tasks fulfillment in cooperation and autonomously; the quality of managerial influences on the interaction subjects; the continuity of interaction maintenance during the operational task fulfillment; the potential of combat (service and combat) capabilities of different forces units involved in the common tasks fulfillment.

For quantitative and qualitative evaluation of the interactions subjects' possibilities as for the common tasks fulfillment and the structural optimization of the executive elements in the form of "executors-tasks" combinations and resource support, it is proposed to apply the method of structural and functional analysis.

As a target function, it is proposed to ensure the maximum effectiveness of the actions of individual elements of the state border protection construction through the involvement of forces and means of interaction subjects for the accomplishment of common tasks:

$$\Delta U_{inij}^{(I)} = \left[1 - \prod_{k=1}^{n} \left(1 - w_{ij}\, p_{ij}\right)\right] K_I \cdot Q_i \cdot Y_i, \qquad (1)$$

where K_I – the effectiveness of control influences;

$p_{ij} = 1 - e^{-\frac{t_0}{ta}}$ - the probability that *j*-task (function) will be performed by the *i*-subject for the available time t_a.

The analytical dependence (1) for the indicator of the interaction effectiveness increase during the performance of the *j*-function (task) by the *i*- interaction subject considers the potential of combat (service-combat) capabilities of the interaction subjects, effectiveness of control influences, continuity, the efficiency of maintaining interaction, the amount and uncertainty of the information comprehensively, and through the simulation it gives the opportunity to determine such a way (rational choice of the pairs of the interaction subject-task (function)) of the interaction organization, which maximizes the efficiency of operational-service (service-combat) actions. Solving the inverse dependency problems (1) will allow you to find such time parameters, the

potential of subjects and information signs, with the help of which the effectiveness of the interaction organization will be achieved and it will not be lower than the given one.

The effectiveness and quality of command of interacting subjects during training and conducting operational and service (service and combat) activities depends on the completeness, timeliness and reliability of information.

When deciding on the interaction organization, there are three typical informational situations [7–9]: decision-making under reliable and complete information; decision-making under condition of risk; decision-making under uncertainty. Decision-making *under reliability and completeness of information* is characterized by the presence of an unambiguous, deterministic connection between the taken decision and the received result. In this case, the interaction effectiveness depends only on the chosen variant and the deterministic factors that characterize the situation and conditions of operational-service activities. Decision-making *under condition of risk* is to choose one variant of interaction from the variety of possible. In this case the value of the efficiency indicator depends on the chosen interaction variant, the deterministic factors and random factors with known distribution laws. In the case of decision-making *under uncertainty*, the efficiency indicator depends, in addition to the chosen variant and the fixed parameters, also on random factors with unknown distribution laws or uncertain factors, for which only the variety of possible values is known.

Table 1

The Criteria for Making Decisions Concerning the Organization of the Troops Interaction in Typical Informational Situations

Informational situation	Criteria for making decisions	
	Name of the criterion	Mathematical expression
The known variant of the violations of legislation on border issues	Maximum result	$U^*_{вз} = \max\limits_{s\in S} U_{вз}$
A priori probabilities of actions variants of the violators of the legislation on border issues are known $P(k), k=\overline{1,K}$	Maximum mathematical expectation of winning	$U^*_{вз} = \max\limits_{s\in S} \sum\limits_{k=1}^{K} U_{вз} P(k)$
All actions variants of violators of the legislation on border issues are equally probable	Maximum of the average win criterion of Bernoulli-Laplace	$U^*_{вз} = \max\limits_{s\in S} \frac{1}{K} \sum\limits_{k=1}^{K} U_{вз}$
There is no information available on the actions of the violators of the legislation on border issues of equal probability	Extreme pessimism criterion	$U^*_{вз} = \min\limits_{s\in S} \min\limits_{k\in K} U_{вз}$
	Minimax risk criterion (Savage)	$U^*_{вз} = \max\limits_{s\in S} \min\limits_{k\in K} \left(\min\limits_{k\in K} U_{вз} - U_{вз}\right)$
	Pessimism-optimism criterion (Hurwicz)	$U^*_{вз} = \alpha \min\limits_{k\in K} U_{вз} + (1-\alpha) \max\limits_{k\in K} U_{вз}$
	Maximum (minimax) criterion (Wald)	$U^*_{вз} = \max\limits_{k\in K} \min\limits_{s\in S} U_{вз}$, $U^*_{вз} = \min\limits_{k\in K} \max\limits_{s\in S} U_{вз}$
	Extreme optimism criterion	$U^*_{вз} = \max\limits_{s\in S} \max\limits_{k\in K} U_{вз}$

At the same time as the optimal method of the SBSE interaction, it is expedient, from the formal point of view, to choose the one which follows from the recommendations of a greater number of used decision criteria, since it is unlikely to fail. If different decision criteria recommend different ways of the SBSE interaction $\left(s,\ s=\overline{1,S}\right)$, an in-depth analysis of the obtained results and the use of the decision-makers' practical experience are necessary. The criteria for making decisions concerning the organization of the SBSE interaction in various information situations as for the actions of violators of the legislation on border issues $\left(k,\ k=\overline{1,K}\right)$ are given in table. 1 [5].

Conclusions. During the decision-making concerning the interaction organization there are such situations: the decision-making under reliable and complete information; decision-making under conditions of risk; decision-making under uncertainty. For each of the above-mentioned information situations, the following decision criteria must be applied: the maximum result, the maximum mathematical expectation of winning, Bernoulli-Laplace maximum of the average win criterion, the extreme pessimism criterion, Savage

minimax risk criterion, Hurwicz pessimism-optimism criterion, the maximum (minimax) criterion, the extreme optimism criterion.

The direction of further researches is the elaboration of the methodology for making decisions concerning the interaction organization in various information situations.

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Обґрунтування показників та критеріїв оцінки ефективності організації взаємодії суб'єктів прикордонної безпеки

Резюме. Державна прикордонна служба України виконує завдання з охорони та оборони державного кордону. У дослідженні обґрунтовано показники оцінювання ефективності взаємодії та розроблено цільову функцію розв'язування задачі оптимізації вибору функціональних елементів для виконання завдань з охорони державного кордону.

Ключові слова: взаємодія, державний кордон, критерій, показник, ефективність.

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Показатели и критерии оценки эффективности организации взаимодействия субъектов пограничной безопасности

Резюме. Государственная пограничная служба Украины выполняет задачи по охране и обороне государственно границы. В исследовании обоснованы показатели оценки эффективности взаимодействия и разработана целевая функция решения задачи оптимизации выбора функциональных элементов для выполнения задач по охране государственной границы.

Ключевые слова: взаимодействие, государственная граница, критерий, показатель, эффективность.

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Methodology of the border guard detachment headquarters' work on the organization of mobile unit's deployment

Resume. The proposals to the methodology of the border detachment headquarters work on the organization of the mobile unit's deployment have been outlined in the article. These proposals are based on the analysis of the existing legal and regulatory framework for organization and management of mobile units operational and service activities and the work experience of the border detachment headquarters.

Keywords: mobile unit, methodology, analysis of management documents and experience.

Formulation of the problem. During the years of the existence of mobile units of the State Border Guard Service, border guards gained considerable experience and at the same time found in their work a number of issues that need to be improved. So, at present, one of the main tasks is the reformation of special-purpose units.

In the complex socio-economic and military-political conditions of the present, which characterize the dynamic situation at the state border, the problem of finding fundamentally new approaches to the organization and management of operational and service activities of mobile units, training of subordinate personnel is actualized.

Analysis of recent research and publications. The analysis of available materials covering the experience of use of mobile units and the guiding documents of the State Border Guard Service of Ukraine, which determine the procedure for organizing their use in operational and service activities, was conducted.

The purpose of the article is to outline the methodology of the work of the border guard unit aimed at organizing of mobile units' use during operational and service activities on the basis of the analysis of the existing legal and regulatory framework of organization and management of operational and service activities of mobile units and the experience of work of the border units' headquarters on their deployment organization.

Presentation of the main material. Operational and service activity of mobile units is a complex process that involves influence of both objective and subjective factors. While developing a methodology of border guard staff headquarters' work on planning of mobile units' use must take into account uncertainty and diversity of conditions under which the latter carry out their operational activities.

The *methodology* of border detachment headquarters' work on organizing mobile unit's use in operational and service activities is a set of methods, techniques, methods that enable achieving a certain goal. The methodology, on the one hand, should be based on the scientific principles of management, on the other hand, it should take into account commanders' knowledge and experience.

A *method*, in the broad sense of the term, is understood as techniques by which action over controlled objects for the purpose of practical accomplishing of tasks is manifested. The term "method" often means approach, way, action, process, technique, procedure, rule, skill.

As methods may vary greatly, the main thing is the ability to determine the necessity and expediency of using the most rational one.

The proposed methodology is presented as a sequence of interconnected stages, operations and procedures.

The aim of the methodology is to help the commanders (management bodies) to achieve the purpose of the operational and service activities of a mobile unit under any circumstances.

In the process of the methodology elaboration it was considered that it should meet the requirements resulting from the conditions and specifics of the process of operational and service activities. Therefore, given the creative nature of this process, the following requirements are put forward to the methodology:

compliance with the laws of dialectical thinking, the theory of cognition, logic, laws and principles of management - a commander (management headquarters) should master the methods of thinking, having the ability to

investigate problems, to organize both own intellectual activity and the work of the personnel involved in operational and service activities;

versatility and flexibility - the characteristic of the methodology suitability for all conditions of the situation and scope of activities. The purpose of the methodology in this case is to enable the corresponding commander (management headquarters) with scientific methods of thinking and most rational ways of organizing their work, which provides an opportunity to identify creative abilities in choosing the best course of actions during operational and service activity;

simplicity and clarity facilitate easy and quick mastering of the methodology by all commanders (management headquarters).

General outline of the methodology. The proposed methodology includes four main blocks, which are given in Table. 1.

Table. 1

Number and stage name	Stage core	Main steps of the stage
1st stage: ***"Planning of operational and service activities of a mobile unit"***	A set of measures to develop solutions for the use of mobile units; methods and consistent actions to achieve a certain goal	- awareness of the task; - assessment of the situation; - decision making; - solution detalization and its documentary design (drafting of planning documents)
2nd stage: ***"Organization of operational and service activities of the mobile unit"***	Complex of measures for organizing the decision implementation on the use of a mobile unit	- planning of mobile unit's service order in accordance with the decision taken; - setting tasks; - organization (clarification) of co-operation; - organization (clarification) of control, including creation of a management structure; - organization of comprehensive support; - organization of personnel education
3rd stage: ***"Control of readiness for operational activities"***	Activities of commanders (management headquarters) that ensure correctness of decisions, compliance of a mobile unit's activities and the ways of necessary corrective actions	- monitoring of the activities of a mobile unit; - comparison of the results achieved with those that had been planned; - detection of non-conformities and their correction (elimination)
4th stage: ***"Practical work on a definite site"***	The activities of commanders (management headquarters) aimed at preparing the activities of a mobile unit for action afield	- route march to the area of deployment; - clarification of the issues of co-operation with the units operating in the area of mobile teams' deployment; - organization of the mobile teams' service in accordance with the schedule, delivering the order of state border guarding; - adjusting the schedule of service in accordance with the situation changes and information received; - route march to the area of permanent stationing

Methodology of the work of the headquarters of the border guard detachment for organization of mobile unit deployment should include the following stages:

planning of operational and service activities;

organization of mobile unit's operational and service activities;

control of readiness for operational and service activities;

practical work on a specific border sector.

Let us dwell on these steps in detail.

Planning of operational and service activities is a set of measures for working out of a solution for mobile unit's deployment, ways and operational sequence for achieving a certain goal.

During this stage, the results of the work of officers of operational and investigation units are analyzed in order to provide operational support for future actions of mobile teams for receiving information on the main areas of illegal activity and clarification of the areas of major efforts concentration.

The main tasks assigned to the Section which organizes operational and service activities are: determining of the main threats that are likely to be present in the area of responsibility; determining the ability of a mobile unit to perform operational and service tasks; determining the

procedure for the use of a mobile unit in the state border protection, main methods of application and the most likely areas of action of forces and means; determining the main issues of co-operation.

When determining the application of a mobile unit, the main forms and ways of action are being reviewed to realize the decision of a commander of the appropriate level of command on its deployment both on the state border and at the border crossing points. As a rule, operational directions and the largest border crossing points are selected.

The basis for determining the deployment procedure is the decision of the commanding officer, proposals of the HQ and of the mobile unit's commander on the use of forces and means for border guarding.

During organization of operational and service activities of a mobile unit, certain measures are carried out to ensure the implementation of the decision on the use a mobile unit.

In particular, while organizing service activities of a mobile unit, the headquarters should determine: the number and composition of mobile teams (patrols), sectors and areas of carrying out of special measures, number and composition of other patrols for accomplishing set tasks; places and time of service; necessary vehicles, equipment and supporting means; servicemen appointed to active duty and standby reserve (to substitute main forces in case of their deployment in border protection); units and time to clarify co-operation procedures; place and time for checking the service of certain patrols.

The tasks and measures of border guarding are given to the commanders of mobile units personally by the chief of staff of border guard detachment, or on his behalf, by deputies and other officials who arrive to a unit in person, by technical means of communication or by delivery of official documents by staff officers. For this purpose, the headquarters of the border guard detachment issues an order stating: necessary situational data; information on violators of border related legislation; directions (areas) of main efforts concentration; procedure and methods of performing tasks; mobile unit's tasks (tasks for a mobile team and separate patrols); the system of command, control and co-operation; the issues of all-round support; reporting procedure; main preparation activities for execution of tasks; time of readiness for performing tasks.

Control of readiness for operational and service activities is the function of border guard detachment authorities, the process of ensuring achievement of the goal by means of evaluation and analysis of the results of subordinate units' activities, timely intervention and adjustment of the tasks of operational and service activities.

The main objective of command and control is to ensure the accurate and timely fulfillment of the requirements of the guidelines, resolutions and orders regulating operational and service activities and maintenance of subordinate units' readiness for actions.

The main task of command and control is to identify and eliminate deficiencies and errors of officials. It is necessarily combined with the provision of assistance to subordinates in solving the tasks of operational and service activities, increasing the professional level of personnel. Monitoring and assistance to mobile units is organized and implemented by the commanders (heads) of all levels, management bodies, service management center shift as well as by the officials of a border guard detachment within the limits of their powers.

Command and control effectiveness is achieved by systematic, purposeful, timely, comprehensive activities, depth, objectiveness and effectiveness of inspections.

The following issues must be given thorough checking: timely receiving of orders and directives by a unit; conformity of the decisions taken by subordinates to the concept of operational and service activities and to the tasks received; timeliness and quality of performance of activities aimed at preparation for carrying out of the tasks set for the units; organization of co-operation and comprehensive support; readiness of the unit management system; organization and implementation of measures aimed at mobile units' readiness for action.

The ultimate objective of command and control is actual improvement of the state of affairs in subordinate units, prompt elimination of identified shortcomings, prevention of violations of current legislation and legal order, detection of irresponsibility and the facts of lax discipline.

In order to execute control measures, a chief of mobile unit plans and performs inspections in person or on behalf of a senior commander, assisted by deputies. The number of inspections by the head of a mobile unit is determined on the basis of forces and resources available and is aimed at ensuring an adequate level of unit's readiness for action.

Planning of such inspections consists in determining the number of inspections per week, (night and day checks of patrols); determining of the main task of inspection and its conducting;

determining of places and time of patrols' checks; determining of inspecting persons.

In the course of practical work on a specific border sector the following is performed: clarification of the directions of main efforts concentration; clarification of places of service and patrolling routes; determining of camouflage measures while performing tasks; clarification of places of location and rest; clarification of the issues of co-operation with the units operating in the area of mobile teams deployment (coordination of actions by tasks, border-lines and time, identification of major co-operation and alert signals); clarification of the information exchange procedure.

In addition, the service of mobile teams is organized in accordance with the schedule; the order for the state border protection is delivered; the schedule of service is adjusted in accordance with the situation development and information received; the march to the place of permanent dislocation is performed.

In order to ensure abruptness, effectiveness and camouflaging of mobile units' activity a limited number of officials is involved at the stage of direct preparation for deployment. Disturbing actions of the border patrols and border units are carried out in order to mislead the enemy with regard to the place, time and directions of units' deployment for execution of the state border protection tasks.

Conclusion. Thus, the article determines the methodology of the work of border detachment headquarters aimed at organizing of mobile units' use during operational and service activities based on the analysis of existing guideline papers and the experience of organizing mobile units' deployment in operational and service activities, which allows us to proceed to substantiation of the recommendations for mobile unit service management.

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Методика роботи штабу прикордонного загону з організації використання мобільного підрозділу

Резюме. У статті, на основі проведеного аналізу існуючої нормативно-правової бази щодо організації та управління оперативно-службовою діяльністю мобільних підрозділів та досвіду роботи штабів прикордонних загонів, викладені пропозиції до методики роботи штабу прикордонного загону з організації використання мобільного підрозділу .

Ключові слова: мобільний підрозділ, методика, аналіз керівних документів та досвіду.

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Методика работы штаба пограничного отряда по организации использования мобильного подразделения

Резюме. В статье, на основе проведенного анализа существующей нормативно-правовой базы по организации и управлению оперативно-служебной деятельности мобильных подразделений и опыта работы штабов пограничных отрядов, изложены предложения к методике работы штаба пограничного отряда по организации использования мобильного подразделения.

Ключевые слова: мобильное подразделение, методика, анализ руководящих документов и опыта.

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Structural Change Configuration of the System of Combating Cross-Border Threats at the Borders of the European Union

Resume. The article focuses on measures to combat transborder threats in the EU, in particular: the establishment of the European Border Guard and Coast Guard on the FRONTEX platform; the use of NATO forces and assets in the police operation in the Aegean Sea; the mechanism of information interaction between the border agencies of the EU member states - EUROSUR; The operations of international institutions are aimed at assisting the border services.

Keywords: cross-border crime, organization of illegal migration, system of combating cross-border threats, European Border and Coast Guard, NATO.

Formulation of the problem. Globalization is an objective phenomenon of the modern world. The globalization of cross-border crime is a consequence of the globalization of all global relations, economic, financial and technological. It is obvious that the internationalization of crime in the conditions of globalization primarily intensifies cross-border crime, affecting both its quantitative indicators and indicators that determine the level of its social danger. This, in turn, makes it necessary to internationalize the system of counteraction to cross-border crime, since it is impossible to control it at the level of individual states. At the same time, international law-enforcement activity in the EU for a long time was characterized by inertia, reactive way of responding to trans boundary criminal threats, inconsistency of purpose and means of implementing criminological policy in each of the states, which reduced the ability of such an intergovernmental union as the European Union to effectively counteract trans border forms of crime.

Formulation of the problem. Globalization is an objective phenomenon of the modern world. Globalization of all economic, financial and technological international relations results in corresponding globalization of cross-border crime. It is obvious that the internationalization of crime under the conditions of globalization primarily intensifies cross-border crime, affecting both its quantitative indicators and the indicators that determine the level of its public threat. This, in turn, makes it necessary to internationalize the system of counteraction to cross-border crime, since it is impossible to control it at the level of individual states. At the same time, international law-enforcement activity in the EU for a long time was characterized by stagnancy, reactive way of responding to cross-border criminal threats, inconsistency of purpose and means of implementing criminological policy in each of the states, which reduced the ability of such an intergovernmental union as the European Union to effectively counteract cross-border forms of crime.

Analysis of recent research. Countering new cross-border threats in Europe is not a new subject of research for the criminologists and representatives of related fields of science both in Ukraine and abroad. The work of O. Shostka, for example, is devoted to the theoretical and applied problems of organized crime counteraction in European countries. A. Bilas conducted a comparative legal study of law-enforcement activity in the EU. The mechanism of legal regulation of EU activity in the field of cross-border crimes countering was revealed in the work of A. Pavlenko. At the same time, in the studies of Ukrainian authors, the problem of institutional development of cross-border threats counteraction system is highlighted fragmentarily and without taking into account new factors (such as the migration crisis in Europe).

The publication of Sergio Carrera and Leonhard den Hertog are of particular importance for our study as they analyzed the potential role in countering the cross-border threats of the newly created Border Police and Coast Guard of the EU.

The purpose of the article is to consider the dynamic structural configuration of the institutional system for countering cross-border threats at the external borders of the European Union.

Presentation of main material. The leaders of the twenty-seven states of the European Union in the Rome Declaration, signed at the jubilee summit dedicated to the 60th anniversary of the Rome Treaties, identified four areas for convergence of major efforts. Among these four priorities the first place is given to providing "secure Europe: the union where all citizens feel safe and can move freely; where the external borders are safeguarded, and the migration policy is responsible, efficient and sustainable, respecting international norms; where terrorism and organized crime are being combated [1-2]. A number of critical events in this sphere have brought up the problems that are being addressed by the researchers [3]. In particular, it is pointed out that during the "migration" crisis that occasionally exacerbated in the EU since the Agency was established in 2004, the "decision" most often consisted in increasing its budget, without providing the Agency with the appropriate operational means and competences to "master" such increased financing. For example, of the 775 border guards requested for by Frontex during 2015, the Agency received only 447 officers. But this is not the only and not the major problem. As underlined by S. Carrera and L. Den Hertog, the common European interests defended by Frontex often do not correspond to narrow-minded interests of some states (not only of the countries that are at the frontline of protection against cross-border crime, such as Greece and Italy). In order to address this problem in 2015-2016, the EU's "Communication on European Border and Coast Guard, and Effective Governance at the External Borders of Europe" was adopted [4].

The creation of the European Border and Coast Guard on the platform of FRONTEX (which should be regarded as a response to the migration crisis) was a revolutionary and long overdue event in the EU. The decision was adopted by the European Parliament in June 2016. The powers of the newly created institution were formalized by Regulation (EC) 2016/1624 of the European Parliament and the Council of the EU of 14 September 2016 [5]. The newly created Border organization officially started its service on October 6, 2016. Its first units were stationed on the border of Bulgaria and Turkey. The mandate of the new agency allows the border guards to participate in operations in third countries, for example, in the North Africa. It should be emphasized that this is the first security and law enforcement agency manned with own operational staff and subordinated to the supranational bodies of the European Union. The decision to use the forces and means of the NATO Alliance in a typical police operation in the Aegean Sea (which is also a response to the migration crisis) can be considered the second quite significant (if not revolutionary) event. According to the NATO Summit statement, "the massive flow of migrants brings problems and threats to international stability, security and prosperity" [6]. Two of these facts confirm internationalization and globalization of efforts in addressing the global threat of cross-border crime associated with the illegal smuggling of migrants. In our view, absolute criminological significance in the context of counteracting cross-border crime should be given to such a mechanism of information interaction between the border authorities of the EU member states as the EUROSUR (European Border Surveillance System) which is a supranational element of the common EU external border protection, focused on processing and sharing of information in order to respond in a timely manner to the risks associated with cross-border crime, illegal migration and the death of migrants at sea.

Significant progress in changing the criminal situation in the trans-border area is reached when the system of countermeasures meets the global nature of the threat. This can be demonstrated by the example of the formation of an unprecedented system of international political, legal, diplomatic and other (even military!) measures to counteract the crime connected with illegal smuggling of migrants to the EU [7], which is given in Table. 1.

It should be noted that FRONTEX acts not only on the basis of ad hoc changes in the situation. The Agency also practices forecasting of probabilistic scenarios that reflect the implementation of border security policy and the dynamic change of cross-border threats. These options are also designed to reflect the possible consequences of cross-border crime, which can serve as a basis for its prevention. In particular, as of 2016, seven possible scenarios have been developed that include conditional depletion of the EU; passivity of the EU; controlled diversity of the EU policies; the policy of restrictions; ununiform Euro-integration; on the contrary, closer integration in security matters; and finally, open-door Europe [1, p. 56-57].

As we see from these titles, these scenarios differ in approaches to prevention of cross-border crime, in the options of institutional support of cross-border threats countering, etc. It should be noted that individual EU countries are implementing their own decisive steps towards combating cross-border threats, even if they, to some extent, contradict general approaches within

the EU. To illustrate this thesis, we will demonstrate the experience of Hungary. In 2015, the country faced new cross-border challenges related to migration, in particular: illegal and organized nature of migration; aggressiveness of migrants, which was manifested in damaging activities involving the destruction of the border infrastructure facilities and disobedience to the orders of the border authorities; failure to identify a large part of migrants; a wide gap between the migrants' system of values and the one of the local population; highly predictable link between many migrants and organized extremism.

Table 1

The system of counteraction measures targeting cross-border crime at the external borders of the EU

Generalized description of counteraction measures	**Subjects of counteraction measures**	**Description or examples of counteraction measures**
EU partnership with migrants' transit countries and their countries of origin	EU-Turkey	The agreement of March 7, 2016, which provides for a coordinated mechanism to counter illegal migration
	7 African countries - Tunisia, Mali, Senegal, Niger, Ethiopia, Nigeria, Libya **2 countries of the Middle East** - Jordan and Lebanon	The principles of interaction with these countries in the field of migration will be based on principles similar to those selected earlier in the development of the EU-Turkey agreement. Main goal is to eliminate the functioning mechanisms of migrants' smuggling and creation of a border guard security system in these countries. For example, the 1770-kilometer maritime border of Libya is guarded extremely ineffectively
Extending the powers of the naval forces of the countries involved in countering cross-border crime and spreading them to the border areas of the countries of maximum criminal risk (Libya).	Regional organizations fighting against illegal migrants' smuggling and trafficking in human beings and UN Member States	The Security Council extended the Resolution No. 2240 giving additional powers regarding the inspection of the vessels near the coasts of Libya on the high seas, if there are sufficient grounds to believe that such vessels were used, are used or will be used by organized criminal groups for illegal smuggling of migrants. In the event of disasters at sea, EU rescue services shall capture drowning illegal immigrants directly near the coasts of Libya and shall take them to Italy for registration
Operations of international organizations to counter trafficking in human beings and illegal migration	Interpol	"INFRA Hydra" (abbreviation which stands for International Fugitive Round-up and Arrest) Startup in June 2016. The operation is aimed at tracing the organizers of cross-border smuggling of people. The list of wanted persons includes 180 smugglers from 31 countries
	FRONTEX	"Triton" - a joint operation of FRONTEX and Italian Border Guard Service, Search and Rescue Service and Migrants' Registration and Identification Service. The vessels and aircraft of 25 EU Member States are deployed in the joint operation.
		"Poseidon" - joint operation of FRONTEX and Greek Border Guard and Police forces in the Aegean Sea
		"Minerva", "Indalo" - joint operations of FRONTEX and Spanish Border Guard Service in the Western Mediterranean
Naval operations	EU	EUNAFOR MED "Sofia". Startup on June 22, 2015, with the mandate until 07/27/2017. The purpose is to destroy the economic model of migrants' smugglers in the southern and central Mediterranean. Additional tasks: training of Libyan coast guard and assistance in the high seas off the coast of Libya to implement the UN arms embargo. Powers: Identification and destruction of the vessels used by migrants' smugglers, facilitation of apprehension and transfer of the organizers of migrants' smuggling to Italian criminal justice agencies
	NATO	7 NATO ships collect the information in the Aegean Sea, and exchange it with Turkish Coast Guard, Greek Coast Guard and FRONTEX. NATO ships do not send back migrants' boats
Institutional development of the system for counteracting cross-border threats	European border and coastguard	The main task of this newly established institution is to identify weaknesses in the system of protection of the EU external borders and to assist the countries concerned, which also includes the fight against terrorism and organized crime. At the same time, the specialists of the new agency (created on the FRONTEX platform) should work in cooperation with the national border services.
Globalization of the European Border Surveillance System	EUROSUR	The element of the common EU external border protection, which is based on the collection, processing and exchange of information for timely response to risks associated with cross-border crime,

		illegal migration and the death of migrants at sea by means of satellites, aircraft and UAVs

To counteract this and other challenges, Hungary took the following steps:

adjustment of legal regulation of migration procedures;

strengthening of engineering and technical means of state border protection;

improvement of institutional interstate interaction;

change of the state border barrier level.

Let us consider these measures separately by summarizing them in the Table 2 [9].

Table 2.

Hungary's proposals for the EU and related organizational and managerial resolutions on combating cross-border challenges at the state border (based on the experience of Hungary in 2015-2016 according to István Shamu)

No.	Implementation startup	Proposals, organizational and managerial resolutions
1	September 2015	Enable the EU's joint border forces to protect the borders of Greece. Refugees and economic migrants need to be separated outside the Schengen borders. The EU should define a list of safe countries for refugees. All contributions need to be increased by 1% and the costs reduced by 1%; these 3 billion euros can be used for the crisis management. Creation of privileged partnership with the countries without which it is impossible to solve the problem (especially Turkey). Creation a worldwide quota for distribution of refugees not only at the European level but throughout the world.
2	April 2016	Borders: Schengen rules must be observed. Identity: compulsory biometric identification at the external borders. Improvement of the procedure for granting asylum outside the EU. Correction of common European asylum system. Conclusion of the agreement on readmission and return to the country of origin and transit.
3	April 2016	Return: return to safe countries of transit and origin. Substantiation: different EU policies should ensure the objectives of migration policy. Support: financial and other support for the target countries. Safe countries: a common European list of safe third countries. Voluntariness: solving demographic and labor market problems based on autonomous decision of the Member States (voluntary admission).

Conclusions. Thus, we believe that *further research* should be focused on assessing the effectiveness of such elements of the institutional system of cross-border threats combating as European border and coast guarding (protection), application of forces and means of NATO, and the mechanism of information interaction between the border authorities of the EU Member States - EUROSUR.

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Зміна конфігурації системи протидії транскордонним загрозам на кордонах Євросоюзу

Резюме. Основна увага в статті приділяється заходам протидії транскордонним загрозам в ЄС, зокрема: створення Європейської прикордонної і берегової охорони на платформі FRONTEX; застосування сил і засобів НАТО в суто поліцейській операції в Егейському морі; механізм інформаційної взаємодії між прикордонними відомствами держав-членів ЄС - EUROSUR; операції міжнародних інституцій, спрямовані на сприяння прикордонним службам.

Ключові слова: транскордонна злочинність, організація нелегальної міграції, система протидії транскордонним загрозам, Європейська прикордонна і берегова охорона, НАТО.

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Изменение конфигурации системы противодействия трансграничным угрозам на границах Евросоюза

Резюме. Основное внимание в статье уделено мерам противодействия трансграничным угрозам в ЕС, в частности: созданию Европейской пограничной и береговой охраны на платформе FRONTEX; применению сил и средств НАТО в сугубо полицейской операции в Эгейском море; механизму информационного взаимодействия между пограничными ведомствами государств-членов ЕС – EUROSUR; операции международных институтов, направленые на содействие пограничным службам.

Ключевые слова: трансграничная преступность, организация нелегальной миграции, система противодействия трансграничным угрозам, Европейская пограничная и береговая охрана, НАТО.

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Separate aspects of the implementation of the activities of program-targeted planning taking into account the cyclical development of the technological structures

Resume. The aspects of forecasting and study of the dependence of the technical development of society on the development of technology are examined. The laws of development of weapons systems and dedicated ways of interaction between the subjects of defense planning during specification of the requirements to its constituent parts, taking into account technologies of the latest technological structures, have been defined. Challenging issues that affect the development of weapons and military equipment have been analyzed, and conceptual ways of solution and implementation of these issues have been offered.

Keywords: program-target planning, technologies of the latest technological structures, development of the armament system.

Formulation of the problem. Due to the lack of uncertainty and fuzzy ranking of priorities, during the years of Ukraine's independence, a precondition for the loss of scientific and technical income. The reform of the Armed Forces of Ukraine and the development of individual samples of armaments and military equipment did not take place in accordance with the state's technical capabilities. The solution of this problem characterizes the relevance of the article.

Analysis of recent research and publications. Analyzing the historical retrospective as the sum of all progressive changes in society, it is necessary to pay attention to: the sequence of phase transitions of the social system, the development of technologies, the formation of new teachings, the creation of a new worldview, the transition between socio-economic formations, scientific advances in various fields, economic and scientific -technical progress. In the last century, various scholars have discovered that the development of society, economy, research, etc. obeys the laws and is characterized by certain cyclicity [1, 2, 3].

Presenting main material. Analyzing the historical retrospective as the sum of all progressive changes in society, it is necessary to pay attention to: the sequence of phase transitions of the social system, the development of technologies, the formation of new teachings, the creation of a new worldview, the transition between socio-economic formations, scientific advances in various fields, economic and scientific -technical progress.

In scientific studies, insufficient attention is paid to the impact of socio-economic factors on the development of models for the development of a strategy of military-industrial policy, based on forecasts of economic conditions.

On the example of the economies of different countries of the world, repeatedly and at different times, the study of the cycles of certain historical processes, the cycles of which were named after the names of the scientists who discovered them, namely: Kondratiev, Kuznets, Zhuglira, Kitschina. The interaction of these progressive changes in society, and, as a consequence, the development of armaments and military equipment (hereinafter - OVT), depend on the "uplifting" and "lowering" waves of such cycles (Fig. 1) [4, 5].

Cycles Kitchin - are short-term (commodity) cycles with a characteristic period of 3-5 years invented in the 1920s by English scientist Joseph Kitchin. Within this cycle, GDP fluctuations, violations and restoration of the balance of supply and demand on the market occur (first-order equilibrium).

Cycles of the Juggler are mid-term cycles with a characteristic period of about 12 years named after the name of the French scientist, Clement Jugljar. Their difference is fluctuations in the level of congestion of productive capacities of enterprises, rising unemployment, lowering the main active part of fixed capital and investing (second-order equilibrium).

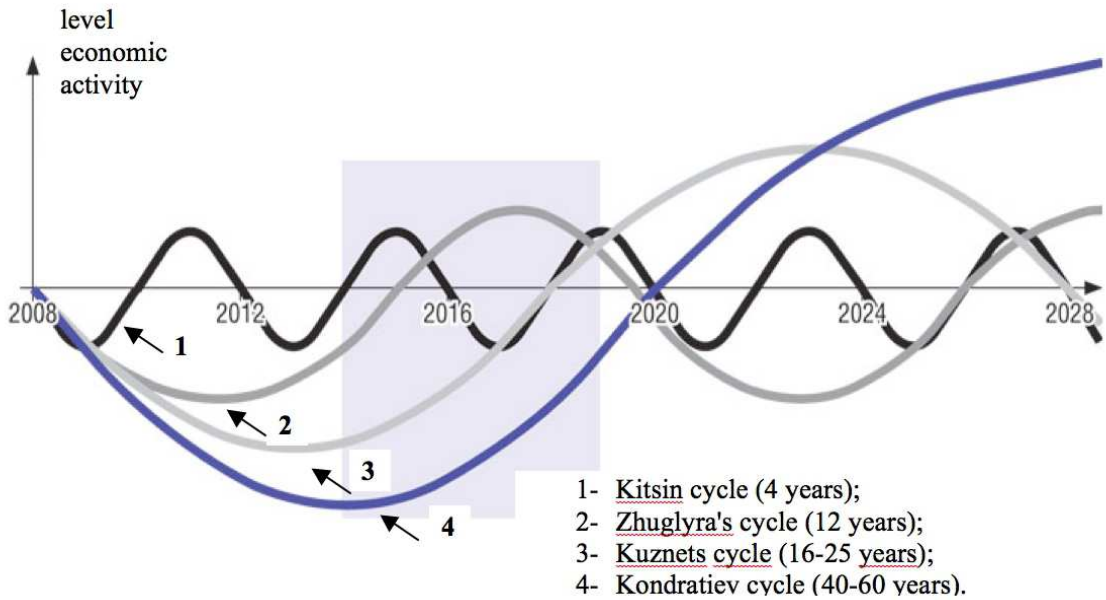

Fig. 1. Relationship between the existing cycles (waves) of Kondratiev, Kuznets, Zhuglara, Kitsin.

The cycles of Kuznets are economic cycles with a characteristic period of 16-25 years. They were invented in 1930 by Ukrainians of origin, the Nobel Prize winner Simon Kuznets, who linked them with demographic processes and corresponding changes in the volume of construction (infrastructure cycles).

A special place in the theory of cyclicity belongs to the Soviet scientist, Mykola Kondratiev, who distinguished the following great cycles (the equilibrium of a long period), which extend for about 50 years and are based on an empirical analysis of a large number of economic indicators of different countries in periods of time, beginning with the end of the XVIII century (price indices , government debt securities, nominal wages, indicators of foreign trade turnover, mining of coal, gold, production of lead, cast iron, etc.).

The introduction into the theoretical circulation of the notion of technological forms led to the emergence of scientific tools for analyzing and predicting the dependence of technical development of society on the development of technologies. Changing technological processes is associated with uneven progressive movement of scientific and technological progress. This is also essential for the study of the laws of the development of weapons and equipment, including the prediction of changes in its development. As for the technological process, then it is characterized by a set of productions having a single technical level and developing synchronously [6, 7].

At present, in the world of technical and economic development, life cycles of five technological processes have been identified, the key factors of which are: in the first - textile machines; in the second - a steam engine; in the third - the electric motor; in the fourth - the internal combustion engine; in the fifth - microelectronic components that have consistently changed each other (Figure 2). The next sixth technological process comes from embryonic development in the phase of growth with the following key factors: nanotechnology; biotechnology; alternative energy. The escalation of international military-political tensions is associated with a change in technological patterns (Napoleonic Wars, US Civil War, 1.2 World Wars, Cold War, the Wars in Afghanistan, Yugoslavia, Iraq) [7, 8].

Implementation of the driving factors of the 6th technological structure will enable the intensive growth of the economy through new technologies and innovations, namely: nanotechnologies; cell technology and genetic engineering techniques; biotechnology based on the achievements of molecular biology and genetic engineering; artificial intelligence systems; alternative energy (hydrogen, wind energy, sun); the global information network and integrated high-speed transport systems. The widespread introduction of a new technological structure is restrained by the low efficiency of the use of productive forces, which is associated with the lack of readiness of means of labor and socio-economic environment. However, the share of the use of constituents created with the technology of the sixth technological process, in the latest models of technology, grows at a rate of 20-35 per cent per year [9].

The technical level of the armed forces armament (hereinafter referred to as "the Armed Forces") of any country in the world depends on the technology of the existing or new technology. Proceeding from the already existing progressive world changes, the indicated phase transitions and the achievements of scientific and technological progress in various fields, in Ukraine, the creation of weapons and equipment requires state regulation of the implementation and implementation of the largest possible proportion of constituent elements created using the latest technological developments.

SCHEME OF TECHNOLOGICAL CONSTRUCTION

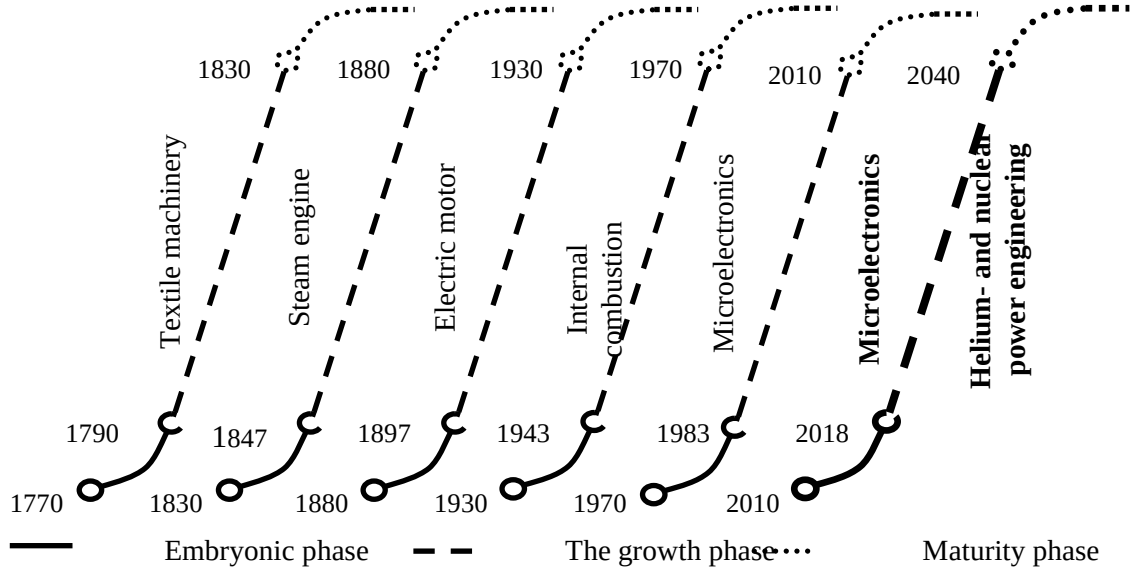

Fig. 2. The sequence of technological changes.

The intensity of the implementation of such an implementation, in the opinion of the authors, may be accelerated when certain requirements are put forward, both to specific components of the defense sector (tasks of the Armed Forces) and to their systems of armament. The weapon system is a balanced multi-level organizational and technical system, which is a set of functionally related and organizationally organized weapons (type of the Armed Forces or the Armed Forces in general) of combat vehicles (systems, complexes and models of weapons, special equipment and means of ensuring their application) , intended to perform tasks of strategic, operational, operational-tactical and tactical levels [10]. Armament systems can be considered in different configurations depending on the tasks facing the Armed Forces and their constituents.

Proceeding from the above, one of the problems of the development of the system of armaments are the requirements to it, which should not be based on the principle of "development from the achieved", in contrast to the implementation of a greater share of technologies of the latest technological developments. The solution of this problem in the development of weapons is the formation of initial data in the course of long and - medium-term planning of its development. Requirements to the system of armament and the requirements to its components (parks of ATV types and forces of troops) are necessary initial data for any planning and depend on the period of "raising" waves of the economic situation and the existing technological situation in the country.

In Ukraine at the present stage, by the order of the General Staff of the Armed Forces of Ukraine dated May 24, 2016, No. 213 "On Approval of the Instruction on the Formation of Operational-Strategic, Operational-Tactical and General Requirements for Arms of the Armed Forces of Ukraine", the procedure for the formation of such requirements was approved. Prior to the commissioning of this order, he was preceded by "Organizational and Methodological Recommendations for the Formation of Operational-Strategic, Operational-Tactical Requirements for Prospective Patterns (Systems Complexes) of Arms", which were approved by the Chief of the General Staff - Commander-in-Chief of the Armed Forces of Ukraine on November 26, 2009. The anti-terrorist operation in the east of Ukraine made the previous approach change and confirmed the urgency of the issue of forming requirements for weapons, although this order is not entirely perfect at the present stage. As an example, there is the State Defense Order (hereinafter - DOS) for 2016, the measures of which were carried out by carrying out research and development works (hereinafter - SCR) on the development and modernization of weapons and ammunition, in which 37% were without corresponding requirements (operational and tactical). In order to improve the procedure for

forming the requirements for weapons and apparatus in 2016, a number of meetings were held at the level of the military management bodies and structural subdivisions of the Ministry of Defense of Ukraine and the General Staff of the Armed Forces of Ukraine with the involvement of research institutions. At these meetings, most of the organizational issues were raised, as opposed to the issues of the order of formation of such requirements.

Taking into account the aforementioned and aspects of the programmatic planning of the development of weapons of mass destruction, there is an imperfection in the relationship between the development of weapons and the requirements for it, which should be put forward and necessary as the initial data when carrying out the appropriate planning of the development of weapons.

A package of requirements for the same type of weapons (parks) in a hierarchically structured order must always be fully formed, which will greatly facilitate the state customer (the Ministry of Defense of Ukraine) to ensure the implementation of state programs for the development of weapons. It is also necessary to periodically make changes to them, along with the changes taking place in the world, taking into account scientific and technological progress and changes in the state of military danger of the state.

The qualitative formulation of these requirements for the weapons fleets will improve the development of the armaments system, from the formation of the main areas of development of weapons and equipment to the long-term perspective until the approval of the tactical task (hereinafter - TTZ), and the implementation of the DSC will increase the effectiveness of the DOS measures implementation (Fig. 3). Having completed the entire package of requirements for weapons (as an integral document) and periodically making changes to it will allow projection of the capacity of the whole system of armament as a whole and reduce the time spent on drafting of the tactical and technical requirements (part of the TTZ) in the case of decisions related to the discovery of the SCR, which is especially relevant for the state in a special period.

In fig. 3 schematically illustrates the relationship between the problematic issues of the development of weapons and equipment and proposes ways to improve the process of forming the main areas of development of weapons and equipment for the long-term, with the further formation of state programs on the development of weapons and equipment and their implementation within the framework of DOS, the development and procurement of modern weapons. The scheme has two blocks. The first, the conceptual block, addresses the aspects of the programmatic and targeted planning of the development of a weapon of war material, which considers possible problems and outlines the way out of their solution. The second, program block, refers to the hierarchy of program documents and factors that influence their formation. At the present stage, when developing (forming) programs (main areas) for the development of weapons and equipment, the requirements for paramilitary equipment are used as input data, first of all, operational and tactical formed by species and forces of forces, which in the near future will have the name of the List (catalog) capabilities of the Defense Forces (Plan-schedule of main measures for implementation of strategic planning of capacity development of the Ministry of Defense and Armed Forces of Ukraine, approved by the Minister of Defense of Ukraine on January 4, 2017). It is this package of requirements (capabilities), in the opinion of the authors of the article, is a prerequisite for the implementation of programmed-targeted planning of the development of weapons, with subsequent changes to it.

The analysis of the presented structural scheme (Figure 3), the interaction and sequence of the above mentioned and reduced factors in Fig. 1, 2 in the area of program-target planning define an integrated approach to the process of equipping the modern Ukrainian military equipment in the future Armed Forces taking into account existing technological processes and other cyclic laws of development of society.

Conclusion. It should be assumed that the proposed measures of programmatic planning and aspects set forth by the authors of the article, in relation to the existing technological arrangements will enable:

to expand the dialogue between the Ministry of Defense of Ukraine and domestic enterprises of the defense industry with regard to the development of weapons and equipment, taking into account the needs of the Armed Forces of Ukraine and other military formations of the security and defense sector;

shorten the time to create new types of weapons;

expand the nomenclature of domestic armaments that will be created for investment or equity;

enterprises of the defense industry of Ukraine, depending on the complexity of the necessary DKR, to direct their activities, which will not be based on "development from the achieved" and will increase the level of military-technical cooperation;

to create competition in the global arms market through the introduction of a larger share of constituent elements created by technologies of the latest technological methods.

Taking into account these regularities of development of society, economy, scientific research, etc. and all aspects of the programmatic and targeted development of weapons of mass destruction will

allow, at the stage of awareness and subsequent stages of the development and equipping of the Armed Forces of Ukraine with modern weapons, to better address the tasks of scientific substantiation and the formation of initial data for the creation of weapons and ammunition.

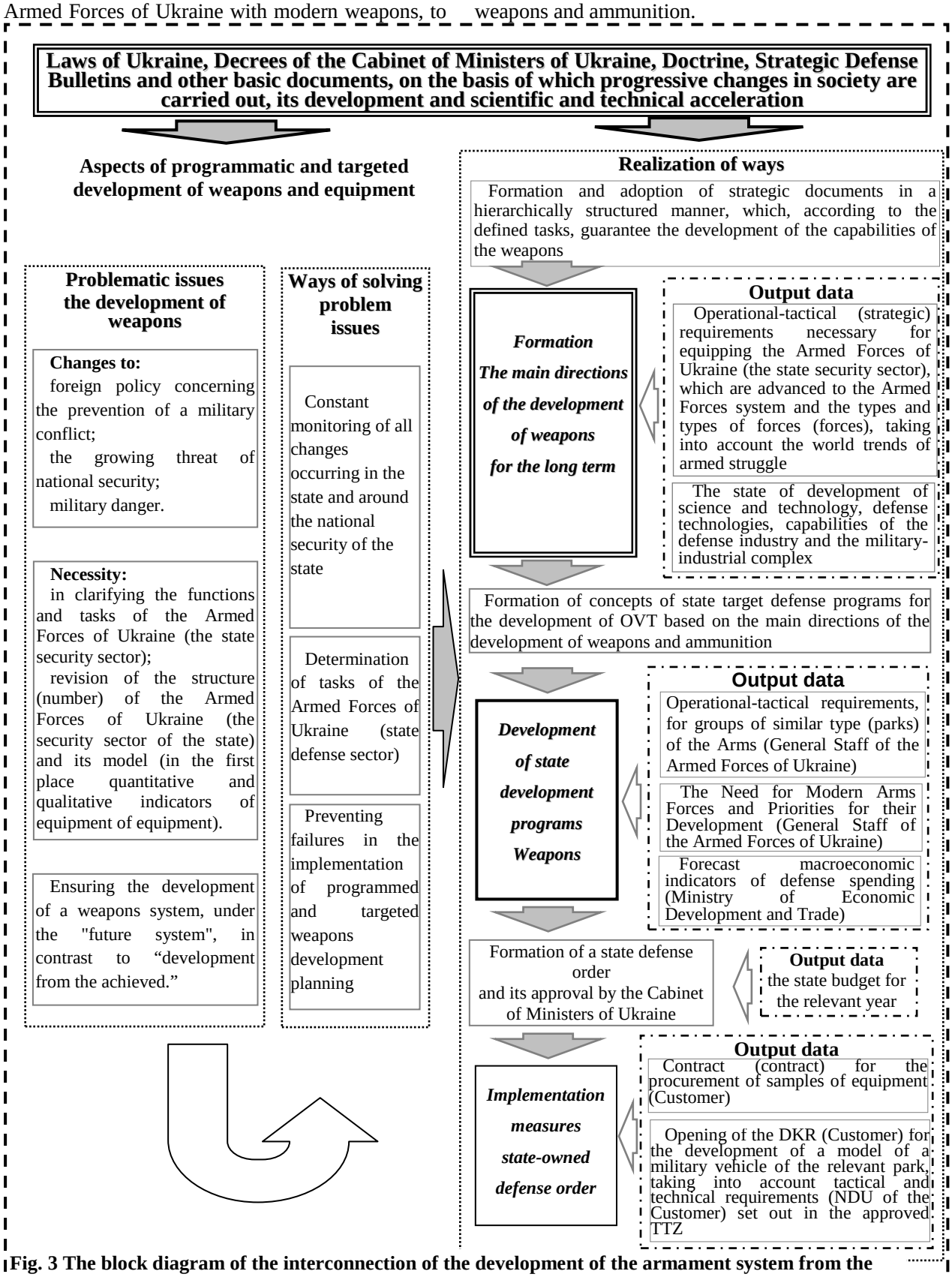

Fig. 3 The block diagram of the interconnection of the development of the armament system from the formation of the main directions of the development of weapons and equipment on a long-term perspective to the tactical and technical task during the execution of measures of the state defense order

Further research should be devoted to the improvement of existing methodological support for identifying ways of equipping military units with weapons and military equipment in the long-

term and medium-term perspective. The defense industry of Ukraine has no opportunity to develop and produce the entire range of weapons and military equipment necessary for the equipping of military formations, which imposes a great responsibility on decision makers in the defense planning system for the development of armaments and military equipment on the choice of ways to provide them with military formations. Therefore, in the decision support system, there is a need for a study of this issue.

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Окремі аспекти виконання заходів програмно-цільового планування з урахуванням циклічного розвитку технологічних укладів

Резюме. У статті розглянуто аспекти прогнозування і аналізу рівня технічного розвитку суспільства та залежності від розвитку базових технологій. Визначені закономірності розвитку системи озброєння збройних сил та окремі шляхи взаємодії між суб'єктами оборонного планування під час висунення вимог до складових з врахуванням технологій останніх технологічних укладів. Розглянуто проблеми, від яких залежить розвиток озброєння та військової техніки, запропоновано концептуальні шляхи вирішення та реалізації цих питань під час програмно-цільового планування.

Ключові слова: програмно-цільове планування, технології останніх технологічних укладів, розвиток системи озброєння.

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Отдельные аспекты выполнения мероприятий программно-целевого планирования с учетом циклического развития технологических укладов

Резюме. В статье рассмотрены аспекты прогнозирования и анализа уровня технического развития общества и зависимости от развития базовых технологий. Определены закономерности развития системы вооружения вооружённых сил и отдельные пути взаимодействия между субъектами оборонного планирования во время предъявления требований к её составным частям с учётом технологий последних технологических укладов. Рассмотрены проблемы, от которых зависит развитие вооружения и военной техники, предложены концептуальные пути решения и реализации этих вопросов во время программно-целевого планирования.

Ключевые слова: программно-целевое планирование, технологии последних технологических укладов, развитие системы вооружения.

UDK: 355.433.1

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A methodical approach to assessing technical parameters of the same type of military equipment in the course of capacity-building planning

Resume. The article suggests the use of the developed methodical approach to the evaluation of technical parameters of the same type of military equipment in the course of planning based on the possibilities for making informed decisions.

Keywords: methodical approach, estimation of technical parameters, defense forces, strategic planning, defense planning.

Problem description. During the development of the bases for assessing the capabilities of the defence forces and achieving their required level for the joint tasks execution in the security and defence sector of Ukraine, it became necessary to choose an approach to solving a multicriteria task that would enable to choose the optimal military equipment from a plurality of the same type assets based on the results of their technical parameters evaluation for decision-making during capability development planning.

An analysis of recent research publications on capability-based planning, response and use of defence forces [1-9] shows that researchers and professionals have many points of view on how to make sound decisions and to improve strategic planning in the domain of defence. The authors of the overwhelming majority of the proposed methods rely on SWOT-analysis, other expert methods that, to a certain extent, enable them to solve their problems when substantiating rational decisions, but depend on the influence of subjectivity, the level of competence and bias of experts.

At the same time, the use of grade-based expert assessments in practice, under the condition of having certain data provided (the actual technical characteristics of military equipment) when solving multicriteria tasks with respect to weapons and military equipment (military assets) in strategic and defence planning based on capabilities of defence forces [6] creates a risk of making a decision based on the judgements of experts, who can change their point of view depending on particular situation, their situational awareness, and influence of other factors.

In [7] the coefficient of realization of combat potential in the form of product of coefficients, determined among the most important factors during the evaluation of combat potential of aviation organizational formations is given. This methodological approach to assessing a combat potential implies that each factor acts independently, and takes into account the averaged dimensional values of the relevant indicators with a minimum of target function.

In [3], an approach is given to the definition of the "actual capability", "desired capability", and "evaluated capability" concepts and the idea suggested to merge them in a certain chain in order to differentiate these concepts by quantitative and qualitative indicators for the selection of indicators, the development of scientific and methodical evaluation apparatus to evaluate the capabilities of the Armed Forces of Ukraine and other components of the defence forces, assessment and practical use of strategic planning for the development of capabilities of the defence forces.

The authors [9] emphasise the need to apply appropriate methodological approaches in the capability-based planning to determine defence forces capability and effectiveness requirements for each scenario and possible situations.

The technical parameters of the same type of military equipment can be estimated on a scale of relations [10], which allows to measure the properties of objects in different measurement systems of their characteristics.

It is also advisable to use the existing methods of vector optimization to solve problems with the choice of alternatives among the elements of the Pareto set, the function of convolution, and the principle of fair compensation of the absolute values of the normalized partial criteria.

Consequently, these and other results of the analysis require solving a partial scientific problem of developing a methodological approach to

assessing the capabilities of military assets in the course of capability-based planning.

The aim of the article is to highlight the methodological approach to assessing the technical parameters of same type military equipment in the course of the capability-based planning to make informed decisions, which will allow obtaining a more accurate and qualitative result when evaluating and comparing the capabilities of military assets of similar types as compared to the requirements to execute the tasks assigned; to elaborate the known approaches to the solution of multicriteria tasks, introduce new elements to them and supplement the Armed Forces development knowledge without changing their substance.

The main body of the article. The development of strategic and defence planning systems in defence forces [1] for joint planning and a clear division of tasks between them in crisis situations involves the introduction of modern planning methods used by NATO member states to enhance their defence capabilities.

Assessing the capabilities of troops (forces) and related military assets in the implementation of modern Capability Based Planning is an integral part of the process of planning forces in the course of the defence review. Implementation of capacity development planning, as defined by the Strategic Defence Bulletin of Ukraine (Operational Goal 2.3) [1], requires the use of appropriate methodology, methodology, methods, methodologies and approaches to evaluation when relevant decision-makers of the planning bodies search for rational decisions aimed for the future.

As capability we will understand the standard or requirement/property to achieve the desired result (main, basic, additional definition of requirement/property) [3] for the selected military asset. The unified requirements/properties of the technical parameters estimates, which are essentially criteria for evaluation (probability of exposure, intensity of intelligence, range of shooting service, accuracy of determination of coordinates, etc.) are put forth to a military asset of the defence forces.

The technical parameters properties (evaluation criteria) must meet a number of requirements [4]: invariability; independence; efficiency; sufficiency. Different methods are used to evaluate technical parameters, the leading place among them is devoted to the methods of the most plausible and guaranteed result that apply when the distribution rule is known. The results obtained must be equal to the value at which the sample has the maximum probability of occurrence.

The difference between one criterion optimization tasks from multicriteria tasks is that one has to choose the target functions and the expected result in the first instance. For example, to evaluate the artillery reconnaissance forces effectiveness, one criterion can be applied, based on a generalized indicator that characterizes its level of effectiveness (capability). However, when comparing and choosing the optimal means of artillery intelligence for troops (forces), it is necessary to apply target functions that prove the optimality of the decision by several criteria.

Taking into account these and other considerations during research and analysis of existing methods of solving multicriteria problems (Fig. 1) a methodical approach to the evaluation of the technical parameters of the same type of military equipment (assets) for assessing the capabilities of troops (forces) has been developed.

In practice it is necessary to make the choice of the same type of military means for a comparative assessment of their technical parameters during the assessment of the capabilities of troops (forces) in the course of their development planning.

In order to apply the methodological approach to the evaluation of the technical parameters of the same type military equipment, a person who makes informed decisions during the comparative assessment of the capabilities of the selected military means must take the following steps:

to identify the necessary military equipment of the same type for evaluation;

choose criteria of assessment (partial indicators);

to put the data in the table with the parameters of the selected military assets;

carry out calculations;

analyse the results obtained.

In this article, as an example for applying the methodological approach, we will take into account the capabilities of artillery reconnaissance forces (forces) that are the same type and are divided depending on the means of sound intelligence (AZK-5), radar (ARK-1, SNAR-10) and optical (optoelectronic) (PRP-4, optoelectronic devices).

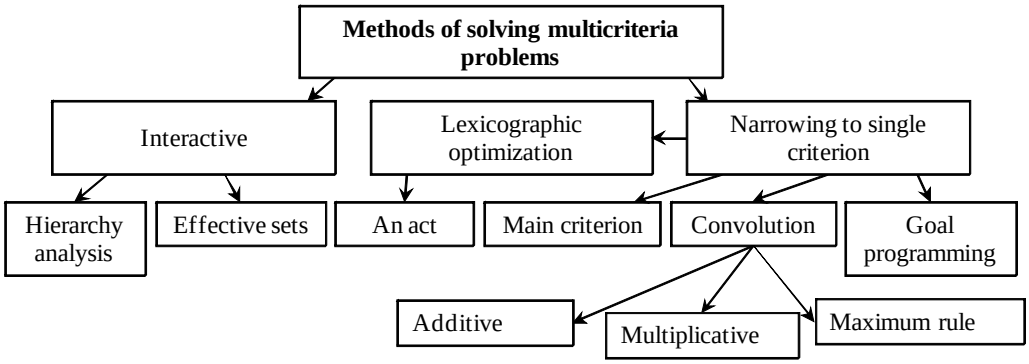

Fig. 1 – Methods of solving multicriteria problems

Step 1. Select the necessary military equipment of the same type (for example, five – $X_1, X_2, ..., X_5$) to evaluate their technical parameters. When choosing, take into account the chosen ability to evaluate and its characteristic features. The difference from other approaches is to eliminate restrictions on the number of m military assets (X_m) and the dimensionality of their characteristics.

Step 2. Select n important evaluation criteria (for example five – $K_1, K_2, ..., K_5$) that can characterize both maximum ($K_n \to \max$), and minimum values of technical parameters ($K_n \to \min$). The number of *n*-th criteria (K_n) may be different, but not less than three, which may lead to bias, and not more than ten, which will overburden the evaluation. The difference from other approaches consists in the application of different by number and nature evaluation criteria of the same type of military equipment that are characterized by dimensional and dimensionless values with the maximum and minimum characteristics of the selected technical parameters.

Step 3. Fill in the table with the technical parameters of the selected military equipment (Fig. 1) using the nominal values of the technical characteristics of artillery reconnaissance forces.

Identify the benchmark of the selected evaluation criteria ($E_1, E_2, ..., E_5$), taking into account the importance of the characteristics of the military equipment of the same type. The number of *j*-th standards (E_j) should equal K_n. The difference from the other approaches is that the maximum required dimensional and dimensionless values of technical parameters are applied both in the long run and in the light of foreign samples available for combat power comparisons of the military equipment in question.

Table 1

Technical parameters of the selected military equipment

Evaluation criteria	The standard of the selected	Forces artillery reconnaissance equipment and their nominal characteristics/					Parameter value
		AZK-5	ARK-1	SNAR-10	PRP-4	Optoelectronic	
Probability of exposure (average)	0,5	0,467	0,433	0,260	0,170	0,153	Max
Intelligence intensity (object/hr)	4,0	3,5	3,5	4,5	3,5	1,5	Max
Range of shooting support (km)	20,0	16,0	24,0	10,0	6,0	8,5	Max
Coordinate determination	25,0	125,0	60,0	25,0	45,0	37,5	Min
Deployment time (min.)	5,0	90,0	6,0	5,0	5,0	6,0	Min

For example, the "intensity of intelligence" criterion is characterized by the number of detected objects per hour (see. Table 1), the value of its standard is 4.0 objects/h, which in general meets the needs of the forces considering the technical parameters of the military equipment selected for comparative evaluation (within the range of 1.5 to 4.5).

The value of the "precision determination coordinate" standard is selected as 25.0 m, since it is the minimum value among the military equipment assessed (in the range of 25.0 to 125.0) and the desired accuracy for effective artillery fire, while another value can be chosen depending on the tasks or characteristics of foreign equipments samples available for comparisons of the parameter.

Step 4. Evaluate military equipment of the same type taking into account the values of their technical parameters.

A matrix of the same type military equipment technical parameters was created for the criteria-depended comparative evaluation (Table 2.).

Table 2

A matrix of the same type military equipment evaluation criteria-depended technical parameters

X_m / Kn	X_1	X_2	X_3	X_4	X_5
$K1$	$K11$	$K12$	$K13$	$K14$	$K15$
$K2$	$K21$	$K22$	$K23$	$K24$	$K25$
$K3$	$K31$	$K32$	$K33$	$K34$	$K35$
$K4$	$K41$	$K42$	$K43$	$K44$	$K45$
$K5$	$K51$	$K52$	$K53$	$K54$	$K55$

Note: $n=\overline{1,5}$, $m=\overline{1,5}$.

The coefficients of the technical parameters of the military equipment (K_{nm}) by the assessment criteria (K_n) of each piece of equipment (X_m) and selected standards (E_j) are proposed to be calculated taking into account the Table 2 by the following rule:

$$K_{nm}=\frac{E_j}{X_m} \text{ when } K_{nm}\to\max, \quad (1)$$

or $$K_{nm}=\frac{X_m}{E_j} \text{ when } K_{nm}\to\min. \quad (2)$$

The obtained coefficient values of the military equipment technical parameters by the chosen criteria of evaluation (K_{nm}) are subject to a summary evaluation using the convolution function. The convolution method depends on the criteria (indicators) and the purposes of evaluation, but most often the additive and multiplicative convolutions of the vector criterion components are used [10].

It is proposed to evaluate in total the received coefficients of the military equipment technical parameters (S_{1m}, S_{2m}, S_{3m}) simultaneously by the three convolutions for comparative evaluation of the military equipment in question to find the optimal piece of equipment from a set of the same type of equipment based on their technical parameters evaluation results:

in the first method (S_{1m}) – by the sum of the coefficients calculated:

$$S_{1m}=\sum_{n=1}^{N}K_{nm}; \quad (3)$$

in the second method (S_{2m}) – by the multiplicative convolutions:

$$S_{2m}=\prod_{n=1}^{N}K_{nm}; \quad (4)$$

in the third method (S_{3m}) – by the average value of the coefficients calculated ($\overline{E}_{nm}$):

$$S_{3m}=\overline{E}_{nm}, \quad (5)$$

where $$\overline{E}_{nm}=\frac{1}{N}\sum_{n=1}^{N}E_{nm}. \quad (6)$$

The peculiarity of the convolutions (3) – (6) is that they do not account for the criteria coefficient values, since their definition in practice is reduced to formal procedures or the use of expert assessments in relation to specific military equipment. This approach is aimed at assessing the military equipment of the same type based on the purpose of decision-making (for example, comparing the technical parameters of the selected equipment), without taking into account the criteria coefficient values, since the selection of evaluation criteria and their number depend on the evaluation objectives and the nature of the tasks to be solved in the future.

Consequently, the convolution of the criteria (S_{1m}, S_{2m}, S_{3m}) is based on the use of the principle of fair compensation of the absolute values of the normalized partial criteria, the essence of which is to find a compromise, in which the values of one of the coefficients are compensated by others, and a formal mathematical method is used that gives a convenient look to the task . This does not take into account the importance of partial criteria [10].

A comparative evaluation of the military equipment of the same type technical parameters using different methods of criteria convolution is carried out to find the optimal product (m_{opt}) according to the dependancy

$$S_p=\max\{S_{pm}\} \text{ when } p=\overline{1,P},\ m=m_{\text{opt}}. \quad (7)$$

The technical parameters evaluation results for the selected military equipment according to the dependancies (1) – (7) are put in Table 3.

Table 3

Selected military equipment technical parameters evaluation results

Evaluation criteria (K_n)		Force artillery reconnaissance equipment (X_m)				
		X_1	X_2	X_3	X_4	X_5
K_1		0,934	0,866	0,52	0,34	0,306
K_2		0,875	0,875	1,125	0,875	0,375
K_3		0,8	1,2	0,5	0,3	0,425
K_4		0,2	0,417	1,0	0,556	0,667
K_5		0,056	0,833	1,0	1,0	0,833
The total assessment of the coefficients obtained (S_p)	S_1	**2,865**	**4,191**	**4,145**	**3,071**	**2,606**
	S_2	**0,007**	**0,316**	**0,293**	**0,05**	**0,027**
	S_3	**0,573**	**0,838**	**0,829**	**0,614**	**0,521**

The difference from other approaches is in the summing up of the obtained values of the evaluation results in the Table 3 with taking into consideration the Table 1 data, as well as a making comparative evaluation of the effectiveness of same type military equipment using various methods of criteria convolutions (by total amount, multiplicative, or average value).

Note. The same type military equipment taking into account the values of their technical parameters evaluation results (see Table 3), are calculated in *Microsoft Excel* and allow analysing the results immidately after performing the relevent data inputs into the Table. 1.

Step 5. Analyse the results obtained. The calculated results of the Forces artillery reconnaissance equipment evaluation and their nominal characteristics are given in Table 3.

When finding the optimal product (m_{opt}) from the set of dependencies of the same type (3) – (7), we can construct the majorant series for these means:

$S_1 = S_{12} > S_{13} > S_{14} > S_{11} > S_{15}$;

$S_2 = S_{12} > S_{13} > S_{14} > S_{15} > S_{11}$;

$S_3 = S_{12} > S_{13} > S_{14} > S_{11} > S_{15}$.

When majorant S_2 does not significantly differ from S_1 and S_3, which indicates the differences in the total estimates of the obtained coefficients of the military equipment technical parameters depending on the chosen method of convolution (3) – (6).

As a result of the assessment, ARK-1 (S_{12}) and SNAR-10 (S_{13}) are found to be the optimal means of artillery reconnaissance, while optoelectronic devices (S_{15}) and AZK-5 (S_{11}) are the least effective ones.

Also, during the analysis of the obtained evaluation results for the Force artillery reconnaissance equipment, according to a formal procedure, the coefficients values have additionally been determined (k_n): $k_1 = 0{,}333$; $k_2 = 0{,}2$; $k_3 = 0{,}067$; $k_4 = 0{,}267$; $k_5 = 0{,}133$.

The evaluation results of the artillery intelligence equipment technical parameters coefficients (X_m), taking into account the coefficients values of the selected criteria (k_n), are given in Table 4.

Table 4

The evaluation results of the artillery reconnaissance equipment technical parameters with taking into consideration the coefficient values of the selected criteria

Evaluation criteria (K_n)	Coefficient values	Force artillery reconnaissance equipment				
		X_1	X_2	X_3	X_4	X_5
K_1	0,333	0,311	0,288	0,173	0,113	0,102
K_2	0,2	0,175	0,175	0,225	0,175	0,075
K_3	0,067	0,054	0,08	0,034	0,02	0,028
K_4	0,267	0,053	0,111	0,267	0,148	0,178
K_5	0,133	0,007	0,111	0,133	0,133	0,111
Evaluation total (S_p)	1,0	**0,6**	**0,766**	**0,832**	**0,59**	**0,494**

The majority of these equipment has appeared as follows:

$S_4 = S_{13} > S_{12} > S_{11} > S_{14} > S_{15}$.

Consequently, depending on the accepted coefficient values of the formal procedure selected criteria or with the use of expert assessments for specific pieces of military equipment, the values obtained change the majority (S_4). In this case, the majority of the first (S_1) and third (S_3) methods of evaluation is the same, and taking into account the coefficient

values of the selected criteria (S_4), the offset is one position, that is acceptable.

The majority (S_2) and (S_4) are significantly different from (S_1) and (S_3), since the offset (S_{11}) is two positions that is considered inadmissible. Taking these and other considerations into account, it is concluded that the first (S_1) and third (S_3) assessment methods are correct, while the second method (S_2) and the use of the selected criteria coefficient values (S_4) may give an false estimate during the evaluation that will affect the rationality of the decision.

It is also possible to apply the values of characteristics X_m та K_n for analysis (comparing) the results obtained and determining the contribution to improving the efficiency of the m-product and assessing economic feasibility, although the scared financial resources available for the military assets can significantly affect the combat power and ability to execute the missions assigned.

In addition, the set of standards for selected criteria (E_j) can be considered as the combat potential of the selected piece of equipment: if the nominal value of the characteristics of similar enemy complexes is placed in the column "Standard of selected criteria" according to the selected evaluation criteria (see Table 1), then it is possible to compare their combat potentials (see Table 3), to enable the Forces development and deployment planning.

Consequently, when deciding on the choice of the optimal military equipment product assessed from a set of the same type military equipment, it is possible to use the developed methodological approach for assessing the technical parameters of the same type military equipment as an intermediate assessment stage during the defence forces capabilities development planning. This will enable the adoption of sound decisions on the maintenance, modernization, creation or purchase of new capabilities and the deprivation of forces from ineffective ones.

The obtained technical parameters evaluation results for the military means of the same type, as opposed to the expert methods, are based on the nominal values of the main characteristics of the selected equipment, and not on the reliability and consistency of the experts' judgements.

Thus, the novelty of the proposed methodological approach to the evaluation of technical parameters of same type military equipment in the course of capabilities-based planning is to find another approach to solving a multicriteria military issue, which, unlike expert evaluation, allows simultaneous use of dimensional and dimensionless values, heterogeneous criteria for evaluating the technical parameters of same type military equipment at the maximum of the target function, as well as simultaneously narrowing to a single criterion task by the three methods to find the optimal product from the multiple same-type ones based on the evaluation of their technical parameters.

In addition, the proposed methodological approach is universal (not specific to military assets) and alternative to other approaches to comparing practical results, including the approach outlined in [6, Annex 4] that was supposed to facilitate a rational decision-making on defense forces capabilities development, but the effectiveness of this method could not be verified due to the fact that it only accounted for the experts points given for selected evaluation criteria and it took as example different types of reconnaissance equipment used in support of ground artillery fire but possessing various basic technical parameters.

Summary. The developed methodological approach to the evaluation of technical parameters of same type military equipment in the course of capabilities-based planning can be applied in practice along with other approaches to compare the results obtained and make a rational decision on the defence forces capabilities development; it could also be considered when developing the scientific and methodical apparatus in relation to the assessment of the capabilities of the defence forces, and used in the process of developing relevant guidance documents on the sequence of organization and conduct of capabilities Forces evaluation.

Further research prospect. Taking into account the results obtained the further research prospect is the determination of the monitoring and evaluation sequence of the defence forces capabilities development results in a course of strategic or other planning in the Security and Defence sector of Ukraine.

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Методичний підхід до оцінювання технічних параметрів однотипних військових засобів у ході планування на основі спроможностей

Резюме. У статті запропоновано використання розробленого методичного підходу до оцінювання технічних параметрів однотипних військових засобів у ході планування на основі спроможностей для прийняття обгрунтованих рішень.

Ключові слова: методичний підхід, оцінювання технічних параметрів, сили оборони, стратегічне планування, оборонне планування.

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Методический подход к оценке технических параметров однотипных военных средств в ходе планирования на основе возможностей

Резюме. В статье предложено использование разработанного методического подхода к оценке технических параметров однотипных военных средств в ходе планирования на основе возможностей для принятия обоснованных решений.

Ключевые слова: методический подход, оценка технических параметров, силы обороны, стратегическое планирование, оборонное планирование.

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Formation of approaches to planning the capabilities of troops (forces), taking into account their resource provision

Resume. The article contains proposals for improving the planning of the capabilities of troops (forces), taking into account their resource support.

Keywords: need, logistics, financing, distribution.

Formulation of the problem. Changes in the nature of modern military conflicts, which were aimed at destroying potential opponents with the strain of all available human and material resources, gradually shift to the background. More recent are new scenarios, changes in the range and content of tasks that the Armed Forces of Ukraine (hereinafter referred to as the AFU) is involved in, increase in the threats declared by the President of Ukraine, the gradual transition of the Ukrainian army to a professional basis by the end of 2020, difficult economic and military-technical conditions of development Armed Forces of Ukraine and low performance indicators for implementing their development programs. This requires the formation of new approaches to the planning of capabilities of troops (forces), taking into account their level of security, since in recent years there has been a steady tendency in the world to increase the material and technical needs of troops both in peacetime and in wartime [1-3].

In a present situation on east of Ukraine, when the Armed Forces of Ukraine to restrain the offensive of aggressor and in spite of anxiety of all society about providing of fighters of anti-terror operation (ATO), necessity of the Armed Forces of Ukraine in financial and material and technical resources satisfied not to a full degree. Both a weapon and live ammunition and food and clothing failing in troops. Clear that in this business there are two major factors is time and quality of preparation of sufficient amount of army to the level of possibility to resist to the troops of aggressor.

Thus it does not follow to forget that it will be to decide one in two task a present top military-political management — to prepare parts and subsections directly for the area of lead through of ATO and simultaneously to worry about creation at least of operative efficient reserve. Not speaking already about a necessity to support him in the high degree of readiness if by chance an aggressor will pass from the hybrid form of aggression to the direct large-scale armed encroachment. In such situation the large scale, intensive and maximally complete use of existing educational-material, and also its transformation to the best world standards which would allow to heave up bases quality of preparation of the Ukrainian army on a considerably higher level, — one of key questions. Consequently, a search of the scientifically grounded ways of planning on the basis of possibilities (POP) of troops (forces) taking into account their level of material well-being is an actual scientific and practical task.

Theoretical principles of the defensive planning on the basis of possibilities were developed the corporation of RAND yet in 1950th and practically inculcated Secretary of defense of the USA by Robert MacNamara in 1962 years. In subsequent the system was substantially finished off and on this time used in the defensive planning of leading countries of the world. At the same time, the question of logistical support of troops on principles of logistic is devoting scientific researches of foreign and Ukrainian research workers: M. Kristofer, D. Lambert, D. Koul, V. Nikolaychuk, A. Sukhorukov, L. Frolov, N. Chukhray et al. However, the questions of perfection of planning of possibilities of troops (forces) taking into account their resource providing and increase on this basis of strength of the state security complex do not light up in scientific literature.

The purpose of the article is determination of the possible going near planning of possibilities

of troops (forces) taking into account their resource providing.

Presentation of the main material. Historical experience testifies that the level of defensive of possibilities of the state depends on military-economic potential of country. Defense of the state is impossible without rational logistical support of military powers. In opinion of soldiery specialists of the USA, "one rear can not win war, but one rear can lose war" [1]. Model, that battle composition of army of the USA is almost 30%, and 60% personnel is on services of providing [2].

Modern local wars and armed conflicts require enormous financial and financial charges, large human capitals, lead through of the special resource preparation which impossible satisfaction of their necessities is without. Modern approaches in relation to planning of possibilities of troops (forces) taking into account their resource providing, must operatively get information from automatic system of logistic, infrastructure, and answer the standards of classification and management material and technical facilities which are accepted and inculcated in NATO.

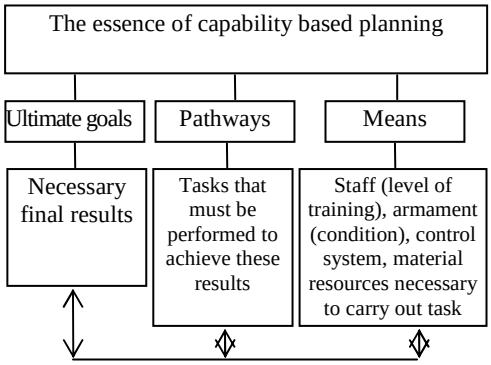
Idea of introduction of planning method on the basis of possibilities consisted in that soldiery organizations no longer will know what country, association of countries or non-state soldiery forming, can potentially present a future threat safety. Some analysts assert that it means that POP replaced the planning system on the basis of threats that used in the cold war-time. However in actual fact POP replaced planning on the basis of scenarios, which was used during 1990th (Iraq and North Korea, that characterized as basic regional conflicts, and later, as basic seats of wars). Consequently, to overcome the problem of indefinite enemy, a defensive review offered an idea, that can foresee the USA possibilities which an opponent can apply. In this connection, a model on the basis of possibilities will allow a country to be more concentrated on that, how “opponent can militate, but not who can be an opponent, or where war can happen”. Final introduction in the system of the defensive planning of planning method on the basis of possibilities in soldiery establishments of the USA took place in 2004 years after making of the Operating statement public in relation to researches of the incorporated defensive possibilities. In this Report marked, that the types of military powers (ground forces, naval forces, aircrafts and marines) had prevailed in the existent process of planning on the basis of necessities and, as a rule, did not examine the complete spectrum of decisions for satisfaction of necessities of specific conduct of the armed fight. In Report it was recommended to apply the process of POP for providing of prevailing of the incorporated necessities in the process of planning, and also for a grant the higher leaders of Department of defense of possibility of influence at the beginning of process of planning, but not on his eventual stages, when it already is uneffective.

A planning process on the basis of possibilities of POP does not have universal determination, but most practical workers will accede to the following: “POP is planning in the conditions of vagueness for providing of the proper possibilities which befit for the wide spectrum of modern terms and calls, within the limits of economic feasibilities of the state”. POP it is approach of the systems, which is directed on an exposure and grant of recommendations in relation to most acceptable after a criterion “cost efficiency” of variants of development of troops (forces) for satisfaction of priorities of national safety.

The features of application of planning with the use of method of POP within the framework of process of development of own military powers, in obedience to the standards of NATO, consist in that [5, 6]: POP shows by itself a process which is used in the process of development of army; POP is used for forming of future possibilities of army; POP is the complex, successive, logical process of determination of types of possibilities, which need troops (forces) to have in the future; POP can not forecast everything, consequently for the process of development of the of Ukrainian army it is still needed it will be to foresee ability quickly to react on contingences (to carry out the grounded correction of plans of achievement of certain eventual goals of development of the of Ukrainian army).

On the basis of possibilities in the process of development of the Ukrainian army will allow to get the use of planning method compromise between the level of threats and possible charges of the state budget. Essence of POP is presented on pic. 1. In other words, POP is a process which is supported the state system of planning within the framework of forming of the programs and budget. It follows to adapt him to the circumstances of separate countries – a template can look identically, but will be used variously, does not have a standard algorithm, acceptable to all. The prime example of it is modern features of introduction from the next year of “planning method on the basis of possibilities” in of the Ukrainian army. A method foresees that planning on the basis of possibilities is not based on a concrete opponent (that was inherently the defensive planning of the USA in the

cold war-time), and also not based on the concrete scenario of credible conflict (planning on the basis of scenarios, which was the inherent the defensive planning USA at once upon termination of cold war). That during planning it is foreseen on the basis of possibilities, that planning will be carried out on the basis of list of general potential threats without attachment to the concrete opponent or scenario. It is needed to understand that POP is not planning on the basis of resources, that planning from a budget. POP must take into account resources with the purpose of choice of optimum list of possibilities, accessible within the framework of the set budget.

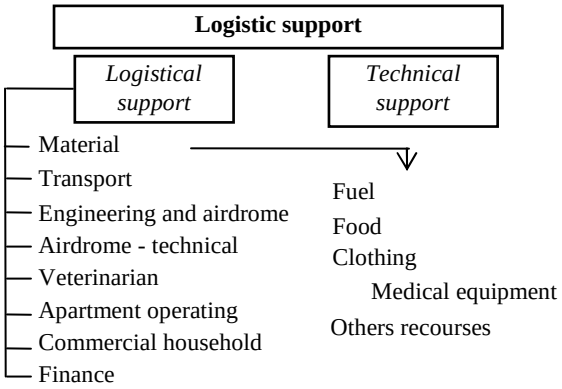


Pic. 1.

Table of contents of process of planning of development of the Ukrainian army on the basis of possibilities consists of a few associate between itself steps: to the analysis of the strategic pointing and political strategy of the state; working off the variant of situation (scenarios of application of the Ukrainian army); determination of tasks troops (to forces) is in accordance with the possible scenarios of application; determination of requirements is to possibilities of troops (forces) on a certain period; determination of lacks of possibilities; search and ground of decisions in relation to optimum allocation of resources.

The special role in the process of planning on the basis of possibilities is played by a process them logistical support (pic.2).

Logistical support of the Ukrainian army is the complex of measures of military management and special service all types of operations (battle actions) and everyday vital functions of military powers, which are carried out with the purpose of providing of troops (forces) a military technique, live ammunitions, military - by technical property increase of efficiency and operating reliability of military technique, its rapid renewal (to repair), after damages, satisfaction of financial, transport, domestic and other necessities of troops (forces), for maintenance of them in an alertness to implementation of fixed on them combat or everyday missions [4-7].



Pic. 2. Components of logistical support

Logistical support must get organized and carried out for the timely and complete providing of subsections the necessary amount of fuels, food, material, medical property et al, materially - hardwires and to plug the accumulation of them in the set norms, maintenance, timely preparation, to the use on purpose and addition after a necessity.

Standards of providing of the Ukrainian army became antiquated and need update. An army is not in a position effectively to manage the property, to register and control his motion. Practically all processes are in a hand management, automation is minimum.

On the basis of possibilities taking into account the resource providing in simplified will describe automation of planning process so: will begin with that it is needed to attain and will move in reverse direction to that it is necessary to purchase. It will underline results (that it is attained) in comparing to the actions (that it is done). Determination of volumes of possibilities, which are not enough for implementation of ambitious tasksΔS, shows by itself a difference between necessary $S_{\text{п}}$ but by present possibilities of army but other the soldiery formings $S_{\text{н}}$:

$$\Delta S = S_{\text{п}} - S_{\text{н}}, \Delta S = 0 \text{ at } S_{\text{п}} \geq S_{\text{н}}. \quad (1)$$

An evaluation and next planning can conducted after every constituent of all list of possibilities in accordance with every situation (at a necessity), every scenario and after Ukrainian army on the whole. Like will carry out the evaluation of necessary resources for the achievement of necessary possibilities. For realization of corresponding evaluation will be used specialists the got is before given in relation to requirements in forces and facilities of the Ukrainian army and other soldiery forming. Farther will use iteration principle or, as they say, principle of "nest-doll", idlest there will be a base of these corresponding calculations as

tables – for every component possibility and resources separately. But a form of table and order of her filling will be remain unchanging.

One of the most ponder able indexes during realization of the corporate strategic planning it is possible to count the index of ability of country $Z(T)$ to create and provide own of the Ukrainian army so that they during the period of planning T, or on his end (depending on maintenance of plan) were able to execute as possible anymore ambitious tasks with the certain level of readiness to their implementation

W_n (n=1,…,R – an amount of ambitious tasks of the Ukrainian army is during the period of planning T). W_n it is a function from the index of probability of origin of threat $P_n(T)$ on a set task and scenario during the period of planning and from the index of degree of potential danger - weight of consequences from the practical origin of danger $L_n(T)$. Id est:

$$W_n(T) = f[P_n(T); L_n(T)]. \qquad (2)$$

In a general view index of ability of country Z(T) in relation to providing of necessary possibilities for implementation of ambitious tasks removes in itself the index of level of defensive capacity of country.

Planning of possible ways of achievement of end-point, evaluation of indexes of possible influence decides iteratively, both in the direct raising and in reverse direction. Id east a search and choice of rational decision come true in the processes of planning from ambitions and planning on the basis of possibilities (sometimes planning talk from resources). Development of plans and programs, analysis of them реалізуємості has a very important practical value. Influence of the resource providing on the choice of directions of development of of the of Ukrainian of army will limit the amount of ambitious tasks that will depend upon of the of Ukrainian of army and vice versa, at their increase in volumes or the achievement of most rationality in actions to add the most actual tasks to the list of tasks that can be executed. The ways of decision of any task to development also will depend on possible influences of economic factors and will affect end-point. In fact by the large problem of logistic not only of the of Ukrainian of army, but also in general forces of defensive there is that when an operation lasts, to her all power departments are attracted, as a rule. Thus absent system of mutual settlements, trade-out by material facilities and others like that. Such situation arises up because providing is conducted in the terms of peace-time. Every constituent of forces of defensive gets on the line only that orders case-insensitive compatible subdivisions. During realization of general operations of forces of defensive the logistic goes out on other level. In an operation can participate representatives of power structures, each of that has a separate budget. It is not simple assignations, that is spent on maintenance, cash cover and others like that, and money is exactly on realization of operation. Therefore a certain problem is realization of mutual settlements.

The Army of the leading European countries is preparing, as it should be, at the points of permanent disposition or at the bases. In accordance with these needs organized logistics. When it comes to deciding on the use of divisions, another system of security begins to work. For example, a unified operational command is being created, to which parts of different types and types of troops are subordinated. This body is planning a transaction and its logistical support. For example, the budget of Operation Desert Storm was $ 3 billion. The funds for its implementation were allocated separately, but not from the accounts of the maintenance of the parts that took part in it.

In the Ukrainian army as yet there are not a division of concepts “preparation” and “application” of forces. For that, if this principle began to work, as in the countries of NATO, it is necessary to change all system of logistic to the battalion and company inclusive, in fact management organs in a present kind are not able to work in the conditions of clear distribution. For example, if to find out the general of businesses from the resource providing, a commander must appeal to the staff of Rear, Armament, Management of the operative providing and yet to many different structures. In fact general organization, where operatively collected and analyzed all information, in the Armed Forces it is not as yet. Every public servant as though is responsible for the area of work, but “general picture” nobody can not recreate. Meantime for a decision-making to any commander the exactly generalized is needed given. For this reason in the Strategic defensive bulletin (A decree of President of Ukraine is from 06.06.2016), the necessity of creation of Main administration of logistic and Command of Forces of logistic is expounded. First structure - it J-4 on the NATO standards. She is needed for that, if any commander could decide necessary questions in one place. Exactly in J-4 he will be able to get all necessary information.

For the complete understanding of requirements to possibilities and determination of insufficient possibilities, it is necessary constantly to check up accordance of present organizational structure of troops (forces) to the certain scenarios them possible application. Scenarios can and must

be worked out on the basis of existent plans of realization of operations and plans of actions in emergencies, but they must not be limited to this. As a rule, they must go beyond the scopes of the most reliable situation of application, and even to include for itself the less reliable, but possible (and maybe more risky) situations of application of the army of Ukraine. Scenarios that does not give to possibility carefully to check accordance of organizational structure of troops (forces) to the possible calls can not define where weak points and problems are, and thus, can assist creation of such organizational structure of troops (forces), that essentially not suitable for application in the wide spectrum of situations.

Scenarios and situations will be used for recognition and determinations of those possibilities that will be needed for application in future conflicts. However at first must be classified possibility of troops (forces) after groups. Classification of possibilities allows decomposing them on more simple parts. It is necessary through the scale of problems that is investigated, because it more easily to work with more subzero level of working out in detail, id east dividing possibilities into less groups. The careful choice of distribution of possibilities on groups the amount of cases can shorten also, when weapons or personnel is attracted after a few groups.

During determination of component possibilities of the Ukrainian army, that is not enough for implementation of ambitious tasks, the first step is limitation of list of ambitious tasks taking into account the requirements of current legislation, and also on the indexes of prognosis economic feasibilities of the state in relation to possibility of providing of the Ukrainian army in general. Determination of these indexes needs unambiguous establishment on what index the pre-arranged (prognosis) charges will be determined on the Ukrainian army. Definiteness with the index of financing of the Ukrainian army will give possibility to set the volumes of tasks that will depend upon them in a period of planning, and form more adequate list of necessary possibilities of the Ukrainian army.

Possibilities of the Ukrainian army in relation to implementation of the tasks fixed on them can be characterized by the relative indexes of willingness of certain composition of troops (forces) to execute the put tasks and by relative sentinels and quality indexes of the possible this job processing:

$$Z = f(W_{FR\ UA^3}) = f(U_i; T_i) \Rightarrow \begin{cases} U_i = \dfrac{U_{real.}}{U_{need}}; \quad \grave{O}_3 = \dfrac{\grave{O}_{real.}}{\grave{O}_{need}}. \end{cases} \tag{3}$$

де: $U_{real.}; U_{need.}$ – real (provided) indexes of quality of implementation of the put tasks (it can be different soldiery and not a military, for example: level of possible losses it or opponent; amount of the prepared subdivisions and quality of their preparation, quality of providing connection; amount of international measures and studies and others like that);

$T_{real.}; T_{need}$ - time of the job processing is real (provided) and needed(calculation).

The end-point of planning on some certain period on the previous stage of evaluation will be is in permanent dynamic move, but will change in certain limits.

$$\begin{cases} \overset{*}{N}_{task}(T) - \text{amount at } T \text{ task;} \\ S\left(\overset{*}{N}_{task}(T)\right) - \text{index of composed and structure;} \\ \overset{*}{C}_{\sum}\left(\overset{*}{S}\left(\overset{*}{N}\right)\right) - \text{index of price concrete composed.} \end{cases} \tag{4}$$

Such system of indexes will characterize the list of tasks and scenarios that the state is able to provide after a previous evaluation taking into account and limitation that is laid on by a current legislation and economic feasibilities of the state. The previous evaluation of indexes (4) will allow forming the list of necessary possibilities of the Ukrainian army that they must purchase during a period of planning for implementation of certain list of tasks.

It can be considered a starting point for planning of process of development of the Ukrainian army during a period of planning on basis of possibilities. The perspective planning must not put itself in complete dependence on the presence of resources. Objective necessities in execution a constantly growing amount and volume of tasks can be a stimulant factor for the search of new ways of development of the Ukrainian army, new technologies, new material resources and others like that. Id est in the process of planning it is necessary to take into account those resource possibilities that the state can attain during period of planning. At the same time, the range of possibilities of the Ukrainian army on a period of planning must be clearly certain and to answer resource possibilities of the state.

By the next step of process evaluations of component possibilities, that is not enough for implementation of the Ukrainian army of already certain list of ambitious tasks, there is determination of the analogical system of indexes(5), but at the terms of taking into account of resource and other limitations, with their progress trends during a period of planning:

$$\begin{cases} \text{limits} \\ \text{of resourse} \end{cases} \begin{cases} N^{*}_{task}(\grave{O}) - \text{amountat}\, T \text{ task}; \\ S\left(N^{*}_{task}(\grave{O})\right) - \text{iindexof composedand structure}; \\ C^{*}_{\sum}\left(S^{*}\left(N^{*}\right)\right) - \text{indexof priceconcretecomposed} \end{cases} \quad (5)$$

These indexes expose the limits of the possible implementation programs and plans and are indexes that must be attained during a certain period of planning. On this stage the indexes of having a special purpose efficiency of decision *i* task are determined after *j* by a scenario (W_{ij}) but indexes of total cost of all types of resources, necessary for implementation put tasks are at certain level $C_{\sum i}$.

Application of methods of analysis and surplus of different variants of indexes of composition and structure of troops (forces) is determine variants, that most economically effective and reasonable on an index that characterizes the amount of the got effect on unit of the pre-arranged or spent resources:

$$E_{ij} = W_{ij} / C_{\sum ij}, \quad (6)$$

where: E_{ij} .it is efficiency of preparation of the Ukrainian army to the decision of *i* task after *j* by the scenario, certain composition of troops(forces).

The index of W_{ij} characterizes the necessary indexes of readiness of troops (forces) to implementation of a limit list of tasks, what of them must attain during a планового period. In future the process of evaluation of possibilities of the Ukrainian army in relation to implementation of ambitious tasks is taken to balancing between economic indexes of providing of these possibilities (to the plan and the real after years indexes of financing of the Ukrainian army) and by the indexes of cost of creation of necessary possibilities of the Ukrainian army.

Conclusion and direction of further researches. Studies undertaken an in the article allow to understand the basic features of planning of development of the Ukrainian army on the basis of possibilities taking into account their resource providing. The next stage of development of the system of the defensive planning in the nearest prospect is passing to planning on the basis of possibilities taking into account their resource providing, that will allow executing a task in a dynamics. Acquisition of certain possibilities and them the resource providing will allow to take into account all potential scenarios of development of situation and determine a task in relation to the defensive of the state, defense of sovereignty and territorial integrity. A strategic aim in relation to acquisition of the Ukrainian army of certain possibilities touches questions of increase of efficiency of preparation of troops (forces), integration in this process of standards of NATO, taking into account of experience of anti-terror operation.

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Формування підходів до планування спроможностей військ (сил) з врахуванням їх ресурсного забезпечення

Резюме. У статті викладено пропозиції щодо удосконалення планування спроможностей військ (сил) з врахуванням їх ресурсного забезпечення.

***Ключові слова**: потреба, матеріально-технічне забезпечення, фінансування, розподіл.*

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Формирование подходов к планированию возможностей войск (сил) с учетом их ресурсного обеспечения

Резюме. В статье изложены предложения по совершенствованию планирования возможностей войск (сил) с учетом их ресурсного обеспечения.

Ключевые слова: потребность, материально-техническое обеспечение, финансирование, распределение.

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Analysis of the current regulatory framework in the field of electronic identification and authentication of users of existing and prospective information systems

Resume. The article analyzes the normative acts, standards and procedures for electronic identification and authentication of users of existing and prospective information systems.

Keywords: identification, authentication, regulatory framework, personal data, electronic digital signature, electronic register, identifiers, identification data.

Formulation of the problem. The development of systems and tools for the identification and authentication of users of existing and future information systems in Ukraine, while adhering to a high level of electronic identification guarantees, provides a wide opportunity to interact with service providers at a new convenient and high level [1].

Our state has chosen the course of European integration, which demands bringing it into a line with domestic normative acts, standards and procedures. There is a need for a detailed analysis of the condition and trends of this sphere, both in Ukraine and in the countries of the European Union.

The conducted analysis will help to solve the task of constructing normative and technical basis in the field of electronic identification and authentication of users of existing and perspective information systems

In this aspect, the task will be to ensure legal, organizational, conceptual and technological co-ordination (interoperability) both at the national and international level.

In addition to positive results in the political, economic, legal and scientific and technical context from the introduction of modern means of electronic identification and authentication in Ukraine, the mental attitude of the society towards such implementation should be taken into account, the reluctance to contain additional means identifying a person, losing time and material resources.

Analysis of recent research and publications. The main native and foreign scientists, in particular L. Adelman [4], A. Berezovsky [5], L. Bokov [7], A. Borovikov [9], L. Zavadskaya [10], V. Zadiraka [5, 6], R. Smith [11], A. Fal [10], L. Shevchuk [5, 6], O. Yudin [8] and others, have been studying the problems of identification and authentication of information systems, evaluating the reliability of algorithms and methods of data protection.

The purpose of the article is to analyze the current legal and regulatory framework in the area of electronic identification and authentication of users of existing and perspective information systems.

Presenting main material. The basic legal acts regulating the principles of the development of schemes and mechanisms of electronic identification and authentication in Ukraine are: Civil Code of Ukraine; Tax Code of Ukraine; Law of Ukraine “On Information”; Law of Ukraine “On State Registration of Civil Status Acts”; Law of Ukraine “On Protection of Personal Data”; Law of Ukraine “On Access to Public Information”; Law of Ukraine “On Electronic Digital Signature”; Law of Ukraine “On Information Protection in Information and Telecommunication Systems”; Law of Ukraine “On the United State Demographic Registry”; Law of Ukraine “On State Registration of Legal Entities and Individuals – Entrepreneurs”; Rules for ensuring the protection of information in information, telecommunication and information-telecommunication systems, approved by the Resolution of the Cabinet of Ministers of Ukraine dated March 29, 2006 No 373.

An important issue facing the developers of the electronic identification and authentication

systems of information systems is the discrepancy between normative definitions, as well as approaches to the selection and adherence of the corresponding level of guarantees for the authentication of users of information systems.

For example, it should be noted quite different definitions of the term “identification” in various regulations. It should be noted that the normative documents only partially differentiate terms and procedures related to the identification of a person with the participation of third parties or with the use of information systems, that is, an automated way.

The definition of “person” in general, in accordance with the regulatory legal acts of Ukraine, applies to both individuals and legal entities. In accordance with the Civil Code of Ukraine, an individual is a person who is a participant in civil relations, whereas a legal entity is an organization formed and registered in accordance with the procedure established by law.

In order to identify a person with the direct participation of other persons (mostly natural persons who are officials) in the domestic normative-legal documents, it is provided for the identification of individuals or legal entities in a set of data that according to documents issued by the authorized bodies, which makes it impossible to doubt the person , which applied for certain legal actions.

The Law of Ukraine “On Notary” stipulates that “the establishment of a person is carried out on the passport of a citizen of Ukraine or other documents that make it impossible to arise any doubts regarding the person of the citizen who applied for the notarial act”. At the same time, the listed documents, according to which identification of a person is possible or impossible.

In different laws, the definition of “identification of a person” is given with a double interpretation, for example, the Law of Ukraine “On Banks and Banking” explains this process as the establishment of the owner on the basis of the document, and in the Law of Ukraine “On the Uniform State Demographic Registry” it is determined that this process is a check of the provided data in file cabinets, databases, registers [3].

Separately, it is necessary to pay attention to the term “personal data”, which is provided in the Law of Ukraine “On Protection of Personal Data”, which specifies that it is a collection of information about an individual that is identified or can be identified. In this concept, the definition of “identification of a person” is interpreted. This concept and its contents are key in considering issues of electronic identification and authentication in information systems.

Even more confusing is the situation with the description of the process of identification and authentication of individuals as users of information systems, in cases where the action takes place in automatic mode.

Different from the terms “individual” and “legal entity” used in the “non-numeric field” is the definition of “user information in the system”. According to the Law of Ukraine “On Protection of Information in Information and Telecommunication Systems” is a individual or legal entity who, in accordance with the procedure established by law, has the right to access information in the system. The Law of Ukraine “On Electronic Digital Signature” defines the term “signer” as a person who legally owns a private key and imposes an electronic digital signature upon his or her name or on behalf of the person she represents when creating an electronic document.

In addition, the Law of Ukraine “On Electronic Digital Signature” specifies: “electronic digital signature - the type of electronic signature obtained from the cryptographic transformation of the electronic data set, which is added to this set or logically combined with it, and allows to confirm its integrity and identify the subscriber“

Thus, the specified document describes the mechanism of identification of a separate category of users of automated (information) systems (subscribers). However, this applies only to the situation where EDS (electronic digital signature) is used to confirm the integrity of electronic documents.

In other by-laws, the definition of the term “identification” within the “digital” field varies.

Rules for providing information security in information, telecommunication and information and telecommunication systems. Approved by the Resolution of the Cabinet of Ministers of Ukraine dated March 29, 2006 No. 373, introduces the term “identification” as “the procedure for recognizing the user in the system, usually using a predefined name (identifier) or other a priori information about it that is perceived by the system.”

Order of the Ministry of Economy of Ukraine “On Approval of the Procedure for the Planning, Creation, Operation, Maintenance, Systematization of Electronic Information Resources of the Ministry of Economy of Ukraine and Access to them” dated 16.07.2010 No. 854 defines “user identification” as "the procedure for assigning a user to a set of personal electronic requisites (usually used by a couple of login

passwords) or providing it with a special electronic key that is in its exclusive use.

According to the Order of the State Nuclear Regulatory Committee “On Approval of the Rules for the Physical Protection of Nuclear Installations and Nuclear Materials" of 04.08.2006 No 116 “Identification of a Person” is the establishment of conformity of identification signs of a person entered in documents or a database, the actual characteristics of the person himself.

Thus, it is necessary to streamline the conceptual framework on electronic identification and authentication at the normative level. This is a prerequisite for building an electronic identification and authentication infrastructure for users of existing and future information systems, ensuring its interoperability at both the technical and semantic level and policy levels.

A unique issue is the uniqueness of identification data (IDs), which make it possible to identify an object (physical or legal person, information system) among the presented set of objects.

The normative legal field of Ukraine presents a wide set of identification data that is used during the information exchange in information systems.

The main, most influential citizens of Ukraine, legislative acts are: the Civil Code of Ukraine; Tax Code of Ukraine; The Law of Ukraine “On the United State Demographic Registry and documents confirming the citizenship of Ukraine, certify the person or his special status”; Law of Ukraine “On State Registration of Legal Entities and Individuals – Entrepreneurs”; Law of Ukraine “On State Registration of Civil Status Acts”; Law of Ukraine “On Compulsory State Pension Insurance”; Law of Ukraine “On the State Register of Voters”.

These legal acts define the list of data that make it possible to distinguish between individuals or legal entities among other entities for business, legal and social interaction, the conclusion of diverse civil acts, and, in particular, the implementation of this or another activity during the information interaction.

Currently, the following list of basic identity data of individuals is defined by legislative acts of Ukraine: surname; name; patronymic; citizenship; date and place of birth; date of death; sex; place of residence; electronic (digitized) sample signature; electronic (digitized) face image of the person; electronic (digitized) fingerprints; series and passport number (identification document); unique entry number in the Unified State Demographic Registry; registration number of the tax payer's account of the individual; civil status or social status.

However, there is a practice whereby citizens of Ukraine can change the basic identification data (for example: surname (marriage), name, patronymic (adoption), date and place of birth), concluding civil status acts.

Also, people can change their place of residence, and sometimes citizenship and gender.

Over time, every person changes face and personal signature.

The data specified in the death certificate of an individual must be canceled in the event of the appearance of a person.

The law stipulates that electronic (digitized) fingerprints are provided only with the consent of the individual.

It should be noted, that the series and numbers of documents certifying the person, as well as their civil status or social status, are only the accounting data of these documents, and during the life of the person are not permanent and may be changed in accordance with the procedure for issuing a duplicate or a complete replacement in case losses.

The above identifying data is only valid at a certain point in time for valid identification. In the area of electronic identification and authentication, some identifiers (identification data) at any processing stage, for example, during user registration in the information system, may be mistakenly entered. This complicates the verification procedure.

Thus, the identification data of individuals should be unchanged, use the format optimal for automatic processing, taking into account the calculation of the checksum. This will enable you to prevent erroneous insertion, as well as ensure their automatic formation. Such identifiers that meet these requirements should be recognized by the registration number of the individual tax payer's account and the unique entry number in the Single State Demographic Registry.

Today, in the regulatory legal field of Ukraine there is a possibility of the individual’s refusal to receive the registration number of the payer's account in connection with his religious beliefs. According to the State Fiscal Service of Ukraine, about 200 thousand people refused to receive an “identification number”. In this case identification is carried out according to the series and passport number of the citizen of Ukraine. The problem is the volatility of these data, as discussed above. It is also significant that the country does

not have a system for collecting and processing data on valid, lost or invalid passports.

As a result, the application of the unique number of the Uniform State Demographic Register in accordance with the Law of Ukraine "On the Uniform State Demographic Registry" [3], which has already been implemented during the issuance of "biometric" passports, is predictable, will serve as the basis for developing the electronic identification and authentication infrastructure.

Consequently, it should be noted the need to amend the regulatory legal framework of Ukraine to standardize the use of a unique record number of the Single State Demographic Registry as the sole identifier of a person in any information system. This in turn involves the exchange of identification data between the Single State Demographic Registry and other registers, for example: the State Register of Civil Status Acts, the State Register of Voters, the State Register of Natural Persons - Taxpayers, the State Register of Insured Persons, the registers of property rights, databases judicial system etc.

Conclusions. In the current legislation in Ukraine, the scope of electronic identification and authentication is not systematically regulated. At present, work on reforming legislation is being submitted, in particular, to the Verkhovna Rada submitted in the second reading of the Draft Law "On electronic trust services", which is intended to make changes in the field of using public key infrastructure and the provision of electronic trust services, taking into account the experience of the European Union, the development a single trust area based on the system of electronic trust services, recognition of electronic trust services provided by foreign suppliers of electronic trust services in Ukraine that will ensure the active development of cross-border cooperation and integration of Ukraine into the world electronic information space.

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Аналіз сучасної нормативно-правової бази у сфері електронної ідентифікації та автентифікації користувачів існуючих та перспективних інформаційних систем

Резюме. У статті проведено аналіз нормативних актів, стандартів та процедур електронної ідентифікації та автентифікації користувачів існуючих та перспективних інформаційних систем.

Ключові слова: ідентифікація, автентифікація, нормативно-правова база, персональні дані, електронний цифровий підпис, електронний реєстр, ідентифікатори, ідентифікаційні дані.

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Анализ современной нормативно-правовой базы в сфере электронной идентификации и аутентификации пользователей существующих и перспективных информационных систем

Резюме. В статье проведен анализ нормативных актов, стандартов и процедур электронной идентификации и аутентификации пользователей существующих и перспективных информационных систем.

Ключевые слова: идентификация, аутентификация, нормативно-правовая база, персональные данные, электронная цифровая подпись, электронный реестр, идентификаторы, идентификационные данные.

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Analysis of existing methods cybernetic intelligence of information and telecommunication networks

Resume. This article describes the importance of national security in the cyberspace. It is justified the urgency and the necessity of intelligence activities in cyberspace of the enemy in this article. It is defined the stages, components and the methods of cybernetic intelligence in cyberspace and critical data is identified which must be collected in the realization of intelligence activities for providing the headquarters with information gathered about the enemy.

Keywords: national security, cyberspace, cybernetic intelligence, cybernetic impact, unauthorized access, research of enemy, intelligence tools, information and telecommunication networks.

Formulation of the problem. Studying the enemy in order to identify its capabilities and intentions is one of the oldest forms of information activity. With the advancement of the formation of the information society, the nature of this activity has changed significantly. On the one hand, new means of extraction and processing of information, including info communications and information technologies appeared; on the other hand, the amount of information that needs to be processed to obtain the necessary data about the enemy has sharply increased. In addition, the competition intensified sharply. It has become global in nature, has become more dynamic and less predictable. In these conditions, new approaches to the use of cybernetic space methods and tools are needed, which enable them to plan offensive cybernetic operations in order to dominate the cybernetic space over the enemy and to identify and prevent in advance the directional cybernetic impact on critical information objects -telecommunication networks (TN). Therefore, increasing the effectiveness of intelligence in the cybernetic space of the enemy is an issue of relevance to the study.

Analysis of recent research and publications. Despite the many studies conducted by M. S. Dahiya, Howard Chivers, and Monowar H. Bhuyan regarding the development of cybernetic intelligence methods, there is no effective solution to this problem at our time. Therefore, they require additional and more in-depth study and analysis.

The purpose of the article is to analyze the advantages and disadvantages of the passive and active method of cybernetic intelligence of the opponent's ITM and to determine the ways of the complex use of the advantages of each method when developing and introducing means of obtaining intelligence data of ITM, which will increase the efficiency of cybernetic intelligence in time constraints.

Presenting main material. Component of cybernetic intelligence (Figure 1) is a computer intelligence, in which the extraction of intelligence is to obtain data and information circulating in the means of electronic computing, local and global computer networks, including using unauthorized access (NSD) [2]. Cybernetic intelligence is organized and conducted in the interests of solving two groups of tasks, namely, the provision of intelligence information from computer systems or information networks (IMs) and their processing through hardware and software (computer intelligence), as well as extraction and systematization of data on potential sources of cyber threats (intelligence cybernetic threats) [1]. The first group of tasks is solved by carrying out a complex of coordinated measures on unauthorized access to the MI and computers of foreign state and government organizations. The decision of the second group of tasks (extraction of information about cybernetic threats) involves the use of completely new sources, technologies and technical techniques, namely hardware-mathematical modeling of cybernetic attacks.

The main factor that influences the process of implementing cybernetic attacks is the means and methods of intelligence in the cybernetic space that make it possible to plan offensive cyber attacks to dominate the cyberspace over the enemy and to pre-determine and prevent targeted cybernetic influences on critical- ITMs. The provision of information security is the confidentiality, availability and integrity of the information, or a set of measures aimed at ensuring the security of information from the NSA. Influence on any of

these components can be considered as a cybernetic attack. The object of an attack may be a personal computer, a network device, an IM or an information system.

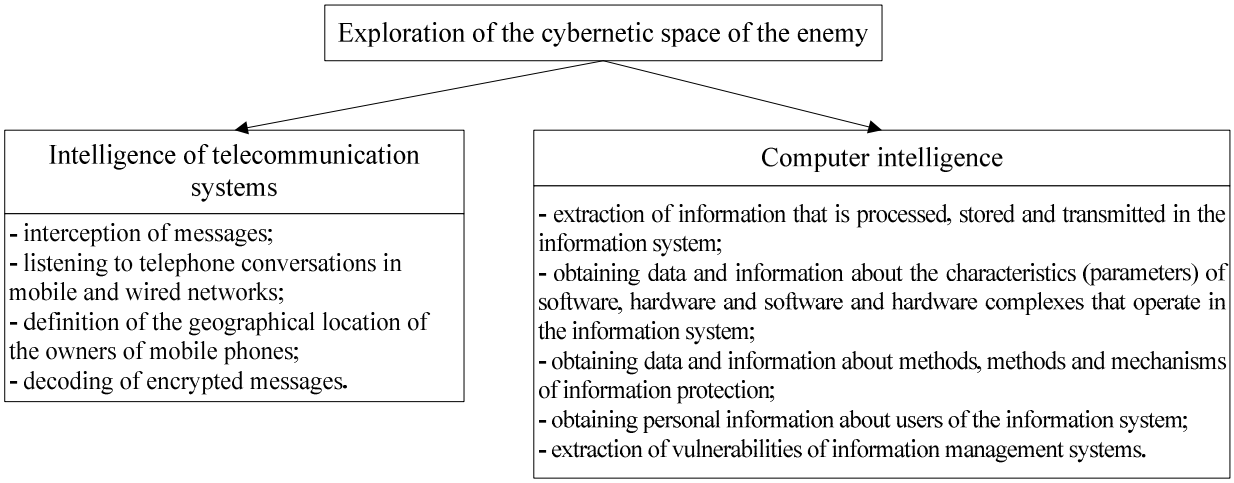

Fig. 1. Components of cybernetic intelligence

A prerequisite for a successful cybernetic attack is the intelligence of the cybernetic space of the enemy, which is characterized by time and quality criteria for obtaining information, characteristics of one or more remote computers of the opponent's ITM. Obtaining information can be used to build a model of the attacking system and facilitate the future attempt to penetrate it to implement cybernetic effects. Exploration of the cybernetic space of the enemy can be divided into the following stages (Fig. 2):

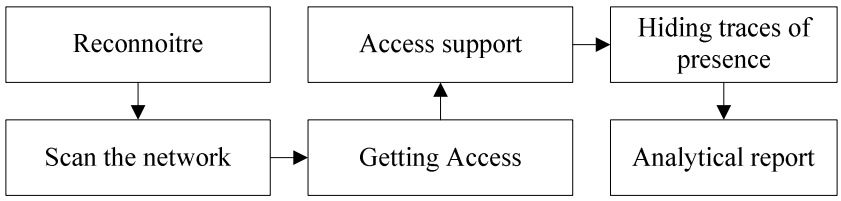

Fig. 2. Stages of cybernetic intelligence

Each of the above stages of cybernetic intelligence has its own goal, which ultimately results in intelligence activities giving the opportunity to obtain the desired information about the enemy (Table 1), which in turn is a non-trivial task [6].

Table 1

Getting intelligence information about the enemy

Getting Network Information	• domain name (internal, external); • topology of the network; • IP-addresses of systems; • TCP and UDP running services;	• network protocols; • VPN points; • ACLs; • IDS systems
Getting information about the system	• user names; • names of local groups; • system banners; • architecture of the system;	• type of remote access to the system; • user passwords.
Getting information about the management bodies	• information about employees; • information from the management site; • management heads; • territorial management location;	• fax and telephone number of the organization; • Different secret information is related to the management body

The main methods for extracting data in the cybernetic space of the opponent are the network scanning technologies (scanning of the address space and ports using active and passive methods)

and interception of network traffic using the methods of NDD to the information circulating in the ITM, as well as the use of classical methods of social engineering (psychological manipulation to induce a person to perform certain actions or to disclose confidential information) [3]. Additionally, information from whois servers can be used, and the information of the DNS servers of the network can be viewed to detect records defining the routes of the email (MX records). The use of NSA methods can not be carried out without preliminary research of the network, which contains various software and hardware communications, as well as information resources (objects of influence) of the enemy.

The process of examining one or more network hosts is called network scanning, it uses a remote analysis method. It is implemented by sending test queries to establish a connection and define a list of active services that provide remote maintenance at any host. In the process of scanning enemy information objects, the scan helps to determine the likely targets of attack [5]. The network scan is used in the previous step before the attack, and provides the opportunity to obtain the necessary initial data about the likely object of influence (a list of open ports and, accordingly, a list of allegedly attacking applications on the server that are downloaded to the computer) [7].

Early collection of information may be correlated with hidden observation. Today, the following network scanning methods are used [4] (Figure 3):

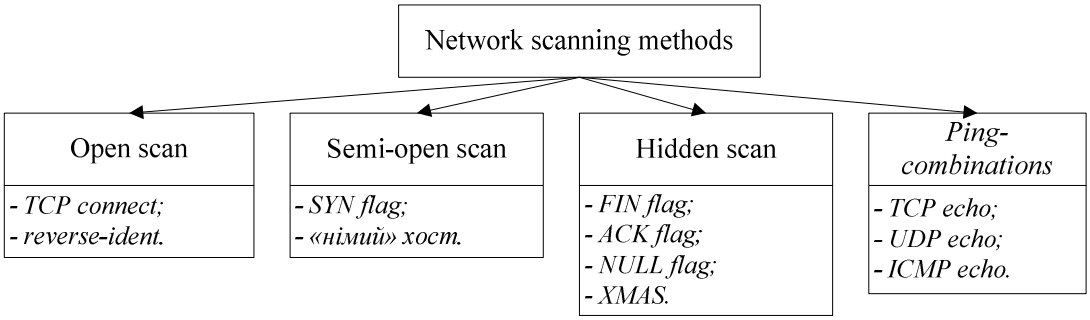

Fig. 3. Network scanning methods

One of the most important means of intelligence in the cybernetic space is the tools of remote analysis and identification of the objects being studied by the enemy. However, despite the fact that a lot of attention has been paid to the issue of building intelligence tools, the key issue remains - the effective use of cyber-security intelligence tools. Today, cyber space intelligence methods are classified as active and passive, each with its own advantages and disadvantages. When using the passive method of collecting intelligence information, contact with the object under study does not occur. Direct data extraction does not generate traffic, does not register a connection to the host or server in the event log, and also reduces the overall load on the network segment under investigation when scanning. Despite all the advantages of a passive method of obtaining information, it also has drawbacks. For passive analysis, it is always necessary to integrate into the segment of the investigated object of the network to carry out the role of the sensor, through which the network traffic circulating in this segment between the objects of the intelligence will pass through and analyze (Figure 4). Or, as an option, requires remote connection with the information resource of the investigated object to generate network traffic and its further analysis to identify the remote object, which in turn loses the relevance of latent remote analysis. A major drawback is the high probability of erroneous identification of the investigated object, which affects the quality indicators of the information obtained during the conduct of reconnaissance activities.

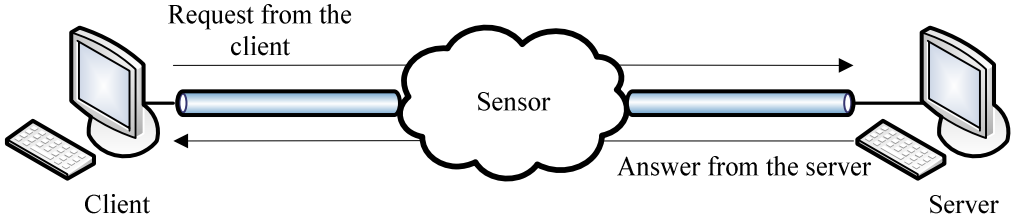

Fig. 4. Passive method of collecting intelligence data

The method of active acquisition of intelligence data consists in direct contact with the explored object of investigation using hidden scanning methods, which makes it possible to be

invisible when exercising influence on the enemy (Fig. 5). Also, in contrast to the passive data extraction method with active extraction, the probability of erroneous identification of the remote object decreases the perception that increases the accuracy of the intelligence information and the effectiveness of the subsequent formation of cybernetic influence on the basis of the obtained intelligence data about the object of research.

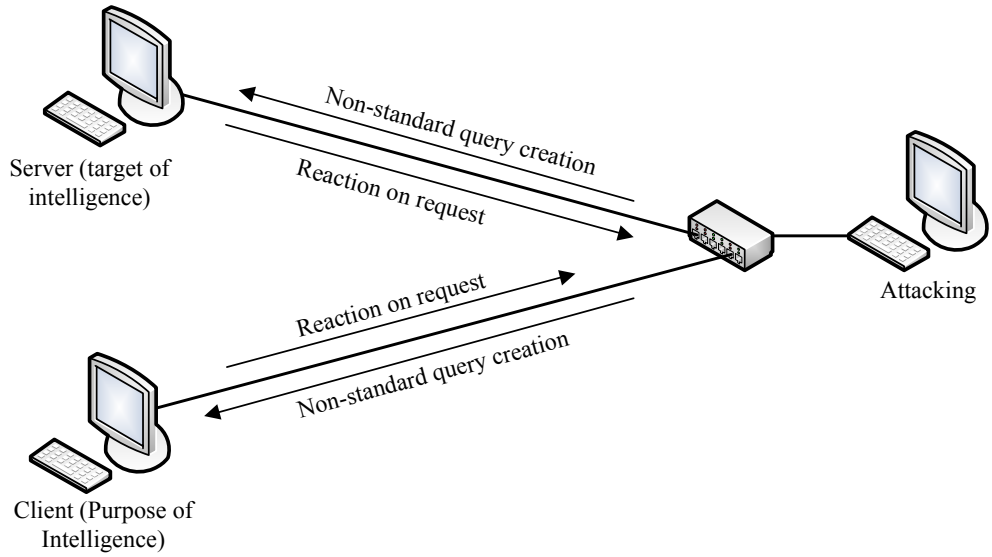

Fig. 5. Active method of obtaining intelligence data

In turn, for the comparative analysis of intelligence tools, you can apply the following criteria for software development [8]:

Scalability (the ability to add new resources, as well as the ability to manage a single distributed cybernetic intelligence system);

openness (possibility of integration into the system of additional developed components);

cross platform (the ability to transfer the application to a different platform of the family of operating systems Windows, MacOS X, Unix);

methods for obtaining exploratory data of the object under investigation (TCP, UDP and hidden scan of the remote object);

time of execution of reconnaissance measures (reduction of the use of time for obtaining information);

the quality of the intelligence obtained (minimizing the erroneous identification of the object).

However, the analysis of research and publications, as well as the experience of exploiting cybernetic intelligence tools (Table 2), shows that none of them fully meets the above criteria.

Table 2

Comparative analysis of cybernetic intelligence tools

Characteristics	Intelligence tools for cybernetic space								
	Strobe	*Tcp_scan*	*Udp_scan*	*Nmap*	*Netcat*	*SuperScan*	*IpEye*	*WUPS*	*Fscan*
Crossplatform	-	-	-	+	-	-	-	-	-
Openness	-	-	-	+	-	-	-	-	-
TCP scan	+	+	-	+	+	+	+	-	+
UDP scan	-	-	+	+	+	-	-	+	+
Hidden scan	-	-	-	+	-	-	-	-	-

Conclusions Based on the above comparative characteristics, it can be concluded that the most favorable means of cybernetic intelligence is Nmap, which allows an adequate level of conducting reconnaissance activities to investigate the enemy's remote object.

At the same time, taking into account the advantages of this means of extracting intelligence data over others, it should be noted that under the time limitations this remote identification tool of the investigated object is not able to obtain the wanted intelligence information about the enemy in the shortest possible time.

Therefore, this determines the relevance of further research, which consists in the development and implementation of a distributed cybernetic intelligence system of the target object of the enemy, which will make it possible to reduce the use of time to perform intelligence information during intelligence activities.

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Аналіз існуючих методів кібернетичної розвідки інформаційно-телекомунікаційних мереж

Резюме. У статті розглянуто питання важливості забезпечення національної безпеки держави у кібернетичному просторі. Обґрунтовано актуальність та необхідність проведення розвідувальних заходів у кібернетичному просторі противника. Визначено етапи, складові та методи кібернетичної розвідки у кібернетичному просторі, а також критичні дані, які необхідно добути у ході проведення розвідувальних заходів для забезпечення командування інформацією про противника.

Ключові слова: національна безпека, кібернетичний простір, кібернетична розвідка, кібернетичний вплив, несанкціонований доступ, дослідження противника, засоби розвідки, інформаційно-телекомунікаційні мережі.

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Анализ существующих методов кибернетической разведки информационно-телекоммуникационных сетей

Резюме. В статье рассмотрен вопрос важности обеспечения национальной безопасности государства в кибернетическом пространстве. Обоснована актуальность и необходимость проведения разведывательных мероприятий в кибернетическом пространстве противника. Определены этапы, составляющие и методы кибернетической разведки в кибернетическом пространстве, а также критические данные, которые необходимо добыть в ходе проведения разведывательных мероприятий для обеспечения командования информацией о противнике.

Ключевые слова: национальная безопасность, кибернетическое пространство, кибернетическая разведка, кибернетическое влияние, несанкционированный доступ, исследования противника, средства разведки, информационно-телекоммуникационные сети.

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Formation of an effective reserve of candidates for promotion and its use during the preparation and adoption of personnel decisions

Resume. The analysis of the personnel management process regarding the formation and use of candidates' reserve for promotion and career management of military personnel was conducted. The proposals for improving the process of forming a reserve by a rating principle based on the application of IT technologies are grounded.

Keywords: personnel reserve, recruitment of armed forces, automated personnel management systems.

Formulation of the problem. The political confrontation in the East of Ukraine, which arose in the spring of 2014, has grown into a protracted armed conflict. The desire to resolve the conflict by force has turned into numerous human victims on both sides. In order to put an end to further bloodshed and peace in the region, the parties to the conflict, with the participation of international mediators, went to conclude the Minsk Agreements.

The Minsk agreements have the general title of documents that provide for the ceasefire in the Donetsk and Luhansk regions, as well as a series of measures of military, political, economic and humanitarian nature, aimed at peaceful settlement of armed conflict in the territory of the oblasts.

The Minsk Agreements are not ideal and acceptable to all parties involved by the document. It was a compromise between the desirable and the real. According to international experts, the conflict in the Donbas has gone into a lingering phase.

Experts close to the Kremlin consider the most likely scenario to freeze the conflict in the East of Ukraine for many years, or forever. This is stated in the report of the Center for Political Conjuncture. The experts of the center estimated the probability of a "pessimistic scenario" to freeze the conflict for many years for 50% [1].

The conflict in the East of Ukraine will continue for a while. This opinion is expressed by political experts on the portal “Word and deed”. They note that the war ends when one of the parties loses its resources to the war and, as a result, accepts the terms of the other. While resources are available on both sides, the war can not be stopped. Today Ukraine has a resource, because the West continues to support. There is also a resource in Russia, which has adapted to new realities and finds opportunities in communication with countries outside the West. Ukraine wants a sovereign road to the West, and Russia controls Ukraine. These are incompatible things, so the war will last [2].

In Ukraine, in a special period, ***six rounds*** of partial mobilization have already been carried out, which resulted in a massive recruitment of human resources to the Armed Forces of Ukraine.

Thus, the question arises of the formation of a military reserve, that is, a certain number of citizens who have undergone preparatory selection (assessment) and have the necessary capacity to perform their direct duties in the required post within the prescribed time.

In order to increase transparency and efficiency in the adoption of personnel decisions regarding the appointment of servicemen to positions it is expedient to use the rating principle.

Analysis of recent research and publications. Formation of an effective Reserve for candidates for promotion and ensuring its effective use by the personnel of the Armed Forces of Ukraine requires the carrying out of certain studies that can be submitted in the form of a structural and logical scheme shown in Fig. 1.

Sources [3-5] highlighted the peculiarities of the formation of the Military Reserve in the leading countries of the world. In [6], a generalization of the experience of the armies of the leading countries in the world regarding the creation of a personnel reserve and analysis of global trends in the automation of personnel management processes has been carried out.

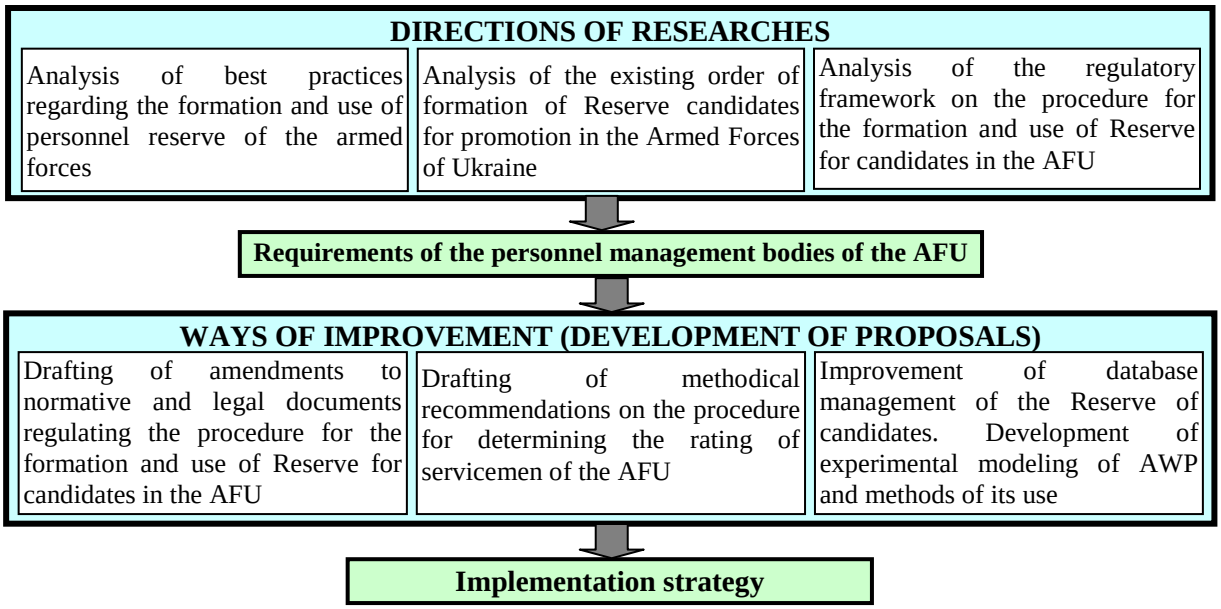

Fig. 1. Structural-logical scheme of researches

Formation of the Reserve for candidates for promotion by the personnel of the Armed Forces of Ukraine is regulated by the relevant normative legal acts (more than 20 documents), the main ones are given in Table 1

Table 1

№	Title of the document
1	Constitution of Ukraine
2	Law of Ukraine "On the Armed Forces of Ukraine" dated December 6, 1991, No. 1934-XII
3	Law of Ukraine "On Military Duty and Military Service" of 04.04.2006 № 3597-IV
4	Law of Ukraine of 21.10.1993 "On Mobilization Preparation and Mobilization"
5	Law of Ukraine dated March 25, 1992, No. 2233 (as amended) "On Military Duty and Military Service"
6	Order of the Minister of Defense of Ukraine dated March 31, 2008 No. 129 "On Approval of the Program for the Implementation of the Personnel Policy Concept in the Armed Forces of Ukraine" (as amended)
7	Order of the Minister of Defense of Ukraine dated May 20, 2009 No. 233 "On Approval of the Provision on Typical Military Career Management Algorithm and Procedure for its Application"
8	Order of the Minister of Defense of Ukraine dated 15.10.2009 № 520 "On Approval of the Regulation on Committees of the Armed Forces of Ukraine for the Selection of Candidates for Appointments to the Post"
9	Order of the Minister of Defense of Ukraine dated June 30, 1993 No. 140 "On the Introduction of the Advisor on the Work of the Personnel Armed Forces of the Armed Forces of Ukraine"

The rating principle when making personnel decisions means that each candidate for the corresponding position is given a quantitative and qualitative rating, on the basis of which decisions are made.

The paper [7] proposes a staff recruitment regulation, which includes the following measures: determining the need for a job; initiation of the search and selection process, determination of the main requirements for the candidate; choice of search methods (internal and/or external); formation of a resume/questionnaire database; primary selection in the resume / questionnaire; interviewing; candidate evaluation; decision making; job offer.

Methodological recommendations on the procedure for determining the rating of servicemen of the Armed Forces of Ukraine, approved by the Director of the Personnel Policy Department of the Ministry of Defense of Ukraine dated December 29.12.2009 № 226/1/4545, were developed for the implementation of the ranking procedure in the process of selection and placement of personnel and during consideration of candidates for training.

The purpose of the article is to highlight the results of the analysis of the existing order of formation of the Reserve of candidates for promotion in the Armed Forces of Ukraine and the formation of proposals for improving the formation of the Reserve on the rating principle of the ways of using IT technologies.

Presenting main material. Personnel reserves are citizens of the state, which are planned for appointment to the necessary posts. Such a reserve of nominees has a conditional structure.

Personnel reserve (professional reserve) can be both internal and external. As for the internal reserve, it consists of active servicemen and is divided into operational and perspective.

The formation of an external reserve is made up of the military-liable citizens of the state. As for military service, citizens in Ukraine are divided into the following categories:

- pre-conscripts of persons who are subject to appointment to conscripts;
- conscripts of a person assigned to conscripts;
- servicemen of persons who are in military service;
- persons liable for military service who are in reserve for the acquisition of the Armed Forces of Ukraine and other military formations for a special period, as well as for the performance of work for the defense of the state;
- reservists of persons who serve in the military reserve of the Armed Forces of Ukraine, other military formations and intended for their assembling in peacetime and a special period.

The process of personnel management in relation to the formation and use of Reserves for candidates for promotion and career management of military personnel includes such processes (see Table 2).

Table 2

№	Назва підпроцесу
1	Accounting for all categories of the population of Ukraine as regards military duty
2	Calculation of the needs of the Armed Forces of Ukraine for a specified period
3	Selection of candidates for admission to higher education institutions
4	Selection of candidates for military service training in universities
5	Planning for acquisition of the students and distribution of graduates of higher military educational institutions of the Armed Forces of Ukraine
6	Formation of a career template (career template), planning and maintenance of a personnel career with the use of a predetermined career management algorithm for officer, sergeant, senior staff and rank of personnel
7	Support for personnel training and training processes
8	Personnel marketing in the selection and placement of personnel based on multi-criteria search of candidates and vacancies
9	Implementation of the rating selection in the process of selection and placement of personnel
10	Preparation of information and analytical reporting on all indicators of personal and staff accounting, formation of statistical reports according to the forms established by the guiding documents

Currently, *personnel records* are in accordance with the established forms in accordance with the guidance documents in the institutions involved in the personnel management processes:

- The Ministry of Defense and the General Staff of the Armed Forces of Ukraine (I level);
- types of the Armed Forces and operational command (II level);
- association (III level);
- military units, military commissariats, local self-government bodies, enterprises, institutions, educational institutions (IV level).

The calculation of the needs of the Armed Forces of Ukraine for a specified period is based on the flow of urgent reports, which is regulated by the Directive of the Chief of the General Staff-Chief of the Armed Forces of Ukraine No. DHA-12 dated December 30, 2005. This information flow is classified by sections and it covers almost all structural subdivisions of the personnel management system of the Armed Forces of Ukraine:

- on mobilization and personnel work (section I);
- on organizational and planning issues (section II);
- on the analysis, forecast and implementation of personnel policy of the Armed Forces of Ukraine (Section III);
- on the issues of staffing and staffing (section IV);
- on the assignment of military ranks, awards and decorations of the Ministry of Defense of Ukraine (Section V);
- on the implementation of international programs (section VI);
- on information, accounting and statistics (section VII).

The algorithm for selecting recruitment *candidates for higher education* is shown in Fig. 2

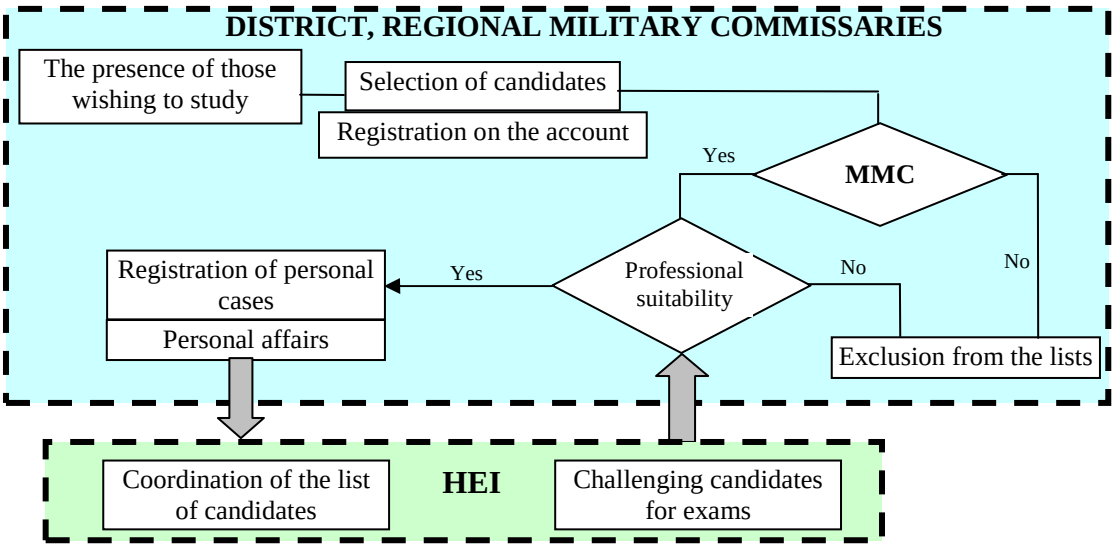

Fig. 2

Similarly to this algorithm, the selection of candidates for military service at *higher educational establishments* is conducted.

The formation of a career scheme (planning template), planning and career support of personnel is expected to involve the use of a specific career management algorithm for officers, sergeants, officers and senior staffers. For an example in Fig. 3 shows the algorithm of actions of officials of the personnel bodies on the management of the career of officers.

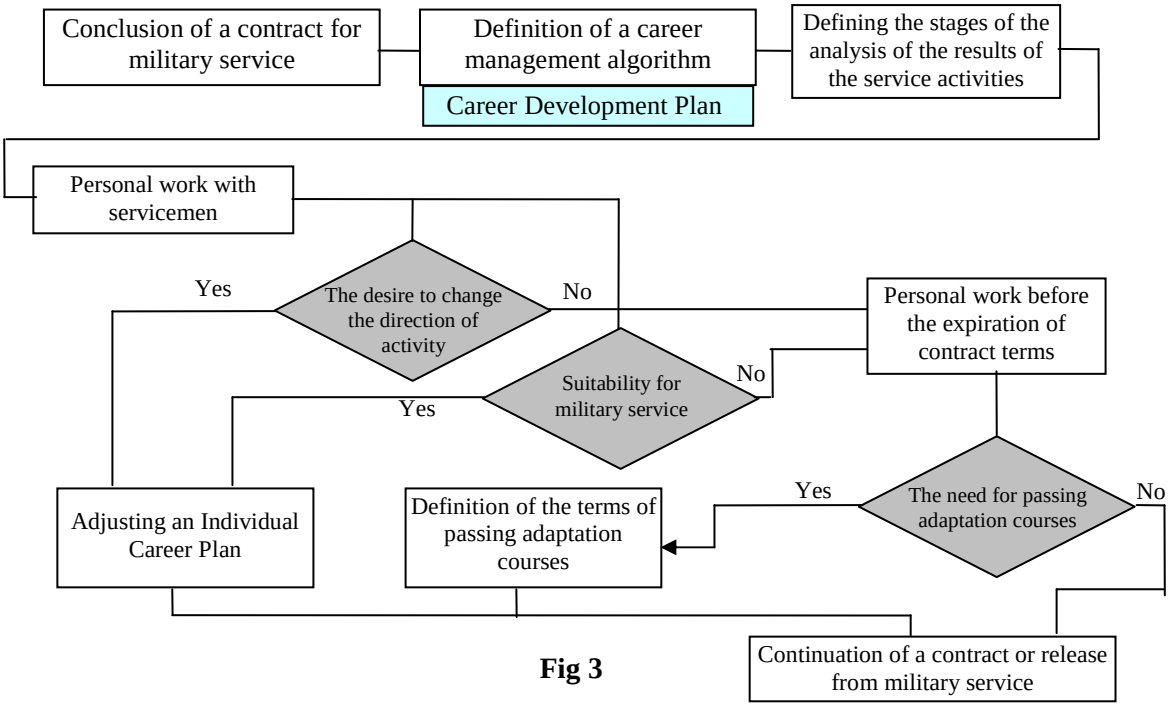

Fig 3

The starting point for career management is: qualification requirements for persons applying for a particular position; assessment and attestation characteristics; planning and replacement. This takes into account the qualification requirements for candidates. Work on the implementation of the "Career Officers Management" process is carried out in accordance with the Law of Ukraine "On Military Duty and Military Service".

The above analysis allows us to conclude that the construction of the Armed Forces of Ukraine uses the multilevel principle of manning (Fig. 4).

Level 1 - Personnel Officers and Contractors.

Level 2 - An organized reserve of a person of a certain age who has experience in military service.

Level 3 - Stock - is made up of persons who have left the previous levels by age, health or for other reasons. The task of ensuring the replenishment of troops in the event of a protracted conflict or large-scale military action.

COMPLEXING THE ARMED FORCES OF UKRAINE

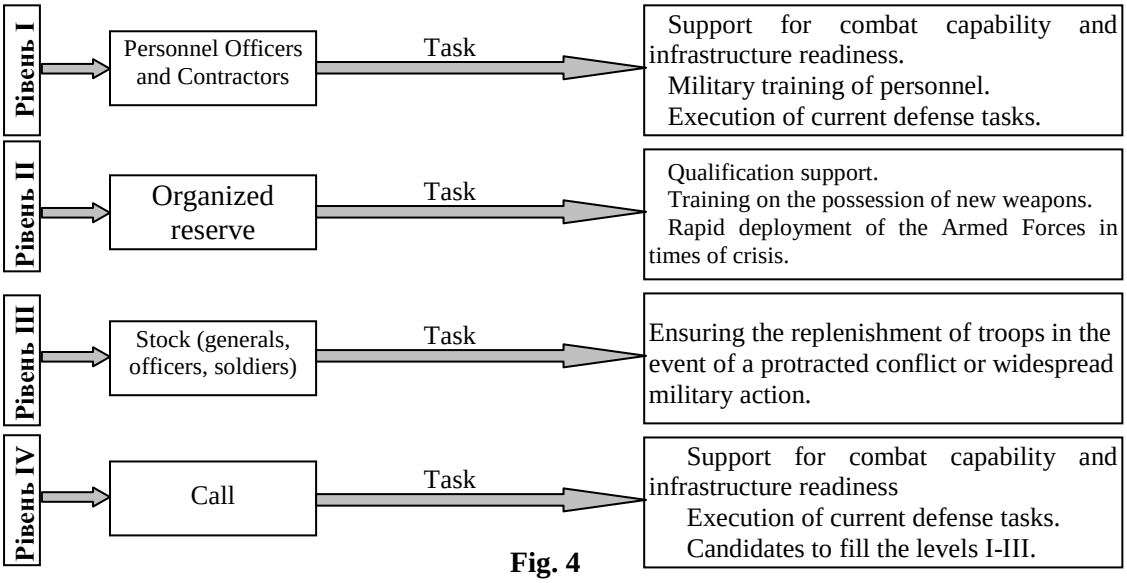

Fig. 4

Level 4 - Senior military service prizes; military service for a prize during mobilization, for a special period; military service for officer officers.

Such an organization allows a small regular army and, with minimal cost, maintains a high combat capability of the Armed Forces and, in the shortest time possible, multiplies their number to the required level of defense.

The procedure for selecting candidates for appointment to positions on a rating basis is shown in Fig. 5

ORDER OF SELECTION OF CANDIDATES TO APPOINTMENT BY RATING PRINCIPAL

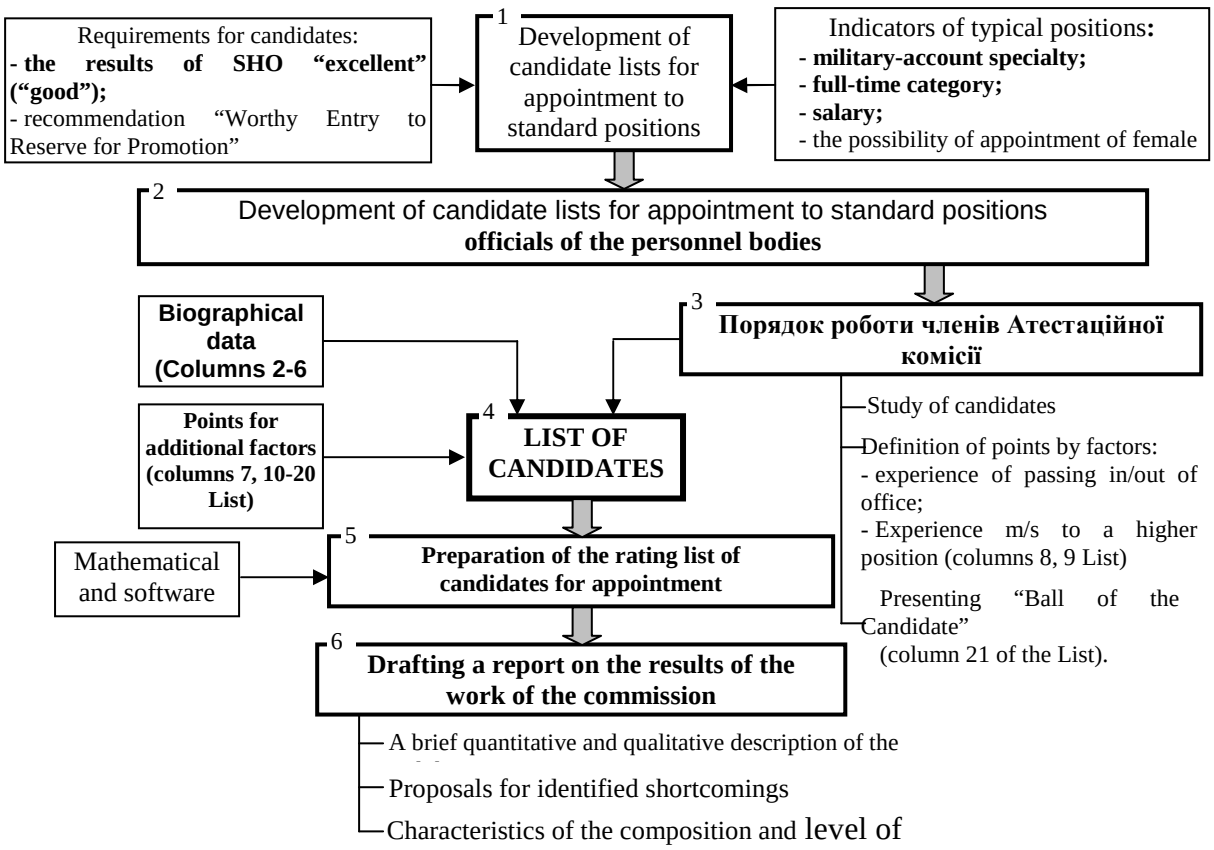

Fig. 5

Analysis of the procedure for selecting candidates for appointment to positions on a rating basis allows us to conclude that the main work is performed by the secretary of the relevant Attestation Commission (blocks 1, 2, 4-6). This process can be improved by creating an *automated workplace (AWP) of the secretary, which will provide access to the necessary databases (DBs), software for drawing up the rating list of candidates for appointment and drawing up a report on the results of the work of the commission*.

The analysis and assessment of the IAS state created for the automation of the processes of accounting and personnel management (UMS AEP) of the Armed Forces of Ukraine provides an opportunity to reach the following conclusion:

- existing IASs are narrow-profile, with the exception of the IAS “Personnel” and subsystem “Personnel” of the Unified management system of administrative and economic processes of the Armed Forces of Ukraine;
- the functionality of the developed systems is analyzed in relation to: maintenance of organizational-staff structure; HR; reporting and data exchange;
- the most complete functionality of the IAS “Personnel” and the subsystem “Personnel” of the UMS AEP of the Armed Forces of Ukraine;
- in the subsystem “Personnel” of the UMS AEP, the Armed Forces of Ukraine needs to set up such sub processes: keeping records of organizational directives, submissions to the assignment of the next rank, support and management of processes for the preparation and allocation of draft orders, and a plan for dismissal.

Conclusions. The improvement of the management system of the Armed Forces of Ukraine should be based on the application of modern methods of management, the introduction of modern information technologies, methods of operational analysis of information, support of decision-making processes on the basis of an integrated information environment.

Automated systems, which at present are implemented in the work of the personnel of the Ministry of Defense of Ukraine and the Armed Forces of Ukraine, do not have the functional possibilities for the formation of Reserve candidates for promotion and its use in the preparation and adoption of personnel decisions, but can provide general information about a serviceman or military equipment ' the results of the annual assessment of the military.

Further studies should focus on the development of special software for compiling the rating list of candidates for appointment and drawing up a report on the results of the work of the Attestation Commission.

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Формування дієвого резерву кандидатів для просування по службі та його використання під час підготовки і прийняття кадрових рішень

Резюме. Проведено аналіз процесу управління особовим складом щодо формування і використання Резерву кандидатів для просування по службі та управління кар'єрою військовослужбовців. Обґрунтовані пропозиції щодо удосконалення процесу формування Резерву за рейтинговим принципом шляхів застосування ІТ-технологій.

Ключові слова: кадровий резерв, комплектування збройних сил, автоматизовані системи управління персоналом.

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Формирование действенного резерва кандидатов для продвижения по службе и его использование во время подготовки и принятия кадровых решений

Резюме. Проведен анализ процесса управления личным составом относительно формирования и использования резерва кандидатов для продвижения по службе и управления карьерой военнослужащих. Обоснованы предложения по совершенствованию процесса формирования резерва по рейтинговому принципу путем применения ИТ-технологий.

Ключевые слова: кадровый резерв, комплектование вооруженных сил, автоматизированные системы управления персоналом.

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Ways of data integration of defense resource management information systems

Resume. The article is devoted to the problem of determining possible ways of data integration, which arises during the implementation of projects for the development and creation (modernization) of information systems for the management of defense resources. Projects are implemented as part of the creation of a unified defense resource management system, which requires the organization of data exchange, both between new and existing (legacy) systems, to improve the effectiveness of defense planning and defense resource management.

Keywords: information infrastructure, integration methods, data integration, integration bus, service-oriented architecture.

Formulation of the problem. Creation of an effective system of management of the Armed Forces of Ukraine, as the basis of the system of defense control of the state, is one of the priorities of the defense reform of the state. The Strategic Defense Bulletin of Ukraine [1], conceptually, outlined the main directions of the defense reform. First of all, it is the introduction of effective defense planning and defense resources management using modern Euro-Atlantic approaches. The problem of fulfilling this task is the fact that the current system of management of the Armed Forces of Ukraine is largely not automated.

One of the priority directions aimed at improving the effectiveness of defense planning and defense resources management is the fulfillment of task 1.4.8 "Matrixes for achievement of strategic goals and fulfillment of the main objectives of defense reform" in relation to the creation of defense resource management information systems (DRMIS).

An urgent problem, the solution of which is the creation of DRMIS, is the need to provide the military management bodies with information and analytical components (tools) to support decision-making in the field of management of defense resources in the areas of management: personnel, organizational structure, defense planning, logistics, health care, purchases, estate, finance and budget, administrative activities.

The extent of the problem. Today, for each of the directions of defense resources management, separate information systems have been created, but they are heterogeneous in terms of the time of creation, degree of completeness, technologies used, scope of processes, amount of deployment and filling of data.

The state of the information infrastructure and provision of information needs of the leadership of the Armed Forces of Ukraine does not meet the needs of the present. Integration of information systems for the management of defense resources in separate directions is absent or carried out fragmentarily, which leads to duplication and insufficient reliability and completeness of information on integrated management of defense resources in general.

Thus, in spite of the implemented software and hardware solutions, the separate information systems available in the Armed Forces of Ukraine do not fully support the defense planning and defense management processes.

The purpose of the article is determining ways to integrate data of defense resources management information systems to increase the effectiveness of defense planning and management of defense resources.

Presentation of the main material. Insufficient effectiveness of defense planning, defense resources management and poor information infrastructure is due to the following reasons:

the lack of common methodological, technical and organizational principles and approaches to the creation of information systems and the implementation of information technology;

organizational dispersal and functional disparity of existing information systems;

the lack of a single platform with centralized access, storage, processing and data sharing services;

the lack of standards for data exchange between information systems to ensure interoperability;

insufficient branching of information and telecommunication networks and fast data transmission channels;

insufficient development of questions of protection of information (information resources) and high cost of carrying out of measures on creation of complex information security systems;

the lack of unified technical support for information systems, training and customer support.

One of the ways to solve the problem is to improve the functional interaction of existing and promising information management systems of defense resources based on data integration methods [2]. Integration of information systems of management of defense resources into a single system (DRMIS) will enable to form a single information space [3], in which structured information is consolidated, operational access to this information is provided for analysis and decision-making.

The task of data integration and the creation of a unified information management system for defense resources arises from the fact that, firstly, the volume of data is rapidly increasing, especially through the development of new information systems, and secondly, information systems are created by different developers who use various software platforms and database management systems. Data integration is understood as providing a single unified interface for access to a certain set of heterogeneous, independent data sources. Thus, the information resources of the entire set of integrated sources are presented as a single source. A system providing such capabilities is called the data integration system [4].

In its architecture, the data integration system is divided on the basis of data integration methods: consolidation, federalization, distribution, service approach [5].

When using the consolidation method, data is collected from several primary systems and integrated into one common repository. This is a one-way process that runs at a certain time interval and leads to a certain delay in updating data.

When using *the federalization method of data* a single virtual information space is created in which data is stored in different sources. Receiving data is performed by request, which is divided into a set of requests addressed to the desired local sources. In another, this process is similar to consolidation.

Method of data dissemination is to transfer data from one system to another in an operational mode, depending on certain events. Updated data in the primary system can be transmitted to the end system synchronously or asynchronously. Regardless of the type of synchronization, the distribution method guarantees the delivery of data to the destination system. As a rule, synchronous distribution supports two-way data exchange between primary and end systems.

Service approach allows you to combine information from multiple sources in a way to provide it as a service. Services are separate software components that provide a certain functionality through a series of requests for the required information and other services. Typically, services are built on a limited number of requests for information required by its functions.

Depending on the architecture chosen, several approaches can be applied to create a data integration system for data management systems for defense resources [6]. Among them, there are **three main approaches** to creating an integrated system based on:

1) use of a monolithic system of class ERP;

2) methods of consolidation, federalization and dissemination of data;

3) service-oriented architecture.

The ERP system can provide support for managing financial, material, human resources at all levels of management, providing relevant information necessary for making operational and strategic decisions. A key feature of modern ERP systems is the use of techniques and integrated analytical tools for strategic management that provide management both at the level of structural units and the spread of management processes at the strategic level.

The second approach is to consolidate the data of existing information systems using a single concept of network interaction and access control of resources. Its application will ensure the transfer to the more modern information environment of the functions of legacy information systems with the further use of available data, as well as will enable the introduction of new information systems based on a single technology. When applying this approach, it is necessary to decide: what tool is better to choose, how will be further developed the new system modules, which standards to follow in the design and development.

The essence of *the third approach* is the application of service-oriented architecture based

on the technology of open systems, which provides:

unified data exchange between different information systems;

simple customization of the interaction with inherited systems;

flexibility of information infrastructure (quick response to change);

reducing the cost of integration, maintenance and scaling.

The basis for implementing this approach is a set of standards that unifies the interaction of all components of the information environment: input/output, interfaces and protocols for data transmission in networks, etc.

Given these approaches, possible variants of data integration of data of defense resources management systems and the creation of DRMIS are as follows:

The first variant – purchase of ready-made ERP class management software for managing a company's foreign or domestic developer resources (which is used in partner countries of NATO or other ministries of Ukraine) and creating DRMIS based on a single software platform.

The advantage of this approach are: ready-tested solutions, high-quality product; short implementation dates; the only technology, the only platform, the only developer; a wide range of specialists in the implementation and support of industrial software solutions in the labor market; standardized user training and technical support at a high level from a developer with world-wide experience; further training of users by their own trained specialists.

As disadvantages it is necessary to note: high cost of the software product, adjustments and technical support; the complexity of developing and implementing a new system; full dependence on the supplier.

The implementation of the first variant contributes to the timely implementation of DRMIS tasks, but may require significant financial resources to acquire licenses for the right to use the software solution, its implementation and further support.

The second variant – the development of new software, separately for each functional management of defense resources, and the further development of DRMIS by integrating existing and newly created systems with the integration bus and defined data exchange protocols.

The main advantages are: lower, compared with the first option, the cost of implementation from the domestic developer (depending on the licensing policy); the further use of existing information systems, for the development and implementation of which a significant financial resource has been spent; possible diversification of developers.

Possible disadvantages are: lower quality than industrial software; longer terms of development and implementation; the need to prepare users for each system separately; technical support for each system separately; lack of user training and technical support for inherited systems; dependence on developers; the risks of the cessation of the existence of small developers.

The implementation of the second variant can complicate the process of creating DRMIS based on a single ideology and design (technology) solutions, has higher implementation risks.

The third variant – a combined approach to the creation of DRMIS based on the use of an industrial integration platform that implements the principles of service-oriented architecture and open system technology, to create new (for unauthorized directories of defense resources management), and to ensure compatibility (interoperability) with existing information systems.

The third variant combines the advantages of the first and second options, eliminates most of their shortcomings, in particular, reduces the risk of failure of the system implementation according to the second option.

Implementation of the third variant will enable the task of creating DRMIS based on a unified ideology and design (technology) solutions with less financial, logistical and human resources.

Conclusions. At the present stage of the establishment of a control system of the Armed Forces of Ukraine, the definition of a rational approach to the integration data of existing and future information systems of defense resources management is an urgent task. The approaches presented in this article can serve as the basis for such integration into a single defense resource management system DRMIS. The use of an integrated system, rather than a set of separate systems, will significantly increase the efficiency and reduce the costs associated with the information provision of defense planning and defense management processes.

The choice and justification of one of the ways of data integration of data management systems of defense resources is an actual topic of **further research**.

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Шляхи інтеграції даних інформаційних систем управління оборонними ресурсами

Резюме. Статтю присвячено проблемі визначення можливих шляхів інтеграції даних, що виникає при реалізації проектів з розроблення і створення (модернізації) інформаційних систем управління оборонними ресурсами. Унікальність проектів, їх обмеження по вартості й часу призвело до відсутності єдиних підходів до інтеграції даних. Проекти реалізуються в рамках створення єдиної системи управління оборонними ресурсами, що потребує організації обміну даними як між новими, так і з існуючими (успадкованими) системам для підвищення ефективності оборонного планування та управління оборонними ресурсами.

Ключові слова: інформаційна інфраструктура, методи інтеграції, інтеграція даних, інтеграційна шина, сервіс-орієнтовна архітектура.

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Пути интеграции данных информационных систем управления оборонными ресурсами

Резюме. Статья посвящена проблеме определения возможных путей интеграции данных, которая возникает при реализации проектов по разработке и созданию (модернизации) информационных систем управления оборонными ресурсами. Проекты реализуются в рамках создания единой системы управления оборонными ресурсами, что требует организации обмена данными, как между новыми, так и с существующими (унаследованными) системами, для повышения эффективности оборонного планирования и управления оборонными ресурсами.

Ключевые слова: информационная инфраструктура, методы интеграции, интеграция данных, интеграционная шина, сервис-ориентированная архитектура.

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Ways to increase the speed of electronic document management on the basis of standards for the exchange of information between NATO headquarters

Resume. The article reveals the concept of information management and its role for the Armed Forces of Ukraine. The structure of information management and the order of interaction NATO Staffs on different management level, as well as the use of tools and algorithms for the exchange of electronic documents have been analyzed.

Keywords: information management, marking and document classification, metadata, document handling system.

Formulation of the problem. The process of document flow has a significant place in any organization, especially in such government structures as armed forces. As founder of the huge Rothschild banking dynasty, Nathan Rothschild, once said: "Who owns information, he owns the world". Given the current conditions, and especially the conduct of the hybrid war against our country, we can add some remark, namely*: the operativeness* of possession of the necessary information gives the decision maker a great advantage. So finding ways to increase the operativeness of obtaining information is an urgent problem.

Analysis of recent research and publications. First of all, the question of automating the exchange of information, which can serve as a different tasks from the top management, providing statistical data on different areas of activity for its further analytical handling, the provision to the top echelon of various forms of reporting, reports on the current status, etc., is partly resolved. This can be seen on the facts of the introduction of electronic document circulation in the state and in the Ministry of Defense of Ukraine in particular [1-4]. But the issue of the influence of the bureaucratic mechanism, which has been a descendant since the Soviet era, remains unresolved [5].

Taking into account the direction of the development of the Armed Forces of Ukraine which was determined by the president of Ukraine, with the goal of future accession to the North Atlantic Alliance [6], we will analyze the experience, best practices, typical problems of Information Management organization (further - IM) and Information and Knowledge Management (further - IKM), that have been implemented and are still developing into the headquarters of different levels of NATO's management.

The mission of information management in NATO is to gain the information advantage that is achieved by creating favorable conditions for providing relevant officials of different layers of the management with necessary and reliable information in any places, in the required format and at a specified time, preventing the enemy from doing the same. This is achieved through qualitative and detailed planning, carrying out certain organizational measures, the use of high-quality communication channels for this equipment and software. The process of parallelizing the bringing of information at all levels of the management hierarchy enables to accelerate the receipt of information to the relevant officials, thereby accelerating the activity of their handling and obtaining the desired result.

The purpose of the article is to determine the ways of timely reporting of information to officials in order to increase the operativeness of its handling, based on an analysis of modern approaches adopted in leading NATO partner countries.

Presenting main material. Today, electronic document management systems are being developed to accelerate the process of communicating information between different levels of management in any large organization. The main task of these organizational and technical systems is to provide

the process of creating, managing access and dissemination of electronic documents in computer networks, as well as ensuring control over the flow of documents.

The volume of document flow consists of incoming, outgoing and internal documents which are processed during one calendar year.

The main stages *of the document flow* are: reception of incoming correspondence; handling and registration of documents; control over the execution of documents; handling and sending outgoing correspondence.

The basic *principles of electronic document flow* are:

one-time document registration that allows you to uniquely identify the document in any installation of this system;

the possibility of parallel execution of operations, which allows to shorten the time of movement of documents and increase the operativeness of their execution;

the continuity of the document's movement, which makes it possible to identify the person responsible for the execution of the document (task) at each time of the life of document (process);

a single (or agreedly distributed) basis of documentary information that makes it impossible to duplicate documents;

an efficiently organized document search engine that enables you to find a document with minimal information about it;

developed reporting system for various statuses and attributes of documents, which enables to control the movement of documents in the processes of document flow and to make managerial decisions based on data from reports.

Thus, the system of electronic document flow should ensure the operativeness of handling and exchange of documents, and the timeliness of their transmission to a certain official who takes direct part in handling the document and / or make managerial decisions.

However, according to the practice of using electronic document flow in the structures of the Ministry of Defense of Ukraine and the Armed Forces of Ukraine, handling of documents is carried out with considerable delay in time.

Certain time limits are set for the handling of any document. It is necessary to take into account the fact that the time of document passage from the customer to the executor can range from one day to more, depending on the location and the possibility of using the document flow system. This greatly affects the remaining time of its handling and the answer of the executor to the customer, which can not exceed the limits for execution. This process can be represented by the following formula:

$$T\text{com} = T\text{crt} + T\text{prc} + T\text{tr} + T\text{exc},\ T\text{com} \le T\text{tot},$$

where Tcom – the common time which will be spent from the moment of creation of the regulatory document by the customer, its transfer to the executor and the return of the hendled material to the customer again;

Tcrt – time spent on creating of regulatory document by the customer (electronic and paper versions);

Tprc – the time spent on digitizing (scanning) the paper version of the document and preparing all attributes for sending in accordance with the requirements for electronic document flow in the organization;

Ttr – the time required for the physical transmission of the document through communication channels, with the possibility of transportation on magnetic media (in case of the absence of direct connection of the executor to the system on the lower levels of management);

Texc – time spent by the executor on working out the document;

Tlim – the time limit for executing the received document is set by the customer.

Total time Ttot includes a complete cycle of processes that are executed with an appropriate document circulating in the electronic document flow system.

1. The head of a higher-level headquarters (customer) assigns the task of working out a specific task to the head of a lower-level headquarters (department, department or other organizational structure), which is displayed in writing (paper version).

2. The administrator of document flow system receives the document on the output, format it (scans and identifies it on the system), and sends it to the addressee. In the absence of direct access by the executor from the list to the system, the document is transmitted to the nearest access point to it, where it is copied to the magnetic media, or printed its paper version and delivered through the relevant services. In this case, the time taken for its reception in the system, the registration of the administrator of the appropriate access point, as well as the process of forming the source document for the performer.

3. After receiving the document by the executor, there is a direct process of its working out. Upon completion of this process, the executor delivers the completed document to the system

administrator, where the process of digitization (copying), registration and preparation for sending to the address of the customer takes place.

4. Once transmitted by the system, the document is registered again in the appropriate manner, printed out and communicated to the customer.

Practice shows that the time of execution *T*exc can drastically decrease, depending on *T*prc, *T*tr та *T*tot. The more time it takes to deliver to the executer, the less he will have the time to work out, which greatly affects the quality of execution.

The reasons for the delay may be the poor quality of the information exchange channels or the lack of branching of the network, as well as the human factor, namely, the lack of staff knowledge about the use of electronic document flow tools, bureaucratic procedures, and the reluctance of the executor to move from using the hard (paper) version of the document to the electronic version.

Hence the problem of finding ways to reduce the time for design, formatting and transporting the document. Taking into account that *T*tot determined by the customer as a constant to which total time *T*com must approach, it is necessary to minimize the value *T*tr та *T*prc.

To solve this problem we will analyze the main guidance documents on information management, adopted as standards for organizing electronic document flow between headquarters of NATO [7-11].

The NATO Information Management model represents a lifecycle of information passing from customer to executor, with return after its handling to the customer. But this lifecycle is not an ordinary flow of information, but is formed from a set of stages, each of which is important, figure 1.

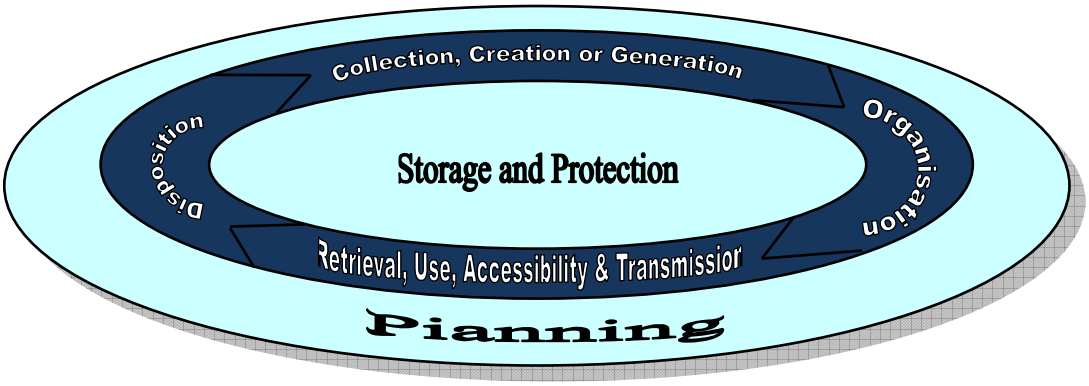

Figure 1. NATO Information Management Lifecycle

The lifecycle of information covers the following stages:

- planning (performed at all stages);
- collection, creating or generating information;
- organizational;
- retrieval, use, accessibility and transmission;
- storage and protection;
- disposition.

Planning is an important step in defining the purpose of information management that is related to the processes and activities of NATO and should relate to its missions, such as NATO operations, projects, programs, contracts and other related tasks, at all stages of lifecycle. Each element of the stages must be clearly elaborated, available descriptively and policy-backed.

At the stage of ***collection, creating or generating information*** the data is accumulated from various sources, both internal and external, such as the Ministry of Defense of the NATO member states. Subsequently, the marking of documents is carried out by assigning metadata, which in future will be used for their identification, which will enable them to determine the order of their storage and disposition, as well as increase the speed of their search and handling. Metadata are used as mandatory characteristics of documents, namely the definition of its owner (organization, military or business units that accumulate, create and process documents) and the level of secrecy, as well as optional (about 40) but desirable, such as taxonomy, performer, availability or limited use, date of creation, registration and deadline, etc. All this is described in the relevant instruction AC\35-D\1032.

During the ***organizational*** phase, measures for the preparation of information are held to ensure its availability, the possibility of qualitative handling and further determination of its disposition. To share information and use it, it should be organized in a standardized way, making it easy to access and secure against unauthorized access. Work with information should be easy to request and receive (the principle of "drag"), as well as distribution (the "drop" principle).

Stage of ***retrieval, use, accessibility and transmission*** related to the search and handling of information. It consists in bringing accurate

information to the right official at a specified time and in the required format in order to provide a reasoned decision or execution. This stage includes: optimizing the use, distribution, exchange and reuse of information by ensuring its relevance, accuracy and reliability; presentation of information in an appropriate and accessible format; ensuring access and safe distribution within the framework of the guidelines for security and information protection.

The purpose of the ***storage and protection*** phase is double. Saving provides support for active information that is used at least 2-3 times a month, and inactive, regardless of media and format, including documents in paper form, in appropriate storage infrastructures (archives). Protection is aimed at ensuring the confidentiality of information, maintaining its integrity and availability throughout its lifecycle. This requires the implementation of mechanisms for protection and evaluation of their effectiveness.

The last stage, ***disposition***, refers to the use of valuation decisions taken at the planning stage, the transfer of information of a permanent significance to the NATO archives, or the destruction of information that was only temporary and not needed anymore.

In order to ensure the processes of information management, the headquarters of different layers of the management creates relevant departments and positions, which are assigned the necessary roles and responsibilities. The number of people involved in these units can range from one to five dozen, depending on the scale of the tasks of information management and hierarchy of headquarters. Among such posts you can see:

IM Senior Officer – senior unit, usually the chief of staff or person is equivalent to this post, who is responsible for all issues related to IM, management of its state and direct IM planning;

Information Manager – persons who perform the tasks of purely information management, namely: support, security, archiving, training and coordination of IM;

IKM Head та IKM Support Officer – chief and Officers on information and knowledge management responsible for education, training and changes to the information management plan etc.

There are standard Microsoft tools for the exchange of information at NATO headquarters, namely SharePoint 2007 with some predefined settings, which are used in accordance with the requirements of the directives and the information management plan. By the end of 2018, they plan to fully migrate to SharePoint 2013, as this version resolved the issue of simultaneous handling of the electronic document by several performers.

All documents that are created, transmitted and handled in the system are stored not on the local PC of the official, but directly on the server storage of the database, that is, to work with documents used technology of thin clients. This gives you the following benefits:

secure data storage in one place, eliminating the duplication of information;

automating file naming processes, document registration, and accounting for versioning, with a complete history of their changes saved;

use of a single system of marking documents;

facilitating the implementation of information security measures by keeping it in a single repository and providing access to documents using electronic links;

effective use of the process of access distinction to information; centralized archiving of information and its destruction, in case of its inactive status, etc.

Consider the algorithm for creating, handling and transmitting documents in the Electronic Document Management System (further - EDMS) using Document Handling System (further - DHS), which is implemented on the basis of Microsoft SharePoint software.

1. The customer of the highек-level staff, for example, NATO Headquarters in Brussels, creates a document in the DHS system to be deployed at the United Nations Headquarters in Naples. Using the SharePoint toolkit is made its marking, which defines the owner of the information, secrecy, the date of creation and registration, the terms of execution, to which topics the document relates to (taxonomy), the list of those who are appointed to work out, which units are involved, etc. After saving this document, the metadata-based EDMS system automatically names the file, assigns it a unique number and version of the document. After these steps, the customer sends it to the appropriate headquarters.

2. The unit that provides information management at the appropriate headquarters receives a file that stores it in a set manner, taking into account its degree of secrecy, and determines the responsible executor of this document on the basis of metadata. After that, an email is sent to the executer's mail with a link to the document that is already stored in the central EDMS repository.

3. An executor begins to get acquainted with the document without waiting for direct instructions from the head of the team to process the document. At the same time, the IM department is familiar with the context of the document, after which it generates an instruction for its handling and sends it

to the appropriate addressee through the system. Since the recipient has, at the initial stage, received a link to the relevant document, the time for bureaucratic actions and delivery has been reduced, and the document has been partially or fully handled.

4. The handled document is sent to the higher headquarters using the same algorithm.

Given the ability of the system to automatically add a version of the document in the file name after each save, if necessary, it will be worked out by another performer and he will receive it in the latest revision. An executor can view the entire history of document changes by saving all versions and may, if necessary, return to any previous version.

If the information contained in the system loses its activity, that is, it is not used at least three times a month, it is transferred to the archive, where the archive of the IM division, depending on the type of document (paper or electronic), registers it in a certain way and retains a certain period. Upon the expiration of the period of information storage, which is determined by the degree of its secrecy, the IM officer informs the owner of the information about this fact, after which a decision is made to prolong the storage, or to reduce the stamp of secrecy of this document and to prolong its storage or its destruction in the established manner, in accordance with the requirements of the directives NATO.

Conclusions Taking into account the results of the analysis of the electronic document flow system between the NATO headquarters, we can conclude that the process of setting up and working out tasks using the electronic document management system can be made more effective by reducing the time *T*prc and *T*tr.

This can be realized, firstly, by creating a document directly in the system of electronic document flow, and not on a local computer, which significantly reduces *T*obr by automating the process of assigning a registration number, marking on the basis of metadata, the need to spend time on the translation of the document from the paper version into an electronic version and maintains the automatic assignment of a version of the document, preserving the history of its changes.

Secondly, starting with Microsoft SharePoint 2013, there is the possibility of parallel work and simultaneous editing of the same document by several executors from different structures, if there is such a necessity, which also reduces the handling time of the document *T*prc.

Thirdly, storing a document on a server, and not on a local PC, and the scalability of the electronic document flow system to the headquarters of the lower levels of management, as well as the effective use of the policy of access of officials to electronic information with limited access, allows to significantly reduce the time spent on transfer of information between the headquarters of various units of management *T*tr.

Finally, the use of just the standard Microsoft SharePoint software, rather than a separate, newly developed, will greatly reduce financial costs, which today is also extremely relevant.

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Шляхи підвищення оперативності електронного документообігу на основі стандартів організації обміну інформацією між штабами НАТО

Резюме. Стаття розкриває поняття інформаційного менеджменту та його роль для Збройних Сил України. Проаналізовано структуру інформаційного менеджменту, порядок взаємодії штабів НАТО різних ланок управління, а також використання інструментарію та алгоритмів обміну електронними документами.

Ключові слова: інформаційний менеджмент, маркування та класифікація документів, метадані, система обробки документів.

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Пути повышения оперативности электронного документооборота на основе стандартов организации обмена информацией между штабами НАТО

Резюме. Статья раскрывает понятие информационного менеджмента и его роль для Вооруженных Сил Украины. Проанализирована структура информационного менеджмента, порядок взаимодействия штабов НАТО различных уровней управления, а также использования инструментария и алгоритмов обмена электронными документами.

Ключевые слова: информационный менеджмент, маркировка и классификация документов, метаданные, система обработки документов.

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Aspects of the practical implementation of the model of the information-analytical system for fixing firings for the Ukrainian side of the JCCC

Resume. The article reveals the features of the practical implementation of the model of the information-analytical system for fixing firings for duty service, the activities of the headquarters and Ukrainian observers of the Ukrainian side of the Joint Centre for Control and Coordination of issues of the cease-fire and the stabilization of the line of delineation of the parties, based on the implementation of GIS tools and database management systems.

Keywords: system of fixing of firing, GIS, DBMS.

Formulation of the problem. The Joint Centre for Control and Coordination of issues of the cease-fire and the stabilization of the line of delineation of the parties (JCCC) was created by the General Staff of the Ukrainian Armed Forces, according to the President of Ukraine's Order “About providing of monitoring and verification of the non-use cease firing regime”, performs the functions of ensuring interaction between the state bodies of Ukraine, the high level of The Ukrainian Armed Forces and other military formations and law enforcement bodies of Ukraine, authorized representatives of other interested parties with the Special Monitoring Mission to Ukraine (SMM) OSCE on defining priorities for monitoring the compliance with the non-use regime and its verification, harmonizing the issues of ensuring the safety of personnel and equipment of the SMM OSCE, exchanging information on violations of the non-use of weapons and preparing proposals for the urgent response to such violations. Also, the JCCC together with CMM are keys in creating a mechanism for the development of forces and means along the cease firing line [1].

Thus, as a result of understanding the essence of the activity and algorithms of the JCCC’s HQ, efforts were made to rationalize the collection of data for further analysis and mapping on the electronic map. An analysis of the performance of functional duties by officers of the JCCC has revealed a low level of automation, with a mainly manual method (for example, seldom with the help of computer technology), functional processes of the HQ. The working model of the information-analytical system for fixing fires (IASF) was initially proposed. It will increase the level of automation and implement a mechanism for rapid visualization and analysis of the situation at the database level to provide the information needs of the Ukrainian side of the JCCC.

When creating the specified IAS it is necessary to decide on its tasks, topology, architecture and place in the structure of the JCCC.

The degree of problem development. According to published materials on the OSCE site, you can see some examples of the use of materials obtained from the Geographic Information System (GIS) [2]. The paper [3] is devoted to determine the role of such a system in the IASF (from the point of view of the presence of the GIS component), which would at the same time satisfy the requirements of the Ukrainian Armed Forces and be consistent with NATO's concepts and standards. The methodology of PhD Gorodnov [4] considered the problems of HQs automation. However, the practical implementation of scientific developments in these papers is devoted insufficient attention.

The purpose of the article is to highlight the main aspects of the practical implementation of the information analytical system for fixing of firing model for the Ukrainian side of the JCCC.

Presenting main material. The task of creating the IASF model in the Ukrainian side of the Joint Centre for Control and Coordination of issues of the cease-fire and the stabilization of the line of delineation of the parties (JCCC) was to increase:

- the effectiveness of the duty Ukrainian officers and military observers of observation teams;

- the efficiency in collecting, transmitting and displaying the violations of the cease-fire on the electronic map of recorded facts;

- the accuracy of the location of the object on the map (including maintaining accuracy when converting from one coordinate system to another) due to a unified approach to the formation of an electronic map of the JCCC and cartographic documents for the JCCC in a specified and approved in the Ukrainian Armed Forces [5] GIS software (ArcGIS).

In order to formalize the passage of information from observers to the HQ within the JCCC, the current state of the information environment was taken into account. The network component of this environment, for transmitting data on the fact of shelling by the illegal armed forces, was considered by the JCCC as an open information that enables the use of the Internet.

The distribution of the nodes level of the information environment of the the Ukrainian side of the JCCC hierarchically contains the following levels:

- Observation Posts;
- Observation Teams;
- The Duty Section;
- The Information and Analytical Section.

This hierarchy of nodes passing information about shelling from the illegal armed forces is the basis of the work of the center. Taking into account its features, the definition of approaches to the visualization of firings on the electronic map was made with their subsequent rapid analysis. Manual mapping (one by one) per day on an electronic map is a rather complicated process, especially in the event of a significant daily amount of shells. Hence, there was a need for batch loading of bombardment data. There were no uniform changes in the formation of daily reporting tables, there was poor data structuring. The solution to this was to organize the data at the database level with their subsequent download to GIS.

In addition, a number of scientific, applied and organizational tasks were solved to create the IASF model. They have

- formalized of the processes of the JCCC was executed for implementation in the software complex;

- prepared geographic database;

- researched of problem issues for automation of collection, registration, storage, analysis and display cease-fire violations on the electronic map;

- prepared of cartographic documents.

To create the IASF model, the following steps were taken:

- formalization of data in the information environment, to minimize the occurrence of errors in the relational database management system (DBMS) due to the manual process;

- automation of import-export data in GIS to cover the current situation of the consequences of violations of the cease-fire on the map‘s display;

- integration of data exchange processes within mobile GIS;

- integration of data exchange processes through GIS-collector applications;

- automated formation of regulated (unregulated) reporting.

The developed IASF model includes a software package (software) and a special software. Therefore, IASF can be divided into two parts: relational database and GIS (it contains static and mobile components).

Using a relational database allows you to: formalize data; consolidation of information in a single data source; automation of the process of confirmation of bombardment data by observers of the JCCC; conducting a quick analysis (sections of information) for a certain period of time; use of information collected in the database for further using in decision support systems of analytical systems by the higher command.

The static component of GIS (installation on a PC or server) provides the ability to: display the current situation on the map, its operational change (if necessary refined data, etc.); automated visualization of violations of the cease-fire regime due to the integration of the DBMS and analytical sections of the intensity of the shelling; the automated formation of standardized cartographic documents proving the use of the illegal armed forces prohibited by The Minsk agreements, schemes for carrying out reconstruction works on infrastructure objects and industry damaged by terrorists.

The introduction of mobile GIS (installation on mobile devices) will enable: the operational collection of information about shelling by officers-observers simultaneously from several directions with help of geographic information collectors and consolidation of the collected information in a single data source through the use of cloud technologies; use libraries for symbols for observing objects; operational change of the current situation on an electronic map and its export to other devices of mobile and stationary GIS; bind to the terrain with the help of a GPS receiver, laying traffic routes; photofixation with automatic determination of the consequences of the

use of the illegal armed forces prohibited by the Minsk arrangements.

The order of the work of the next changes and the analytical group of the Ukrainian side of the JCCC is carried out through the use of relational database. Using the Microsoft Access software model, an automated workplace (AWP) was developed for the next officer of the Ukrainian side of the JCCC and AWP for officer of the information and analytical group. This DBMS was used in the layout as a system for collecting initial data on shelling, processing and exporting data to GIS with the possibility of automated preparation of established forms of statistical and analytical reports on shelling.

The choice of GIS for the solution of the rendering task was made taking into account the requirements of the military standard [5] and the coverage of the maximum functionality of the JCCC. It was chosen ArcGIS software, which became the core of the IASF model. There is the desktop GIS, the GIS-collector on smart devices, the GIS-portal of JCCC organization, external local GIS in the package of geographic information programs' blocks of the ArcGIS family.

The Desktop GIS Block (environment, locators, 3D model, media geolocation) includes ArcGIS (ESRI) ArcMap, ArcCatalog, ArcScene, GIS Collector on smart devices – Collector for ArcGIS software, The Cloud Block for JCCC organization – ArcGIS Online and ArcGIS Viewer software, The Block of External Local GIS – ArcGIS ArcExplorer software.

The portable GIS uses for uploading images and exchanging geoinformation as additional equipment. It includes the military GIS "MAPA" (ArmySOS) as the version for stationary PCs and mobile military GIS "MAPA" as the version for mobile devices with the operating system Android.

It should be noted, that such documents as the Minsk memorandum of 19.09.2014, the Complex of measures on implementation of the Minsk agreements of 02.12.2015, the Appendix in the part concerning the withdrawal of tanks, as well as artillery guns with a caliber up to 100 mm and mortars with a caliber up to 120 mm dated 29.09.2015. So, it contains the main output data for the JCCC electronic map, namely: the limits and the zone of cease-fire in certain districts of Donetsk and Luhansk Oblasts (ORDLO); the withdrawal by parties of all heavy weapons at distances to form a safety zone of a width of at least 50 km (for artillery systems with a caliber of 100 mm and more), 70 km (for missile systems), 140 km (for the jet firing systems "Tornado-S", "Hurricane", "Smerch" and tactical missile systems "Tochka-U"). Also, the boundaries and areas of removal of all types and modifications of tanks, artillery cannons with a caliber up to 100 mm and mortars with a caliber of up to 120 mm (inclusive) at distances for the purpose of creating a safety zone with a width of at least 30 km were imposed; for the Ukrainian Armed Forces' withdrawal of this weapon – from the actual line of collision; for the illegal forces of ORDLO – from the cease fire line in accordance with the Minsk memorandum dated 19.09.2014; there are areas of withdrawal of weapons in the Appendix.

The generated electronic map in ArcGIS includes special layers with points, lines, and polygon symbols with full attribute content, namely: elements of the JCCC and the SMM OSCE; actual cease fire line; elements of the Minsk agreements in 2014 and 2015 (cease fire line; points of the area, which determine the passage of this line, the distance of the withdrawal of weapons on both sides of the collision line in the form of buffer zones by type of weaponry); objects (settlements) where shelling was carried out (as locators for geocoding); boundaries and areas of responsibility of observation teams; template circle buffer zones of distances of specimen damage to artillery systems to verify information and prevent falsification; point objects with media content (photos, videos); rasters of relief heights, with zones of visibility and mutual visibility for each observation post (OP) along the actual collision line; objects of repair and restoration works.

In field conditions, the possibility of using GIS collector to collect evidence of violation of the ceasefire was checked. In the model, it is implemented on the Collector for ArcGIS (mobile application with Android and iOS operating systems). This solution operates on the basis of ArcGIS Online's secure cloud resource. To do this, a geographic database with a defined field structure was prepared in the ArcMap desktop software for fixing on our side the lines of the collision of the consequences of the bombardments (violations). A model created with the geographic DB needed for collection has prepared categorical characters to display violations by the types of enemy weapons used and the ability to fill the photographs. This layer was hosted on the cartographic test portal of the JCCC organization on the ArcGIS Online cloud resource. In this case, the resource review is possible only if you enter a unique username and password of the user.

The observers fill violation's fact, the consequences of the bombardment (including the attached media content), is possible through the installed the Collector for ArcGIS application on

the device (smartphone, tablet, laptop). In this program, on a previously downloaded base map (image), you can set the firing point symbol and fill out a form (previously prepared and published using ArcMap) outside of the Internet, that is, to work offline. With the advent of a mobile device observer in the area of the Internet and having synchronized with the main server, the (collected) objects of the facts of the attack become available at the workplace of the headquarters staff of the Ukrainian side JCCC (if connected to the Internet) in the ArcMap program, or through a browser in the Viewer of ArcGIS Online.

GIS component analysis is implemented in the approaches to visualization on the map during reports and preparation of reporting analytical materials. The use of a direct GIS-component connection from a database allows not only to visualize statistical data by categories in the corresponding conditional marks, but also to carry out analytical calculations, filling them with spatial content. Currently, the following features are implemented:

- construction of columnar graphs of the frequency of use of weapons by type on the objects of the area;
- visualization with the proportionality of the symbols of the frequency of firing on the objects of the area on our side, which was used for fire;
- visualization by means of proportionality of the symbols of the frequency of occurrence of objects of the area on the side of the enemy, from where the fire flew;
- time-based analysis using to specify the degree of damage by different types of weapons with the installed number of enemy munitions on the objects of the area on our side;
- conducting analysis of the time indicators of cases fixed by the subsequent changes of the JCCC regarding the sites of defeat and areas of firefighting heavy weapons, by playing the chronological track of the situation with the ArcMap time tag tool;
- visualization of the frequency of attacks by the illegal armed forces and comparison of them in time;
- definition of areas on the territory of the ORDLO of hidden use of armaments that should have been allocated and the preparation of relevant information materials for the SMM OSCE.

As an expanded functionality of the IASF, 3D models of site areas for a OP and a buffer zone of 30 km width along the lines of delimitation of sides were developed by constructing the TIN model and the heights of the heights using the instrumentation of focal statistics.

Consequently, the practical realization of the IASF in the Ukrainian side of the JCCC was demonstrated in the execution of specific tasks such as:

- development of traffic routes for visiting teams of the Ukrainian side of the JCCC;
- creation of layouts of schemes (cartographic documents in pdf-format with a grid in a definite coordinate system) of repair and restoration works on the actual line of delimitation;
- creation of schemes with targets of fire with measurements of their mutual distance and range of damage to the types of weapons prohibited by the Minsk agreements;
- creation of photo-sketches of the locations of the joint venture the Ukrainian side of the JCCC;
- creation of zones of visibility schemes for each OP the Ukrainian side of the JCCC;
- creation of working patterns of security zones (demilitarized zones);
- drawing of probable sources of enemy fire to provide suggestions for the inspection of these areas to the representatives of the OSCE's SMM.

Conclusions. Consequently, the article describes the main aspects of the practical implementation of the model of the information-analytical system for fixing bombardments for the Ukrainian side of the JCCC. Using of the IASF model will increase the effectiveness of the service of the regular changes of the Ukrainian side of the JCCC and the officer-observers; the efficiency of collecting, transmitting and displaying the violations of the cease-fire on the electronic map of the recorded facts; accuracy (determination of coordinates, measurements of lengths and squares, drawing of objects on a map) and will introduce a unified approach to the formation of an electronic map of the JCCC and cartographic documents for the Ukrainian side of the JCCC.

Further research should be devoted to determining the effectiveness of the "To Be" model of the Ukrainian side of the JCCC using the IASF, as compared to the existing "As Is" model.

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Аспекти практичної реалізації макету інформаційно-аналітичної системи фіксації обстрілів для Української сторони СЦКК

Резюме. Стаття розкриває особливості практичної реалізації макету інформаційно-аналітичної системи фіксації обстрілів для чергових служб, діяльності штабу та українських спостерігачів Української сторони Спільного центру з контролю та координації питань припинення вогню та стабілізації лінії розмежування сторін на основі використання інструментарію ГІС та системи управління базами даних.

Ключові слова: системи фіксації обстрілів, ГІС, СУБД.

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Аспекты практической реализации макета информационно-аналитической системы фиксации обстрелов для Украинской стороны СЦКК

Резюме. Статья раскрывает особенности практической реализации макета информационно-аналитической системы фиксации обстрелов для дежурных служб, деятельности штаба и украинских наблюдателей Украинской стороны Совместного центра по контролю и координации вопросов прекращения огня и стабилизации линии разграничения сторон на основе использования инструментария ГИС и системы управления базами данных.

Ключевые слова: системы фиксации обстрелов, ГИС, СУБД.

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An analysis of the methodological apparatus for a comparative evaluation of the combat power of the armed forces of different countries of the world and the direction of its further development

Resume. The article analyzes the modern methodological apparatus for comparative evaluation of the combat power of the armed forces of different countries of the world using factor analysis and determines the directions for its further development.

Keywords: comparative assessment, factor analysis, the rating of the armed forces, the combat power of the armed forces.

Formulation of the problem. At the present stage of development of the Armed Forces of Ukraine, one of the priority tasks is to increase their ability to reflect possible aggression. However, this problem is characteristic not only for Ukraine, but also for other countries that are not part of any military-political blocs. In fact, the armed forces of these countries should be prepared to reflect aggression from any possible direction.

The basis for decision-making, which should ensure the solution of this problem, should be based on the results of the analysis of as many factors as possible that determine the level of defense of the state. It is clear that it is important to undertake such an analysis, first of all, with regard to the ratio of the combat power of possible counter-parties to certain threatening directions, first of all, to their Armed Forces. At the same time, the prolongation of such an analysis on a certain perspective will be a solid ground for both the substantiation of the required composition of the Armed Forces of Ukraine and for clarification of the content of other measures aimed at improving the defense capability of our state.

Thus, the improvement of the methodical apparatus for comparative estimation of combat power of the Armed Forces of different countries of the world is an actual direction of research.

Analysis of recent research and publications. As is known [1], the combat power of the Armed Forces is a component of the combat power of the state, a set of material and spiritual factors that determine the state of the Armed Forces and their operational ability to perform combat missions. Combat power depends on the numerical and qualitative composition of the Armed Forces, their completeness and technical equipment, the level of training, combat readiness and combat capabilities of the forces, the level of military art, etc. The combat power of the Armed Forces directly or indirectly depends on economic power, politics, military doctrine of the state.

From the analysis of the above definition, it follows that estimating the state's combat power is a rather difficult task due to the need to take into account a large number of factors.

At the same time taking into account a significant part of them, for example, the spiritual factor, the level of military art, etc., is associated with significant difficulties that are of a dual nature. On the one hand, these factors are qualitative, that is, for their formal analysis, it is necessary to introduce some additional scales to ensure that they can provide quantitative values. It is impossible to obtain reliable data on most of these factors (for example, training, combat readiness and combat readiness, etc.) for different countries due to lack of relevant information in open sources.

Proceeding from the fact that the most available for analysis are the characteristics of economic development of countries and the size of their Armed Forces, the modern methodical apparatus for comparative estimation of combat power of the Armed Forces of different countries of the world actually uses two approaches. The first of them compares the combat power of the Armed Forces on the basis of analysis of their numbers (in terms of personnel and equipment with weapons samples). In the second approach, taking into account the dependence of the military power of the Armed Forces on the level of economic development of the country, the indicators, which are related to the country's economy and characterize it, are additionally taken into account.

An example of the first approach is the study of the Swiss multinational financial services holding company [2], which compares the combat power of the Armed Forces of the twenty countries

of the world in six indicators: the number of personnel, the number of tanks, planes, impact helicopters, aircraft carriers and submarines. In this case, each of the indicators is given a weighting factor: the personnel of 0.05; tanks - 0,10; airplanes - 0.20; shock helicopters - 0.15; aircraft carriers - 0,25; submarines - 0,25.

The American Business Insider [3] compares the world's armed forces using seven indicators: the number of armed forces, the number of tanks, planes, nuclear warheads, aircraft carriers, submarines and the general military budget (see Table 1).

Table 1

Rating of the armed forces of different countries according to Business Insider magazine (2014)

Rating	Country	The number of personnel thousand people	Tanks	Planes	Nuclear warheads	Aircraft carriers	Submarines	Military budget, million $
1	**USA**	1430	8325	13683	7506	10	72	612500
2	**Russian Federation**	766	15000	3082	8484	1	63	76600
3	**China**	2285	9150	2788	250	1	69	126000
4	**India**	1325	3569	1785	90	2	17	46000
5	**United Kingdom**	205,33	407	908	225	1	11	53600
6	**France**	228,656	423	1203	300	1	10	43000
7	**Germany**	183	408	710	0	0	4	45000
8	**Turkey**	410,5	3657	989	0	0	14	18185
9	**South Korea**	640	2346	1393	0	0	14	33700
10	**Japan**	247.746	767	1595	0	1	16	49100
11	**Israel**	176,5	3870	680	140	0	14	15000
12	**Italy**	320	600	795	0	2	6	34000
13	**Egypt**	468.5	4767	1100	0	0	4	4400
14	**Brazil**	328	489	748	0	1	5	33142
15	**Pakistan**	617	3124	847	100	0	8	7000
16	**Canada**	68,25	201	404	0	0	4	18000
17	**Taiwan**	290	2005	775	0	0	4	10725
18	**Poland**	120	1063	475	0	0	5	9360
19	**Indonesia**	476	374	381	0	0	2	6900
20	**Australia**	58	59	385	0	0	6	26100
21	**Ukraine**	160	4112	400	0	0	1	4880
22	**Iran**	545	2409	481	0	0	31	6300
23	**Vietnam**	412	3200	413	0	0	1	3365
24	**Thailand**	306	740	543	0	1	0	5390
25	**Saudi Arabia**	233,5	1095	652	0	0	0	56725
26	**Syria**	178	4950	473	0	0	0	1872
27	**Switzerland**	135	200	175	0	0	0	4830
28	**Spain**	123,3	415	531	0	1	3	11600
29	**Sweden**	14	280	216	0	0	5	6215
30	**Czech Republic**	21,06	123	109	0	0	0	2220
31	**Algeria**	512	1050	404	0	0	6	10570
32	**Netherlands**	47,66	0	160	0	0	4	9840
33	**Mexico**	267,5	0	373	0	0	0	7000
34	**Belgium**	33	52	166	0	0	0	5085
35	**North Korea**	690	6600	943	10	0	78	7500

The most authoritative in the world is considered the rating of combat power of the Armed Forces of the world, which is based on data from open sources by Global Firepower [4].

Comparison of combat power is carried out by experts on a large number of indicators (Table 2), based on the following considerations:

only conventional weapons are taken into account, but countries with nuclear weapons receive some additional points;

account is taken not so much of the number of weapons as its variety and quality;

the military power is influenced by the geographical characteristics of the country, its infrastructure and natural resources;

the number of people and available labor resources are taken into account; countries;

landlocked countries do not receive penalty points for lack of a fleet, but countries with a small number of maritime weapons receive penalty points;

NATO member countries receive additional points at the expense of resource sharing;

the nature and features of the current military-political leadership of the country is not taken into account.

Table 2

List of indicators for determining the combat power of the armed forces of different countries by the method of Global Firepower

№	Indicator	№	Indicator
1	Total rank of combat power	24	Number of destroyers
2	Power index	25	Number of corvets
3	Total population	26	Number of submarines
4	Available work force	27	Number of coast patrol aircraft
5	Number of people fit for service	28	Number of destroyers
6	The number of people who annually reach the age	29	Oil production
7	Number of armed forces	30	Oil consumption
8	Mobilization reserve	31	Reliable explored reserves of oil
9	Number of tanks	32	Total labor force
10	The number of armored vehicles	33	Number of merchant fleet
11	Number of self-propelled artillery	34	Number of main ports and terminals
12	Number of artillery systems arranged	35	Coverage by road
13	Number of missile systems	36	Coverage by railways
14	Total planes	37	Number of operating airports
15	Number of fighters / interceptors	38	Military budget
16	The number of strike aircraft with a constant wing	39	External debt
17	Number of transport planes	40	Gold and currency reserves
18	Number of training planes	41	Parity of purchasing power
19	Number of helicopters	42	Country area
20	Number of strike helicopters	43	The length of the coastline
21	The total number of naval forces	44	The length of the borders with other countries
22	Number of aircraft carriers	45	Coverage by waterways
23	Number of frigates		

For each of the country's AF, a certain score (coefficient) is assigned, and a rating table is created based on the analysis of the whole set of points (coefficients).

As a result of this comparison, the Armed Forces of a certain country receive a power index (Power index) that characterizes their military power in comparison with the Armed Forces of other countries. This index is a decimal fraction with four decimal places. It is believed that the ideal army has an index value of 0.0000.

The rank of the Armed Forces in terms of combat power is determined by the results of the ordering of countries with the growth of the power index.

The values of the indicators given in Table. 2 (including ratings), for 133 countries of the world since 2011, are available at https://knoema.com/. However, in different years, the list of countries and the list of indicators for which there are corresponding numerical values are somewhat different.

In giving a general assessment of the methodical apparatus for comparative evaluation of the military power of the Armed Forces of different countries of the world, it should be noted that, in fact, only the results of the comparative analysis are available to the scientific community. The

methodologies (methodical approaches) used in calculations are not provided in the formalized form, which prevents the evaluation of the peculiarities of the comparison conducted and assesses its authenticity.

However, to provide an indirect characteristic of this methodical apparatus can be by analysis of the results obtained by him, which will be the basis for determining the ways of its further development.

The purpose of the article is to highlight the features of the existing methodical apparatus for comparative assessment of the combat power of the armed forces of different countries, review the results and identify directions for its improvement.

Presenting main material. The basis of the analysis of the results obtained using the modern methodical apparatus for comparative estimation of the military power of the Armed Forces of different countries of the world, we will use the factor analysis method, which allows revealing latent relations between the values of the considered indicators.

In doing so, we will proceed from the hypothesis that, regardless of the methodological approach used, the results obtained by them should have a visual meaningful interpretation, and should not contradict existing views on the use of armed forces.

The apparatus of factor analysis is sufficiently detailed in the special literature, for example, [5, 6]. Additionally, according to [7], the results of the factor analysis are considered acceptable if the selected factors allow explaining at least 75% of the variability of the variables under consideration. In this case, the factor is associated with the variable if the factor load on it exceeds 0.7 and the factor load, which is less than 0.43, can be considered non-essential.

The analysis of the results of using modern methodical apparatus for comparative estimation of combat power of the Armed Forces of different countries of the world will be made on two examples.

As the initial data for the first example, we use the data given in the Table. 1, which will provide the basis for assessing the methodological approaches used in the Business Insider magazine.

Factor loads of the returned matrix of factors obtained for the data given in Table. 1, are shown in Table. 3. In this case, the share of the explained variance of the variables for the two selected factors is 0.7988, that is, it is sufficient for obtaining substantiated conclusions.

Table 3

Factor loads of the returned matrix of factors obtained for the data of Example 1

Indicator	Факторні навантаження від	
	factor 1	***factor 2***
Rating	-0,36	0,50
The number of armed forces	0,00	-0,80
Number of tanks	0,00	-0.92
Number of planes	0,91	0,00
Number of nuclear warheads	0,63	-0,54
Number of aircraft carriers	0,96	0,00
Number of submarines	0,00	-0,84
Total military budget	0,94	0,00

Analysis of the data given in Table. 3, indicates that the first factor is related to the weapons samples, the acquisition and maintenance of which requires the largest expenditures from the general military budget and largely determines its size (the number of aircraft and aircraft carriers). In fact, the first factor can be associated with the air component of the Armed Forces. At the same time, the level of combat power, which is determined by the ranking of the army of a certain country in the priority series, with this factor is practically very weak, because its value 0.36 is less than the maximum recommended for inclusion.

The second factor provides the greatest load on the number of tanks, submarines and the number of Armed Forces, that is, it may be associated with other indicators. At the same time, the load from the second factor to the level of combat power is sufficient for the need for its inclusion, but its magnitude indicates the weak influence of these components of the Armed Forces on the assessment of their level of combat power.

The connection of the number of nuclear

warheads to each of the factors is total.

The analysis showed that the assessment of combat power by the approach used in [3] is not very dependent on the aviation component of the Armed Forces, although it is common knowledge that, in most cases, in the absence of aviation (or in the case of its insufficient number), the armed forces are unable to accomplish their tasks. In addition, a weak link was found between assessing combat power and other indicators.

The analysis shows that the approach used in [3] for comparative estimation of combat power of the Armed Forces of different countries, does not allow to provide a clear explanation of the results of the ranking shown in Table. 1.

The starting point for the second example is the significance of the indicators for determining the power index of the Armed Forces of different countries in 2015 according to Global Firepower (available at **https://knoema.com/**). This will provide a basis for evaluating the methodology used by Global Firepower.

The choice of data for 2015 is due to the fact that for him the values of all the indicators shown in the table are available. 2 for 99 countries, that is, a sufficient amount of statistical material is provided for the formation of reliable conclusions based on the results of the analysis.

The factor loads of the returned matrix of factors for these data are shown in Table 4 (factor loads larger than 0.95 rounded up to 1). In this case, the share of the explained variance of the variables for the six selected factors is 0.875, that is, it is sufficient to obtain substantiated conclusions.

Analysis of the data given in Table 4 indicates that the first factor can be associated with the aviation component of the Armed Forces, the second with the human resources necessary for the acquisition of the army, the third with the defense of the territory, the fourth with the protection of the coast, the fifth with the results of rating the armies for combat power in the presence of weak ties, with the equipment of the seaside by ports and terminals, the sixth with oil reserves.

The principal result of the factor analysis for Example 2 is that the ratings of armies in terms of combat power differ in a separate factor, which in fact is not related to other indicators used for calculations.

There is a paradoxical situation where the results of the assessment of combat power are not actually related to any of the indicators used as input data. Logically, it would be expected that the power index would have some, albeit insignificant, factor loadings from all factors, and the consequence of their cumulative effect would be the corresponding values of the power index. However, calculations showed quite different results.

Thus, an analysis of the methodical apparatus for comparative assessment of the military power of the Armed Forces of the world shows that it has a number of disadvantages.

1. In order to compare the combat power of the Armed Forces of different countries, researchers use different methodological approaches and a different set of indicators that characterize combat power, which results in incommensurability of the received levels of military power and the fact that the armed forces of one country in different ratings of combat power occupy different places.

2. Formalized description of the corresponding methodical apparatus is practically absent. We only know that the comparison was carried out with the help of experts, who, on the basis of analysis of the set of indicators under consideration, preferred the Armed Forces of a particular country. This prevents a meaningful analysis of the results.

3. Comparison of combat power of the Armed Forces of different countries is carried out regardless of their tasks. The armed forces of all countries are considered within the same group, although it is clear that in order to obtain useful information on possible directions and ways of development of the Armed Forces of Ukraine it is expedient to divide the armies of the countries of the world into homogeneous groups (clusters) on certain grounds, within which, and to compare their military power taking into account the factors by which they have an advantage over the Armed Forces of Ukraine.

4. The effect on the military power of the Armed Forces of the weapons samples that they are equipped is carried out only in quantitative terms without taking into account their real combat capabilities.

5. During comparison, land-based air defense assets are not included.

6. It is quite difficult to explain the link between the indicators, which estimates the level of combat power of the Armed Forces, with the indicators that were used as input data. In both considered variants of the rating system of the Armed Forces by power, the rating is actually determined by a limited group of factors, which are considered to be decisive in terms of combat power, is rather difficult. In the first case, this is the number of personnel, tanks and submarines, and in the other equipment seafront ports and terminals.

Table 4

Factor loads of the returned matrix of factors obtained for the data of Example 2

Number of indicator from Tab. 2	Factor loads					
	factor 1	factor 2	factor 3	factor 4	factor 5	factor 6
1	0.00	0.00	0.00	0.00	-0.81	0.00
2	0.00	0.00	0.00	0.00	-0.80	0.00
3	0.00	0.94	0.00	0.00	0.00	0.00
4	0.00	1	0.00	0.00	0.00	0.00
5	0.00	1	0.00	0.00	0.00	0.00
6	0.00	0.92	0.00	0.00	0.00	0.00
7	0.00	0.72	0.00	0.00	0.00	0.00
8	0.00	0.00	0.43	-0.60	0.00	0.00
9	0.00	0.00	0.75	0.00	0.00	0.00
10	-0.76	0.00	0.53	0.00	0.00	0.00
11	0.00	0.00	0.89	0.00	0.00	0.00
12	0.00	0.58	0.47	-0.51	0.00	0.00
13	0.00	0.00	0.79	-0.45	0.00	0.00
14	-1	0.00	0.00	0.00	0.00	0.00
15	-0.83	0.00	0.00	0.00	0.00	0.00
16	-0.80	0.00	0.00	0.00	0.00	0.00
17	-1	0.00	0.00	0.00	0.00	0.00
18	-1	0.00	0.00	0.00	0.00	0.00
19	-1	0.00	0.00	0.00	0.00	0.00
20	-0.89	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	-0.66	0.00	0.00
22	-1	0.00	0.00	0.00	0.00	0.00
23	0.00	0.67	0.00	0.00	0.53	0.00
24	-0.81	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.86	0.00	0.00	0.00
26	-0.55	0.00	0.50	0.00	0.00	0.00
27	0.00	0.00	0.00	-0.84	0.00	0.00
28	0.00	0.00	0.61	0.00	0.52	0.00
29	-0.45	0.00	0.44	0.00	0.00	0.66
30	-0.86	0.00	0.00	0.00	0.00	0.00
31	0.00	0.00	0.00	0.00	0.00	0.87
32	0.00	1	0.00	0.00	0.00	0.00
33	0.00	0.48	0.00	0.00	0.46	0.00
34	-0.54	0.00	0.00	0.00	0.61	0.00
35	-0.80	0.54	0.00	0.00	0.00	0.00
36	-0.86	0.00	0.00	0.00	0.00	0.00
37	-0.93	0.00	0.00	0.00	0.00	0.00
38	-1	0.00	0.00	0.00	0.00	0.00
39	-0.86	0.00	0.00	0.00	0.00	0.00
40	0.00	0.78	0.00	0.00	0.00	0.00
41	-0.69	0.66	0.00	0.00	0.00	0.00
42	0.00	0.00	0.60	0.00	0.00	0.47
43	0.00	0.00	0.00	0.00	0.00	0.53
44	0.00	0.54	0.49	0.00	0.00	0.00
45	0.00	0.58	0.65	0.00	0.00	0.00

From the deficiencies identified, the directions of further development of the methodical apparatus for the comparative estimation of the combat power of the Armed Forces of different countries of the world logically follow:

definition of the list of indicators, with the use of which it is expedient to assess the combat power of different armies;

improvement of the method of comparative estimation of the military power of the armed forces of different countries in order to eliminate the identified shortcomings;

the use of clustering methods for the distribution of the armed forces of the world to homogeneous groups (on some grounds), within which it is advisable to compare their military power.

Conclusions and perspectives of further research. Thus, in the article, using the apparatus of factor analysis, an analysis of the existing methodical apparatus was carried out to compare the military power of the Armed Forces of different countries of the world. Specific examples show problems related to the meaningful interpretation of the results it receives.

Further development of the conducted research is seen in the practical implementation of the directions of development of the methodical apparatus for comparative assessment of the military power of the Armed Forces of different countries of the world.

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Аналіз методичного апарату для порівняльного оцінювання бойової могутності збройних сил різних країн світу та напрями його подальшого розвитку

Резюме. У статті проведено аналіз сучасного методичного апарату для порівняльного оцінювання бойової могутності збройних сил різних країн світу з використанням факторного аналізу та визначено напрями його подальшого розвитку.

Ключові слова: порівняльне оцінювання, факторний аналіз, рейтинг збройних сил**,** бойова потужності збройних сил.

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Анализ методического аппарата для сравнительной оценки боевой мощи вооруженных сил разных стран мира и направления его дальнейшего развития

Резюме. В статье проведен анализ современного методического аппарата для сравнительной оценки боевой мощи вооруженных сил разных стран мира с использованием факторного анализа и определены направления его дальнейшего развития.

Ключевые слова: сравнительная оценка, факторный анализ, рейтинг вооруженных сил, боевая мощь вооруженных сил.

UDK 623.618

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An experience of construction of ISTAR in ATO, peculiarities of its implementation and impediments on the way to increasing the combat efficiency of forces

Resume. The article gives an example of the construction and integration of the ISTAR system in the network centric model of forces command and control in the modern military conflict. The achieved result due to the implementation of the system ISTAR shows the possibility of improving the efficiency of military units by means of applying of standard procedures developed in the armies of the leading countries of the world. This example is urgent in the context of the inevitable changes in the approach to the command and control and the necessity of increasing the combat efficiency of Ukrainian units in the current military aggression.

Keywords: intelligence cycle, decision making cycle, sensors, network, shared information, situational awareness, information requirements, commander's intent, Self-Synchronization.

Problem statement. The transition from the outdated concepts of the troops control in Ukraine to more modern and effective is happening in the time of withstanding the neighboring country military aggression and therefore, on the one hand, the task of speeding up such a transition is available at the highest state level, and on the other hand is vital for each soldier in the antiterrorist operation (ATO) at the tactical level.

The management of processes should be as up to date in the military sector of Ukraine as in the economy. At the same time, the transition from the planned (centralized) model of the economy to the market (free) economy occurred throughout the progressive world due to the proven efficiency of the latter. In the planned economy the management of all processes was carried out solely from a single center which led to the significant congestions in each link of the management and eventually to the loss of the ability to respond timely to internal failures and the impact of external factors and as a consequence to the inadequacy of the system to the reality. On the contrary, the market economy exists on the principles of the interaction of each market participant when the adjustment of the processes in the system takes place on the basis of self-regulation which allows to keep the system adequate to the situation in any part of the system without losing control. Each market participant is a sensor whose status is taken into account in the stock markets and regulates the system in the network which A. Smith called the "invisible hand of the market".

In the 90s of the XX century the leading countries of the world launched the transition from the centralized command of the troops to a network-centric (neutralized) which involved networking all the participants of the battlefield: sources of information, command and control sections and combat units.

In the first years of independence the Ukrainian military sector overlooked the communication revolution that had happened in the world but now the country has all the means to increase combat effectiveness through the achievement of the info communicational advantage. Using the latest developed

telecommunication and instrumental equipment, UAVs, new concepts of intelligence collection, analysis and distribution, thousands of tactical units on the FEBA (forward edge of the battle area) have being gaining the experience in the 4th generation warfare during more than 1000 days of the antiterterrorist operation.

With support of the leading countries of the world Ukraine has the opportunity to implement up to date concepts and develop modern doctrines in the military sector taking into account both the experience of its own units gained during the ATO and the doctrines of the armies of NATO countries.

Analysis of the recent research and publications. One of the concepts of the network centric operations (NCO) is ISTAR (Intelligence, surveillance, target acquisition, and reconnaissance) wich the House of Commons Defence Committee of the UK called "the heart of flexibility and effectiveness in operations, maximizing efforts and concentrating the impact of other existing capabilities" in its Report in 2010. And in the same publication – "ISTAR will remain a vital capability. It will be central to dominating the battlespace for the foreseeable future" [1, 2].

Two years prior to the beginning of the Russian military aggression in Ukraine the ISTAR

had bead described in a series of the publications of the Ukrainian authors [3-5] where it was emphasized on the critical need for its implementation in the command and control of the Ukrainian Army Forces [6, 7].

The network-centric concept and its components are constantly updated, their analysis are published in the Joint Publications and Field Manuals of NATO [8-14] as well as in the publications of the countries which had become members of NATO lately [15-20].

The aim of the article is to show the examples of the increasing combat efficiency of forces due to the systems that shorten the length of links "battle space – commander" and "commander – battle space", to emphasize the necessity of generalizing the positive combat experience of networking gained by the forces in the combat operations at the tactical and operational levels, and the need of unification procedures and updating approaches to the command and control of the troops.

Presentation of the main material. Development of telecommunication facilities at the end of the XX century resulted in the onset of the information era in the warfare. "Throughout history, warfare has assumed the characteristics of its age and the technology of its age. Today we see this trend continuing as we move from the Industrial Age warfare with its emphasis on mass to Information Age warfare, which highlights the power of networked distributed forces and shared situational awareness… Within this wider context of military transformation, network-centric warfare (NCW) is one of the key concepts for thinking about how we will operate in the future" [14]. Connecting all the units in a single network the NCW concept focuses on increasing the effectiveness of the forces in the battlefield by achieving the information advantage and concentration of the required amount of forces in the needed place at a specified time.

The NCW concept is implemented in the ISTAR system which is an intelligence facility that integrates intelligence, surveillance, target acquisition, and reconnaissance for improving commander's situational awareness and his ability to correctly and timely understand the meaning and conditions of any change in the battle space to make adequate decisions. The ISTAR includes networked organizational and technical systems and is a well-organized, well-coordinated, combined application of forces and intelligence in accordance with established protocols and procedures. [7]. The structure of ISTAR combines four primary modules: intelligence, surveillance, target acquisition and reconnaissance (Fig. 1.)

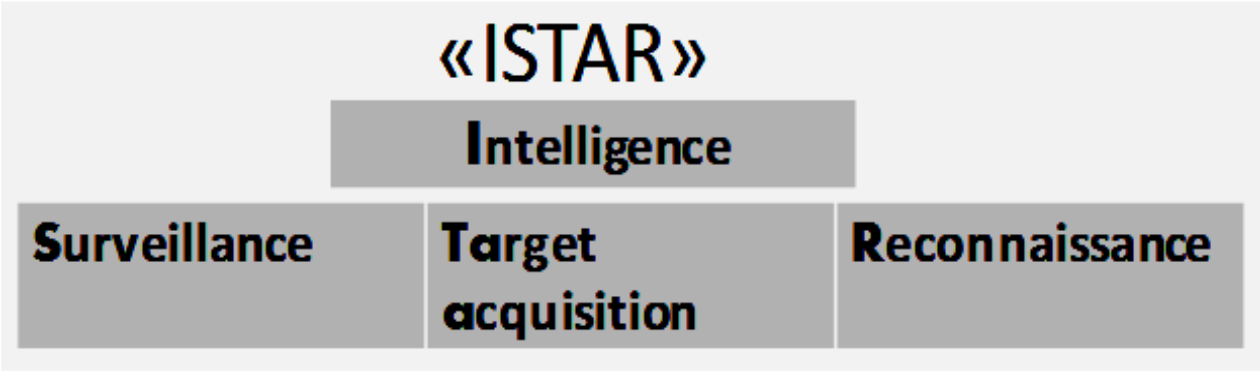

Fig. 1. The structure of ISTAR

Such structure of intelligence facilities contributes to the continuous functioning of the intelligence cycle: «Direction» – "Collection» – «Processing" – «Analysis» – "Dissemination" [11], and allows to produce situational awareness from the data collected from battle space and available information by means of processing, analysis and dissemination. Relationship of data, information and situational awareness is shown on the figure 2. Situational awareness reflects a progressive refinement of data and information and allows to understand and anticipate future situations and it is exactly what is needed for the MDMP (military decision-making process) considering METT-TC (Mission, Enemy, Terrain, Troops, Time, Civil Considerations) [10].

In ISTAR the modules "surveillance", "target acquisition" and "reconnaissance" (STAR) carry out the processes "Collection" and "Processing" of the intelligence cycle and the module Intelligence – "Analysis", "Dissemination" and "Direction".

The ISTAR steps are fully in line with the classical intelligence cycle but in addition they include continuous interconnection of the system modules by circulating information horizontally at each step (Fig. 3).

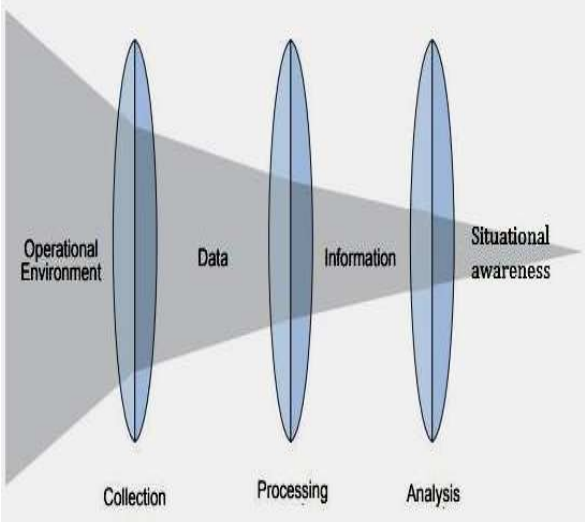

Fig. 2. Relationship of data, information and situational awareness

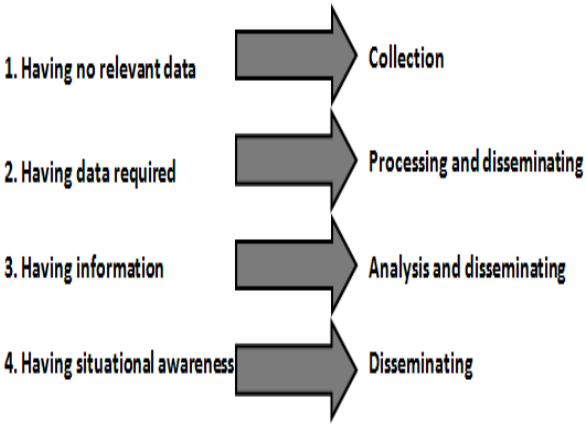

Fig. 3. The ISTAR steps

The ISTAR system as a whole is integrated into the decision-making cycle "Observe" - "Orient" - "Decide" - "Act" (OODA) (Fig. 4) and carries out the processes "Observe" and "Orient".

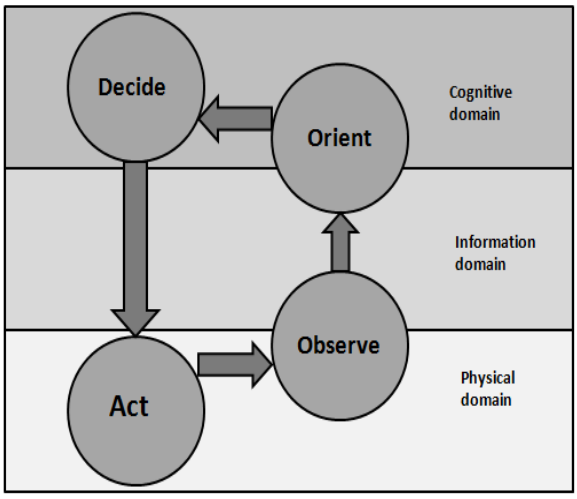

Fig. 4. The decision-making cycle

Like any management system command and control of Army forces operates in three domains: physical, information and cognitive.

The physical domain is the traditional domain of warfare where a force is moved through time and space. It spans environments where military forces execute the range of military operations and where the physical platforms and communications networks that connect them reside. Comparatively,the elements of this domain are the easiest to measure and, consequently, combat power has traditionally been measured in the physical domain.

The information domain is the domain where information is created, manipulated, and shared. It is the domain that facilitates the communication of information among warfighters. This is the domain of sensors and the processes for sharing and accessing sensor products as well as "finished" intelligence. It is where command and control of military forces is communicated and the commander's intent is conveyed.

The cognitive domain is the place where perceptions, awareness, understanding, beliefs, and values reside and where, as a result of sensemaking, decisions are made. This is the domain where many battles and wars are actually won and lost. This is the domain where an understanding of commander's intent, doctrine, tactics, techniques, and procedures reside [14].

An experience of construction of ISTAR in ATO. In 2017 under the massive use of the enemy artillery systems in one of the area of operation in ATO there have been decided to take a counter-artillery measures. With equal initial opportunities in aspects of fortification, quality of arms and technical equipment, from the experience of other wars, the outcomes have consistently been decisive in favor of forces that are robustly networked. When both sides have similar networking capabilities, competition shifts to other attributes [14]. That's why the construction of the counter-artillery measures were decided to set up in accordance with the principles of ISTAR (Fig. 5):

1. "Collection" – was the task for three modules of STAR in physical domain.

The module 'Surveillance" linked all available sensors in a single information network 24/7: observation posts (OP), assets of electro-optical measurement and signature intelligence (EO MASINT), communications intelligence (COMINT), electronic intelligence (ELINT). "ISTAR is everyone's business – a pair of eyes is an ISTAR asset" [21].

The module "Target acquisition" involved facilities of radar MASINT, acoustical intelligence (ACOUSTINT), radio frequency/electromagnetic pulse intelligence (RF/EMPINT).

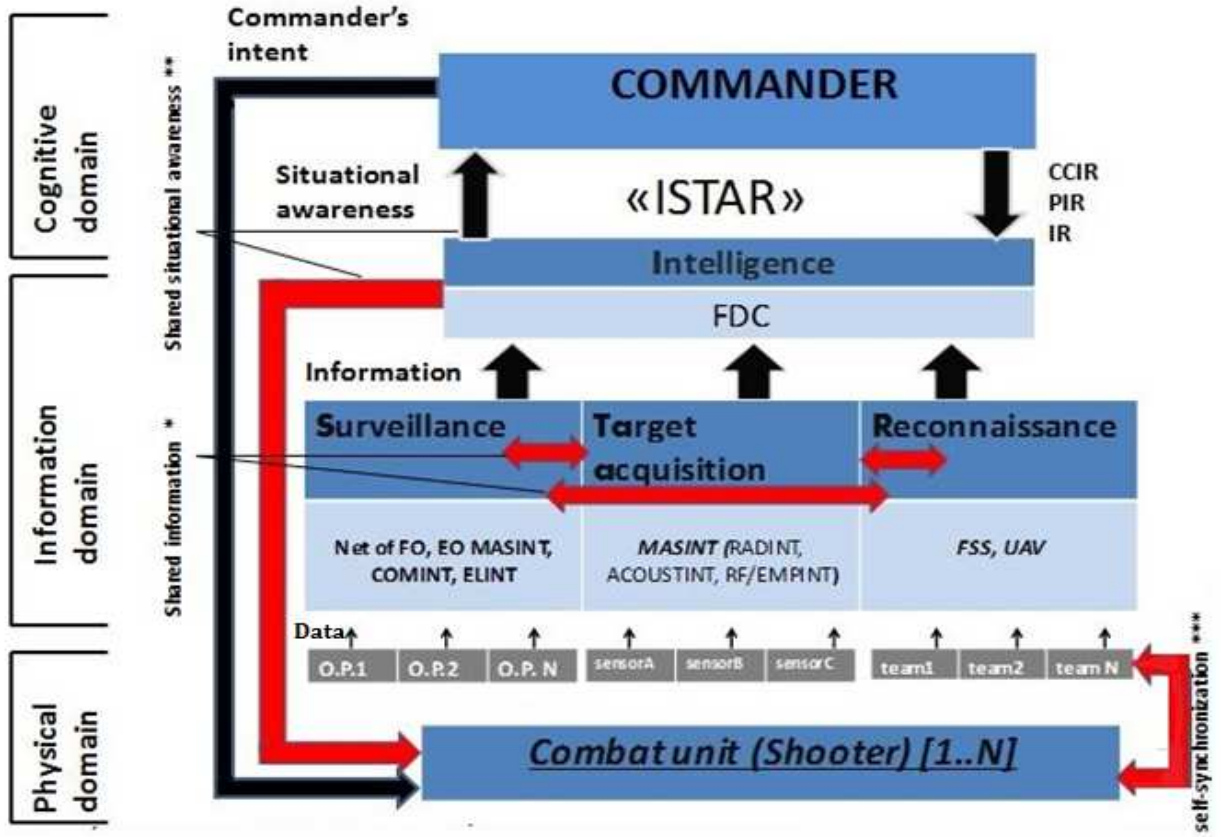

Fig. 5. Implementation of ISTAR into the command and control model

The module "Reconnaissance" engaged teams of fire support specialists (FSS) and sections of unmanned aerial vehicle (UAV).

The development of communications allowed to equip each post and each team with means of communication which made it possible to transfer real-time data from the physical to the information domain from each of the numerous posts in the area of operation.

2. ISTAR is a system of systems. It consists of separate systems, units, headquarters and formations that become more effective and efficient by means of interfaces and central coordination of their information and activities, without adversely affecting the responsibility of the various levels. [18]. During "Processing" S-TA-R modules were strengthened with the headquarters which converted collected data into the information and disseminated it in order to compare with data obtained by other modules in the physical domain. Key feature of the functioning of ISTAR is circulation of information between the system modules. The same events and facts are simultaneously fixed by several participants of the system by various sensors. When, as on figure 6, the participants not only fix the same event but also have an opportunity to discuss it or use it together in collaboration, the information may be both shared and enriched. This enrichment occurs when they process the information in the context of other relevant information from different sensors or prior knowledge. The value of collaboration lies in this capacity to create higher knowledge and understanding in order to organize more effective and efficient activities [22].

There are five crucial dimensions for measuring the quality of information available within a command center: Completeness, Correctness, Currency, Accuracy and Consistency. These five attributes are independent. Information can be complete but incorrect, current but inconsistent, inaccurate but complete, and so forth [22, 23]. Insignificant data becomes important in conjunction with concurrent data from other sensors; other data turns out to be false and unconfirmed by related sources. The interaction of STAR modules in the physical and information domains through the circulation of information (* on Fig. 5) ensures the separation of adequate data from non-compliant data, enables the real-time adjustment of the data collection, processing and disseminating qualitatively enriched information for analysis on next module I.

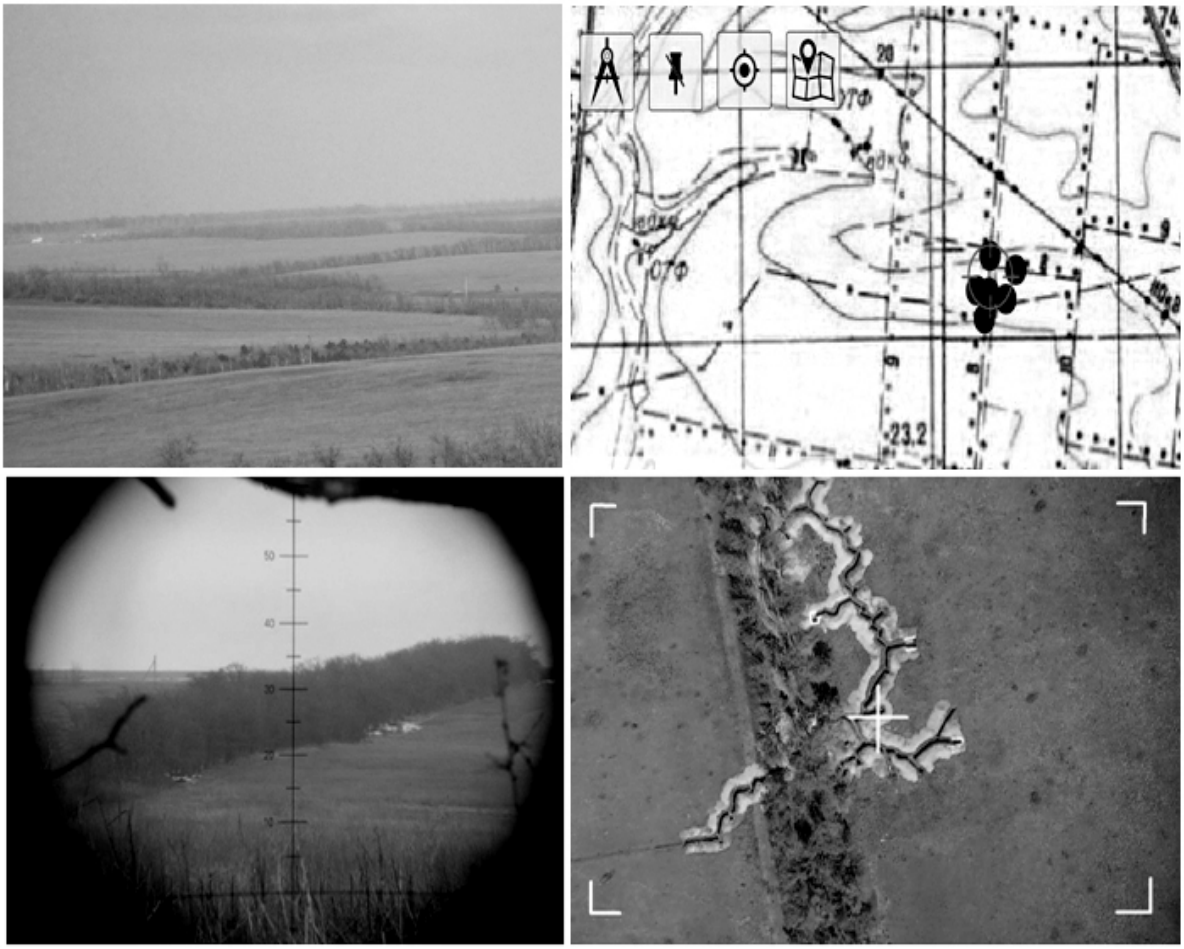

Fig. 6. Fusion of the relevant data from different modules of STAR

3. The next step ISTAR – "Analysis" of qualitatively enriched information was carried out in the Fire direct center (FDC) [11]. In the networked information environment the new technologies of visualization of the battlespace were applied for epy analysis of the information, which helped to obtain the fusion of available data and information for the development of situational awareness [8], understanding and prediction [26]. Studying the patterns of enemy behavior and direct link with the sensors in the physical domain gave the opportunity to receive information about the enemy's activity almost simultaneously with its beginning and often even anticipatorily based on the prediction of patterned actions.

4. The "Dissemination" of situational awareness (** on Fig. 5) occurred horizontally in the united network to increase the response speed and the possibility of adjusting the control of the sensor in the phisycal domain as well as vertically to the cognitive domain for the command decision-making. Of course, when disseminating the situational awareness the requirements for the information assurance were respected: privacy, availability, integrity, authenticity, and nonrepudiation. Taken together, these attributes describe a system that users can trust [22]. Situational awareness that meets all the information requirements is the end product of ISTAR and is designed to facilitate and speed up command decision-making.

The input data from the command level were Command Critical Information Requirements (CCIR) and Priority Intelligence Requirement (PIR) [20] . The data collection directing adjustment was constantly carried out on the basis of widespread information on the lower links of the interaction of all module elements.

The implementation of the above principles of engagagement all the available sensors, sharing of information and the enrichment of its quality, dissemination of situational awareness to all authorized members of the single network eventually resulted into conquaring information superiority over the enemy. The commander received on-line data about the preparation or start of the activity of a specific enemy artillery system, its location and even an image from UAVs or EO MASINT which facilitated and speeded up making commander's decisions.

Peculiarities of implementation of ISTAR in ATO. However, converting of the information advantage into combat efficiency turned out to be

impossible without the implementation of the NCW principles to the entire command and control system. A weakness in one of these links of the system weakens the chain as a whole. [2]. Despite the qualitative product of the ISTAR the information in command and control system continued to flow in the vertical hierarchy: black arrows in the figure 5 show the flow of information in the cycle of decision-making under the centralized command of the troops. The time passage of data from the physical domain through information and cognitive and again to the physical turned out to be too long. This and not networking the combat unit into the single network caused both delayed start of actions and ineffectiveness of actions due to the impossibility of responding to the current changes in the battlespace. Long number of control links caused jamming of control.

In order to increase the combat effectiveness of the fire support units they were connected to the ISTAR network. With the access to shared situational awareness (** on Fig. 5) and real-time data from the physical domain (*** on Fig. 5) the fire units received the ability of self-synchronization in the battlespace. The basic idea of self-synchronization is to push decision-making authority down to the lowest level within the organization by relaxing the traditional hierarchical approach to command and control [24]. Sharing situational awareness on-line to the subordinate units allowed faster and more effective execution of the combat task due to the shortening decision-making cycles OODA [25] and the ability to adjust the task execution in responce to internal changes in the system and external factors of the battlespace. (Fig. 7.)

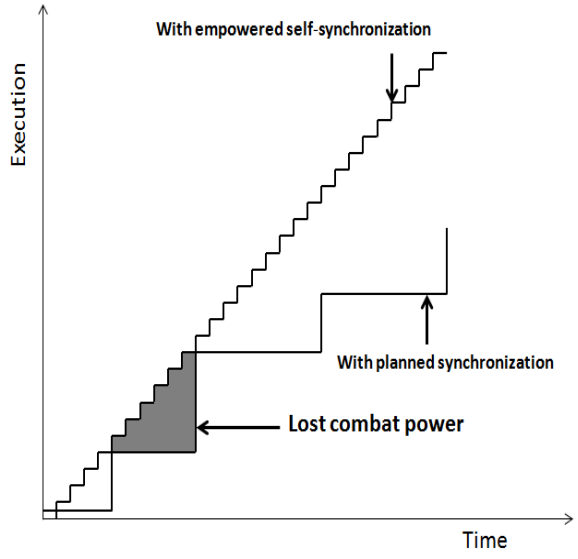

Fig. 7. Lost combat power under the centralized command and control

Due to networking all the units into the ISTAR, the situational awareness were shared, the sensors and fire support units were able to ajust their actions to the changes in current operational environment, the commander had all the assets to quickly make an appropriate decision and disseminate it – all this allowed to restore lost combat power.

As it is shown in the fugure 5:

- observation posts reported about the preparation or the beginning of the enemy artillery systems activity;
- reconnaissance teams and UAV sections began to spot the narrow location of battlefield while the counter-artillery units were led to battle with understanding and situational awareness. Simultaneously the commander had to make a decision;
- the data from surveillance module were verified and proved by the sensors of target acquisition or reconnaissance modules;
- during seconds the situational awareness were disseminated in the net in form of coordinates (X, Y) and image;
- by the time the commander decision were made and distributed to the physical domain all the units of the physical domain already had had situational awareness, were ready to execute the mission and respond to changes in the battle space within the commander's intent. The speed of command was achieved through shortening links of command and eliminating impediments to the information flow;
- groups and posts of STAR modules confirmed mission accomplishments or launched new iteration of intelligence and decision-making cycles;
- after mission achievement the photo-video data and the sensor data (Fig. 6) were accumulated in the module I, analyzed and disseminated for making corrections based on mandatory after action review.

Thus, the implementation of the counter-artillery system built on the principles of ISTAR during three months (Fig. 8) resulted in an increase of the losses of enemy's active artillery systems 10 times: from X items per month to 10X (Fig. 9). What's significant is that the increase in the combat efficiency of the fire support units occurred only after implementation of the principles of NCW by all the units of the battlespace. (Fig. 10).

After suffering significant losses the enemy lost its initiative and significantly reduced the use of artillery systems. The role of self-synchronization in improving the units' combat efficiency was acknowledged, however, it was mistakenly attributed to the mere initiative in a lower level. The counter-artillery system was removed. Only sensors and combat units in the physical domain with direct link between them remained. Disappearance of the system of systems caused another impediment to maintaining combat efficiency at the proper level: gigabytes of data from the physical level slowed down the speed of command, there was no enrichment in the quality of information through its horizontal interchange (* on Fig. 5), the grounds for understanding and

prediction were lost. Having no direct access to the on-line situational awareness sensors and combat units lost the ability to self-synchronization and the combat efficiency decreased again to the previous indicators (Fig. 9). The weakness of one link weakened the chain as a whole.

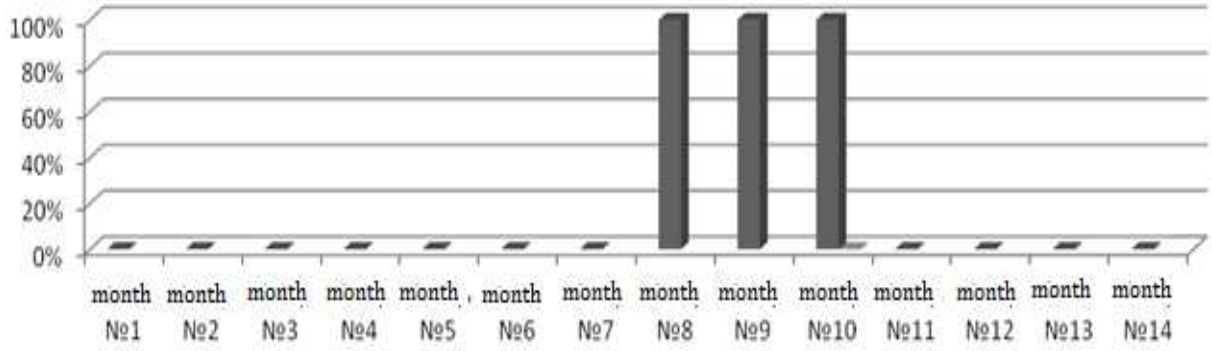

Fig. 8. The implementation of the counter-artillery system built on the principles of ISTAR

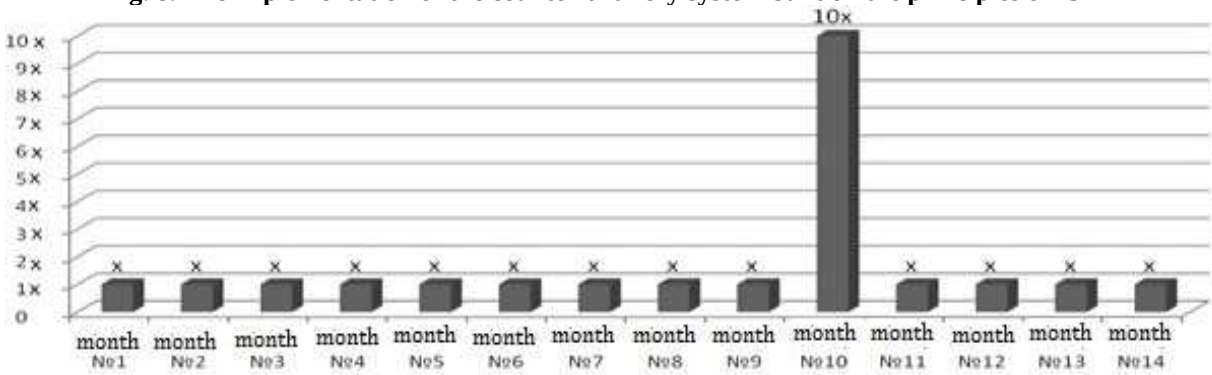

Fig. 9. Losses of enemy's active artillery systems

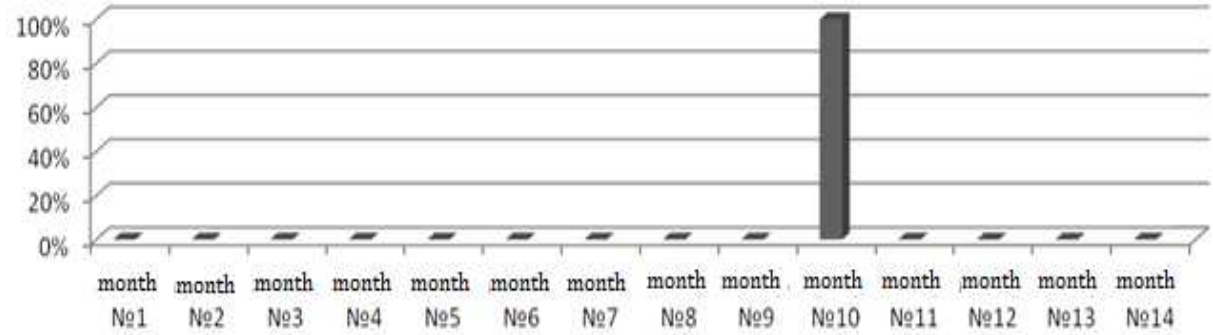

Fig. 10. The implementation of the principles of NCW by all the units of the battlespace

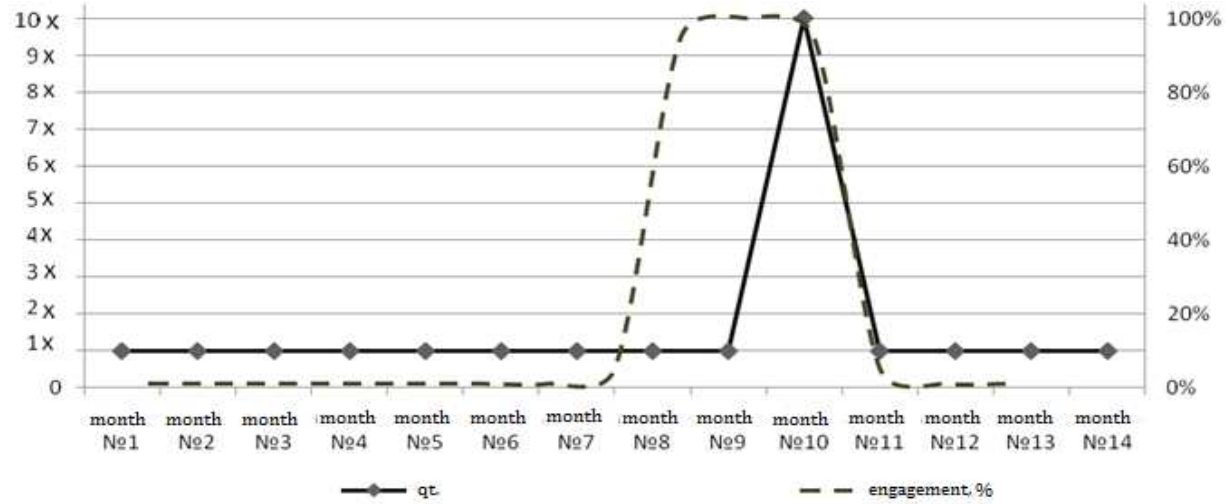

Fig. 11. Correlation between the implementation of ISTAR in the counter-artillery system with the principles of NCW and the increase in the combat efficiency of artillery units

Correlation between the implementation of ISTAR in the counter-artillery system with the principles of NCW and the increase in the combat efficiency of artillery units (Fig. 11) clearly demonstrates the need and the possibility of transition to the modern concepts of the command and controll of the troops.

Conclusions. The concept of NCO uses information technology to directly link "sensor" and "shooter" with the simultaneous increase in the speed of command and decrease in the length of the link "commander" - "combat unit". The reduction in the time of the execution of the cycle "see first", "understand first", "act first", and "finish decisively" [9] by only a few percent leads to the achievement of the mission earlier than the enemy which allows to conquered superiority over the battlefield above the enemy.

The implementation of ISTAR allows reducing the time from observation to hitting the enemy from tens of minutes to just seconds. This can be achieved only by joint work of the structural interacting elements of the system and by the implementation of methods that allows to overcome impediments in collecting, processing and disseminating information. Each step of ISTAR is important:

- massing of sensors during collection and observation;
- dissemination of information in the network during processing for its qualitative enrichment;
- sharing of situational awareness with all the authorized system elements;
- increasing of the speed of command with the simultaneous networking the combat units to the information network and giving them decision-making authority for adjusting the execution of the mission within the commander's intent depending on the changes in the situation in the battle space.

In order to ensure performing each of these steps in all sectors of ATO the programs at the state level should be introduced. These programs are being introduced now in the countries of NATO: «We noted that the MoD had concentrated its principal efforts on improving its collection assets. Yet significant improvements still needed to be made to processing and disseminating the information collected», «The Armed Forces' capacity to process and disseminate information they receive clearly falls behind their capacity to collect. We commend the MoD for acknowledging the problem» [2].

The experience of implementation of ISTAR in the modern armed conflict has proved that one combat unit can become more productive than all other units in the FEBA. What's more significant this unit becomes more effective than itself before networking to ISTAR. The experience gained by Ukrainian units in current ATO is extremely important for unifying the procedures of intelligence into a single standard. The implementation of new approaches to the command and control of Ukrainian troops is an urgent need on the way to increasing the combat efficiency during fighting against the enemy wich prevail in the accumulated power.

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Досвід побудови системи ISTAR в АТО, особливості впровадження та перепони на шляху до підвищення бойової ефективності вогневих підрозділів

Резюме. У статті наведено приклад побудови й інтеграції системи ISTAR у мережоцентричну модель управління підрозділами в сучасному військовому конфлікті. Цей досвід є актуальним у контексті невідворотності зміни підходів до управління військами і необхідності підвищення бойової ефективності підрозділів України в протистоянні військовій агресії.

Ключові слова: цикл розвідки, цикл прийняття рішення, сенсори, мережа, поширена інформація, ситуаційна обізнаність, вимоги до інформації, намір командира, самосинхронізація.

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Опыт построения системы ISTAR в АТО, особенности внедрения и препятствия на пути повышения боевой эффективности огневых подразделений

Резюме. В статье приведен пример построения и интеграции системы ISTAR в сетецентрическую модель управления подразделениями в современном военном конфликте. Этот опыт является актуальным в контексте неизбежного изменения подхода к управлению войсками и необходимости повышения боевой эффективности подразделений Украины в противостоянии военной агрессии.

Ключевые слова: цикл разведки, цикл принятия решения, сенсоры, сеть, распространенная информация, ситуационная осведомленность, требования к информации, намерение командира, самосинхронизация.

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Classification and prospects of the development of technical means of protection and protection of the border

Resume. According to the results of the analysis, there is a significant lack of technical means of border protection that provide automatic detection of moving objects and guarantee the implementation of the principle of continuity in time protection of the land border. Requirements for monitoring of mobile objects on extended sections of the land border have been defined and summarized.

Keywords: moving object, monitoring of the state border, land border, technical means of border guard, technical means of border protection, radio monitoring complex.

Formulation of the problem. More than two dozen names of the technical means of protection (TMP) of the border were used in the past in the border troops to identify offenders (OF). To date, such a list has decreased somewhat, and mainly concerns thermal imaging and optoelectronic devices. Of course, a wide range of means is not a criterion for ensuring an effective strengthening of border protection.

Analysis of recent researches and publications. The publication [1] states that the probability of unleashing large-scale wars is low nowadays, at the same time the threat of initiating local wars and military conflicts with the use of conventional means of armed struggle is increasing. Under these circumstances, modern types of weapons and military equipment, including protection and surveillance means of the state border are of particular importance. This fact has revealed the need for their classification, defining and generalizing the requirements of the equipment used along the lengthy sectors of the land border.

The purpose of the article is to define and summarize general requirements for the monitoring means of moving objects along the lengthy sectors of the land border.

Presenting main material. Due to the comparison of the world market of technical means that can be considered as potential technical means for the state border protection and surveillance (TMSBPS) with their adopted classifications in the State Border Guard Service of Ukraine (SBGSU), the *inconsistency between* the following aspects has been identified:

1) the need for a logical and structured presentation of the list of types of technical means for surveillance and protection and in actual fact unavailability of their general classification model;

2) available types of technical means for surveillance and protection and unavailability of certain types within the current system of classification of technical surveillance means (TSM) of the border;

3) reference of technical protection means (TPM) to the class of TSM of the border and the need for their allocation into a separate class of technical means;

4) the need for the uniqueness of designated names of certain types of technical means, their standardization in various fields and ambiguity within the conceptual apparatus on TSM of the border.

Concerning *the first item*, the general classification model (structure of TSM of the border) is not available nowadays. As such, according to the guideline papers [2, 3] TSM of the border are divided into radar and searchlight means, signalling, optical and optoelectronic ones. Within the above classes TSM are divided according to the degree of their mobility, range of surveillance, which is essentially only the top of the hierarchy of the classification model of TSM variety.

As for the *second inconsistency*, for example, there is no class of sub-surface location means of georadars type. However, such means are successfully used in the SBGSU from 2014. It is obvious that, in case of the available adequate classification of TSM, these means, which have been used for more than a decade in other spheres, could have been used much earlier in the SBGSU. This would not allow evolving of such phenomena, in some cases, for example driving tunnels, pipelines across the state border, into a relatively new threat to national security, originated namely in the border, but present in the military, social, and economic spheres. Similarly, it is logical to consider the use of tactical unmanned aerial vehicles (UAVs) in the border surveillance from the point of view of TSM operation, but not as a kind of aviation vehicle. But they are distinguished solely by TSM carrier, and operation and its

organization is in fact part of the engineering and technical support. This inconsistency may become more acute especially in case of UAVs use on call, according to the data of the initial detection of a law violator (LV) by the surveillance means. Therefore, small tactical UAVs can be considered as TSM class.

Concerning the *third inconsistency*, for example, the previous use of IE-200, GI-1 electroshock means by the border guard troops was implemented in a complex with TSM to which they belong, however, the purpose of the electroshock means is the protection of the border. Today, such means are rapidly developing, and they are mostly called as non-lethal instruments, and their class is expanding more and more [4].

The reasons for the imperfection of TMSBPS classification should be searched not only in the rapid development of radio electronics within the security zone, but also in the uncertainty of the conceptual structure of operational and economic activities of the SBGSU regarding such functions as surveillance and protection of the border. This uncertainty aggravated with the launch of aggression in the southern and eastern parts of the country.

Let us note that surveillance is transformed into protection when locally a LV begins to use force and weapons.

Regarding the technical aspect, in reality, TSM detect a LV and TPM affect a LV physically, complicate the movement at the level of engineering barriers. It was predicted that namely TPM of the border would take priority of their use in the future, without requiring to detect a LV and his/her further detention, if the LV moves towards us and changes his/her intentions due to the impact of border protection means. That means that the process of border surveillance with mandatory detection, observation and detention of a LV can turn into a process of the border protection with non-lethal effect and observation of the zone of influence. At the same time, it is essential that there will be no expensive, complicated, highly sensitive technical means for the detection of a LV.

Concerning the *fourth inconsistency*, for example, according to various state standards, the signalling complexes belong to the means of perimeter surveillance, territorially distributed radio engineering surveillance systems and TSM of lengthy sectors of the border [5, 6]. Therefore, it is logical to propose a designated name for the entire spectrum of technical means that can be used to strengthen the surveillance and protection of the border by TMSBPS [6], which include all technical means that strengthen the surveillance and protection of the state border.

Also the multi-purpose technical means for surveillance and protection of the border, which simultaneously provide both detection and complication of the movement of a LV are allocated into a separate subclass.

The experience of combat operations has identified the need for the development of surveillance means which provide surveillance of positions, checkpoints. In fact, these are signalling surveillance means of certain border sectors, but the latter, due to the imperfection of their classification, and, accordingly, the lack of requirements for individual characteristics, do not provide the necessary functions of these objects surveillance.

Seismic and acoustic devices, georadars are relatively new technical observation means (TOM). Among the abovementioned means, the seismic means are universal ones, because they provide detection and determination of the location of a moving object in the air, on the ground and underground, making this class of TOM promising to detect not only people and vehicles, but also to determine the location of shooting weapons, to determine the movement of objects in the soil, even though, only georadars are effectively used to detect sub-surface communications nowadays.

One of the new dangers is UAV flyover, and obviously, a sensor for detecting such LV is advisably to be represented by radar and acoustic TOM as part of signalling means for the surveillance of lengthy sectors of the border, namely, as part of multi-purpose signalling systems.

Such means as searchlights within the class of lighting equipment will ultimately be displaced in the future due to the use of thermo vision display devices.

Forward-looking approach for the protection of the border sectors is to use electric mines which provide non-lethal effect through step-up voltage.

All of the above mentioned inconsistencies revealed the need to identify and summarize the requirements for monitoring means of moving objects (MOs) along the lengthy sectors of the land border.

General requirements for monitoring means of MOs along the land border of Ukraine.

Intended purpose: automatic detection, range determination to a MO, direction of movement (from us, to us), visual observation within the range of the main engineering structures, identification of a LV.

Equipment set: radio electronic complex with linear and station parts. The linear part

includes a sensor or sensors, night-vision video cameras distributed along the border sector flanks, linked with a power feed and data transmission cable. The station part consists of operator's PC, input/output hardware and power supply. In the future, the complex should include the means of non-lethal effect, engagement of an unmanned MO.

Tactical characteristics and specifications:

- length of the border sector flank - not less than 20 km;
- number of flanks - 2; false alarm-free running period when servicing by one operator and unavailability of video-thermal recognition of a LV - not less than 720 hours;
- false alarm-free running period when servicing by one operator and availability of video-thermal recognition of a LV - not less than 1 hour;
- detected MOs - person, transport mean, UAV, underground communications;
- error of range determination - up to 10 m;
- height of the video camera installation with constant video surveillance - 2-3 m;
- range of UAV detection - up to 3 km;
- depth of underground communications detection - up to 10 m.

Operational requirements: the linear part is located along the left and right flanks of the border sector on the fence, on the pillars or latently. The video cameras with a permanent observation area, with infrared illumination, are installed on reinforced concrete pillars, at the height of 2-3 m. Border control unit equipped with a station part is located in the centre of the sector. The range and direction of a MO is determined upon its automatic detection. Infrared illumination is activated during hours of darkness and the MO monitoring is carried out within the line of engineering border structures. A LV is identified both on a closed and irregular terrain. Looking forward the above mentioned fact concerns both ground MOs, UAVs and underground communications. A non-lethal effect on people and the possible engagement of UAVs is also carried out in case of appropriate means availability.

General requirements for MO monitoring at the observation position.

Intended purpose: automatic detection, identification, determination of a MO location.

Equipment set: device (seismic or other).

Tactical characteristics and specifications:

- automatic detection of a MO at the range of not less than 30 m;
- identification of the sector of a MO unambiguous location is not exceeding 45 deg.;
- false alarm-free running period - not less than 1 hour; not responding to a MO signals moving within a radius of 3-4 m.

Operational requirements: upon automatic detection of a MO approaching the device, it identifies a LV, and determines the sector of the MO location. The device must not give away the observation position, should not react to the nearby MO movement. The device is to be installed directly on the position, near the observer.

General requirements for MO monitoring along local land border sectors.

Intended purpose: automatic detection, range determination to MO, direction of movement (from us, to us).

Equipment set: a device with a linear part. The linear part includes a distributed sensitive element (SE).

Tactical characteristics and specifications:

- length of the protected sector - not less than 2 km;
- error of range determination - up to 10 m;
- false alarm-free running period when servicing by one operator and unavailability of video-thermal recognition of a LV - not less than 720 hours;
- false alarm-free running period when servicing by one operator and availability of video-thermal recognition of a LV - not less than 1 hour.

Operational requirements: SE of the linear part is located along the border sector either along the perimeter of the security installation or atop the fence. The range and direction of a MO is determined upon its automatic detection. The SE should be nearly invisible and ensure functioning both on a closed and irregular terrain.

General requirements for UAV monitoring along the state border.

Intended purpose: automatic detection, identification, determination of range, altitude, course, flight speed.

Equipment set: linear and station part. The linear part includes sensors (radar or other) linked with a power feed and data transmission cable. The station part consists of operator's PC, input/output hardware and power supply.

Tactical characteristics and specifications:

- length of the border sector flank - not less than 20 km;
- number of flanks - 2;
- detected MOs - UAV with a wingspan of more than 2 m and ERS <0,1 m2;
- altitude of target detection - up to 3 km;
- error of target flight course determination - up to 15 deg.;
- error of range determination - up to 30 m;

- error of target flight-speed determination - up to 30 km / h.;

- radar (or other) sensors are remotely controlled, with electronic beam scanning and are installed on reinforced concrete pillars, at the height of 2-3 m.

Operational requirements: sensors of the linear part are located along the left and right flanks of the border guard sector, are fixed on the pillars and should not have moving mechanical antennas. Border control unit equipped with a station part is located in the centre of the sector. The UAV is identified, its coordinates are determined, at least at two points of the UAV tracking, its flight course, speed, and altitude are determined upon automatic detection of a MO in the air.

Conclusions. The given research provides the analysis of the level of equipment with the technical means of surveillance for monitoring of the land border. The result of the analysis is the ascertainment of significant insufficient provision of units with TSM of the border, which ensure automatic detection of MOs and guarantee the implementation of the principle of time continuity in the land border control. The considered main provisions of the monitoring concept have allowed to formulate general requirements for the monitoring means of the MO on the land border of Ukraine.

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Класифікація та перспективи розвитку технічних засобів охорони та захисту кордону

Резюме: За результатами аналізу встановлена суттєва недостатність технічних засобів охорони кордону, які забезпечують автоматичне виявлення рухомих об'єктів та гарантують реалізацію принципу неперервності у часі охорони сухопутного кордону. Визначені та узагальнені вимоги до засобів моніторингу рухомих об'єктів на протяжних ділянках сухопутного кордону.

Ключові слова: рухомий об'єкт, моніторинг державного кордону, сухопутний кордон, технічні засоби охорони кордону, технічні засоби захисту кордону, радіотехнічний комплекс моніторингу.

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Классификация и перспективы развития технических средств охраны и защиты границы

Резюме: По результатам анализа установлена существенная недостаточность технических средств охраны границы, которые обеспечивают автоматическое обнаружение движущихся объектов и гарантируют реализацию принципа непрерывности во времени охраны сухопутной границы. Определены и обобщены требования к средствам мониторинга подвижных объектов на протяженных участках сухопутной границы.

Ключевые слова: движущийся объект, мониторинг государственной границы, сухопутная граница, технические средства охраны границы, технические средства защиты границы, радиотехнический комплекс мониторинга.

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The variant of ranking the military personnel on the basis of taxonomic analysis

Resume. Using the methods of taxonomic analysis, the procedure for constructing the rating list of candidates for appointment to a standard position is presented.

Keywords: taxonomy, factor analysis, military officer rating, efficiency benchmark.

Formulation of the problem. The main requirements of the leadership of the state and the Ministry of Defense of Ukraine for the development of the modern Armed Forces of Ukraine are the implementation of defense reform. One of the priority directions of the reform is the creation of a modern personnel management system, namely, the establishment of an effective military career management system, and a transparent and integrative system of selection, placement and appointment of personnel [1].

Personnel decisions on the appointment of servicemen to positions and relocation are made on the basis of the Reserve for candidates for promotion. The reserve includes the servicemen who, according to the results of the assessment, are recommended for promotion, as well as, in case of official necessity or absence of candidates, and servicemen who, according to the results of the activity, are assessed with the overall assessment “good” [2]. Based on the recommendations of the attestation commissions, the results of periodic evaluation and additional factors, the rating of candidates for promotion is determined. Selection and rating of military personnel is carried out with the purpose of qualitative staffing of positions of servicemen by the most trained specialists capable of performing the tasks assigned to corresponding positions. [3].

In conditions of armed aggression on the part of the Russian Federation, the creation of an effective personnel reserve of the Armed Forces of Ukraine is of particular importance. Consequently, determining the ranking of selected candidates is an urgent task of the present. Since, while taking into account a considerable number of candidate characteristics, it is expedient to automate the specified process.

Analysis of recent research and publications. According to the Minister of Defense of Ukraine, among the directions of reforming the Armed Forces of Ukraine is the creation of a modern system of personnel management: “We have already begun to do this, and there is already a reserve of contract officers who participated in the ATO zone, this reserve is two thousand people whom we move to higher positions “[4]. In work M. Dumenko [5] highlights the problems of staffing that faced human resources in 2014-2015 during the transition to functioning in a special period. In the works of O. Banchuk-Petrosova [6], O. Koval [7], and O. Ustimenko [8], questions of evaluation of efficiency and directions of improvement of the personnel management system are also raised, one of which concerns the adoption of personnel decisions regarding appointment of servicemen to positions.

The task of selecting the best candidate for a position is a rather complicated process that should take into account an effective method of selecting the best soldier among many of the criteria that are put forward for candidates for a particular position.

To solve this problem, methods of statistical processing, multidimensional comparative analysis and others are used, among which methods of cluster and taxonomic analysis of estimation of indicators. The method of cluster analysis is implemented in software (software) "Rating of the candidate" [3]. The main objective solved by the cluster analysis method is to partition a given sample of objects into groups called clusters [9]. Each cluster has properties similar to the properties in the sample, but objects of different clusters are significantly different. In the classical sense, the cluster analysis method does not provide an integral estimate for each research object, with which it would be possible to rank these objects in the list from the highest to the smallest. This

method allows you to select the highest, lowest or average values for the corresponding groups (clusters) [10].

The application of taxonomic analysis enables to evaluate each object of research separately. Taxonomic analysis as well as cluster has become widely used in many branches of science, it is used in archeology, anthropology, medicine, psychology, chemistry, biology, public administration, philology, marketing, sociology and other disciplines [11]. The main advantage of the method is the ability to eliminate subjectivity in the evaluation of comparable objects. Using mathematical methods for ranking and weighing signs, a taxonomic analysis provides an opportunity with a high probability to determine the similarity and difference between objects of comparison.

The application of taxonomic analysis methods for conducting research in the economic sphere was reflected in the works of such scientists as V. Plyuta [10], O. Kozhushko [12], V. Vorobyov [13], Y. Yegupova [14], T. Nadtok [15] and others. But the use of taxonomic analysis methods in the analysis of personnel management processes in open source sources was not found.

The purpose of the article. Substantiation of proposals for automation of the formation of the ratings of military candidates for appointment to a standard position, using taxonomic analysis methods.

Presenting main material. Principles of taxonomy are used in many scientific fields of knowledge, for the organization of objects of geography, geology, linguistics, ethnography and the entire diversity of the organic world.

Certificate. Taxonomy (from other Greek τάξις - order and νόμος - law) - the doctrine of the principles of classification and systematization of complex organizational entities that hierarchically correlate with each other.

The task of forming a rating list of candidates for appointment to a certain position can be submitted as follows:

Output data:

- servicemen - candidates for a position can be described by a plural $M = (m_1, m_2, m_3, ..., m_k)$, where ***k*** - the number of candidates for the post;

- each candidate is assessed according to the methodological recommendations on the procedure for determining the rating of the servicemen of the Armed Forces of Ukraine [3] according to the relevant criteria $W = (w_1, w_2, w_3, ..., w_n)$ where ***n*** is the number of criteria for assessments.

It is necessary to form a rating list of candidates. *The rating list* is a list of all candidates with an indication of the rating point and rating place of each.

Using the taxonomic method involves determining the taxonomic distance - the distance between the points of multidimensional space (investigated objects - candidates for the position). The size of space is determined by the number of features (evaluation criteria). The calculated distances allow you to determine the position of each object under study and make it possible to sort them by rating.

The solution of the task is carried out by successive execution of certain operations.

Output data can be represented as a matrix of observations:

$$X = \begin{pmatrix} x_{11} & x_{12} & \dots & x_{1j} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2j} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{i1} & x_{i2} & \dots & x_{ij} & \dots & x_{in} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{k1} & x_{k2} & \dots & x_{kj} & \dots & x_{kn} \end{pmatrix}, \quad (1)$$

where k - the number of servicemen of the n-dimensional space, which is equal to the number of matrix lines;

n - number of evaluation criteria, which is equal to the number of columns of the matrix;

x_{ij} - the value of the evaluation criterion j, for the serviceman *i*.

Signs in the matrix (1) describe the different qualities of the evaluation criteria, have different assessment scales and can not be compared with each other [16]. To standardize these indicators, it is necessary to bring matrix metrics to centered dimensionless values z_{ij}:

$$z_{ij} = \frac{x_{ij} - \overline{x_j}}{\sigma_j}, \quad (2)$$

where $\overline{x_j} = \frac{1}{k}\sum_{i=1}^{k} x_{ij}$ - the arithmetic mean value of the sign ***j***;

$\sigma_i = \sqrt{1/k \sum_{i=1}^{k} \left(x_{ij} - \overline{x_j}\right)^2}$ - mean square deviation of the sign ***j***.

As a result of the transformations, the matrix (1) will look like:

$$X = \begin{pmatrix} z_{11} & z_{12} & \dots & z_{1j} & \dots & z_{1n} \\ z_{21} & z_{22} & \dots & z_{2j} & \dots & z_{2n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ z_{i1} & z_{i2} & \dots & z_{ij} & \dots & z_{in} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ z_{k1} & z_{k2} & \dots & z_{kj} & \dots & z_{kn} \end{pmatrix}. \quad (3)$$

The next step in the analysis is to calculate the distance between each element z_{ij} with the totality of all the characteristics of the matrix (3) that are being investigated. For this calculation there are several methods: using the metric of Chebyshev, the Euclidean metric, or Humming's distance method [17]. The article uses the Euclidean distance, whereby the matrix (3) is transformed into the form of a matrix ***D***, whose dimension: $k \times k$

$$D = \begin{pmatrix} 0 & d_{12} & d_{1a} & \dots & d_{1k} \\ d_{21} & 0 & d_{2a} & \dots & d_{2k} \\ \dots & \dots & \dots & \dots & \dots \\ d_{i1} & d_{i2} & 0 & \dots & d_{ik} \\ \dots & \dots & \dots & \dots & \dots \\ d_{k1} & d_{k2} & d_{ka} & \dots & 0 \end{pmatrix}, \quad (4)$$

where $d_{ia} = \sqrt{1/n \sum_{j=1}^{k} \left(z_{ij} - z_{aj}\right)^2}$ is the distance between the ***i*** and the ***a***- row of the matrix (3).

Note that the ***a*** line for the matrix (3) is a set of indicators for another serviceman *i*, and thus, the matrix (4) shows how far the commonly standardized indicators among all the evaluation criteria are among each serviceman. That is, the distance from the serviceman in the ***i*** line of the matrix (4) to each other serviceman will be in the sense of the ***a*** column of the matrix, respectively, if ***i=a*** - the value of the indicator is zero.

Standardization of indicators is a necessary taxonomic analysis procedure that has the same effect on all investigated objects. In the process of standardization there is a leveling of dispersions, and the mathematical expectation of all indicators is zero. Therefore, in order to get rid of the leveling of data, it is necessary to set weight coefficients of indicators. The procedure for calculating weight coefficients begins with the definition of critical distances between serviceman and the determination of the extremum: $\varepsilon = \frac{\max}{i} \frac{\min}{a} d_{ia}$ the maximum among the minimum ***i*** values of the distance ***d***, the ***a*** column of the matrix (4).

Then the sum of distances for each object is calculated, at which the value of each of the objects does not exceed the value of the critical distance $Q_i = \left\{ i, a \mid d_{ia} \le \varepsilon;\ i = \overline{1,k} \right\}$:

$$\omega_i = \sum_{i, a \in q_i}^{i} d_{ia} \quad (5).$$

Weights for servicemen are calculated according to the formula $\lambda_i = \omega_i / \omega_m$, where ω_m - the maximum value.

Criteria used as additional factors for ranking soldiers may have a stimulating and disincentive effect. Criteria that have a stimulating effect, characterizing it at the best side form a plurality K_s, respectively, the destimulating effect of the set - K_d

The next step is to calculate the distance C_{i0} from each and every element of the matrix (3) to the point of the efficiency benchmark P_0, taking into account weighting factors λ_i.

$$C_{i0} = \sqrt{\sum_{j=1}^{n} \left(z_{ij} - z_{aj}\right)^2} \quad (6)$$

The efficiency benchmark P_0 is determined on the basis of stimulating and de-stimulating effects of each of the evaluation criteria [13]:

$$P_0 = \left(Z_{01}, Z_{02}, ..., Z_{0j}, ..., Z_{0n}\right),$$

Where $Z_{0s} = \max Z_{rs}$, *npu* $s \in K_s$;

$Z_{0s} = \min Z_{rs}$, *npu* $s \in K_d$.

The taxonomic rating of each soldier (integral score) is calculated as follows [10]:

$$R_i = 1 - C_{i0} / C_0 \quad (7),$$

Where $C_0 = \overline{C_0} + 2\sigma_0$ is the taxonomy coefficient;

$\overline{C_0} = 1/k \sum_{i=1}^{k} C_{i0}$ - mathematical expectation of distances to the efficiency benchmark;

$\sigma_0 = \sqrt{1/k \sum_{i=1}^{k} \left(C_{i0} - \overline{C_0}\right)^2}$ - mean square deviation.

The integral assessment R_i synthetically characterizes the changes in the values of the military staff rating. This indicator can be interpreted as: the higher its value, the higher the rating of the ***i*** military personnel. He also accepts:

- higher values with high rates of criteria-stimulants and lower values of criteria-distimulant;

- lower values with low indicators of stimulant criteria and greater values of criteria-distimulant.

The method of taxonomy is implemented in the current layout of the rating of military personnel using the software Microsoft Access database. The use of the software development environment Visual Basic for Applications has enabled:

- to form rating lists of servicemen for appointment to a standard position, which, according to the results of the annual assessment, are recommended in the Reserve for a higher position;

- to formulate the rating of military personnel according to the integral assessment, which is calculated on the basis of additional criteria of evaluation;

- to formulate regulated reporting forms in accordance with the guidance documents [3].

Conclusions. Thus, the application of the method of taxonomy in the field of career management of the staff will enable the solution of issues related to the accuracy and validity of multidimensional staff assessments. The versatility of this method is the ability of statistical multidimensional analysis of qualities, qualifications, assessment of personnel and their comparison between objects of research.

The implementation of the taxonomy method for determining the rating of military personnel for appointment to positions in automated personnel management systems on the example of the developed layout will allow to increase the efficiency and transparency in the adoption of personnel decisions, and the composition of the layout will enable the developer to understand and implement the activities of the personnel management.

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Варіант побудови рейтингу військовослужбовців на основі таксономічного аналізу

Резюме. Використовуючи методи таксономічного аналізу висвітлено порядок побудови рейтингового списку кандидатів для призначення на типову посаду.

Ключові слова: таксономія, факторний аналіз, рейтинг військовослужбовця, еталон ефективності.

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Вариант построения рейтинга военнослужащих на основе таксономического анализа

Резюме. Используя методы таксономического анализа, представлен порядок построения рейтингового списка кандидатов для назначения на типовую должность.

Ключевые слова: таксономия, факторный анализ, рейтинг военнослужащего, эталон эффективности.

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Modeling the process of detecting invisible military objects of the terrain with the help of UAV

Resume: The article presents the results of visual modeling of the detection of invisible areas and military objects from the point of observation of the selected mountainous terrain of the Republic of Azerbaijan using UAV and Autodesk-3ds-max program.

Keywords: fighting, invisible area, program Autodesk-3ds-max, simulation, unmanned aerial vehicle (UAV).

Formulation of the problem. For successful military operations one of the most important tasks is to detect invisible military objects on the ground. To solve this problem, including the use of unmanned aerial vehicles (UAVs). For high-quality intelligence tasks, rational intelligence routes must be identified to prevent the destruction of an opponent's own UAV.

Analysis of recent research and publications. Observation conditions are one of the tactical outcomes that affect the organization and conduct of combat operations, the use of military equipment [1, 2]. These data are determined by the degree of visibility and distance of observation in the area, and also depends on the conditions of the relief. As a result of the correct organization of surveillance, the information obtained enables us to fully evaluate the place of the operation and make the right decision. The more ground elevations, slopes, ravines, trees, shrubs and buildings, the worse the conditions of observation. When observing the mountains, it is necessary to choose a place where you can see the passages, roads, valleys. Topographic maps are one of the sources of information about topographical elements of the terrain (their coordinates and their relative location, size, etc., quantitative and qualitative characteristics). However, the maps do not display the elements of the combat order of the enemy. The main source of information about unobserved objects on maps is aerial photos taken during hostilities. These photographs can subsequently be used in high-precision weapons navigation systems, such as different types of correlation and navigation systems, to destroy invisible enemy targets [3]. Large obstacles (forest, high hill, mountains, etc.) further complicate the problem and create the need for using an unmanned aerial vehicle (UAV) [4,5]. The use of UAVs, especially unmanned aerial vehicles, has been widely used in intelligence observations [6].

The purpose of the article is to highlight the results of visual modeling of the process of detecting invisible areas and military objects from the point of view of the selected mountainous area of the Azerbaijan Republic using the UAV and the Autodesk-3ds-max program.

Presenting main material. The purpose of studying the conditions of observation is to determine the degree of visibility and invisibility in the area of hostilities from the selected observation point. Observation conditions facilitate or worsen intelligence, fire system organization and unit management. They are characterized by indicators of the distance of direct visibility from the chosen height in the corresponding area of the area, as well as the size and the limits of invisible areas.

*Revealing of the invisible areas and targets on the terrain***.** The goal of the investigation of observation condition in operation field is determination the most advantageous observation point on the terrain or invisibility level [5]. The observation condition helps reconnaissance, organization of fire system and control of military units, or complicates theirs. It is characterized by optical visible distance from one of the heghts of targets sector (zone) and terrain, also by sizes of invisible areas and bondares.

Visible and invisible areas are determined by creation of terrain heghts profile by next method [6-8]. The observation point is shoosen on the one of high place. From this point by along of observation direction in right and left sector borders two straight lines are drafted. The sector is divided by straight lines in several direction and number. It is more preferably to draft these lines along on the tops of heghts or watershed lines. Separate and enclosed profiles are drafted along of straight lines. In each prifile the determined

invisibles area is shaded. The right and left bondares of the shaded areas marked iteratively on the profile line on the map. Considering terrain relief, marked points are jointed by smooth lines and invisible areas are shaded on the map. The wide sector the many profilel's lines and if it is necessary prolong until to ground.

So, for given directions that to determine visible and invisible areas the terrain profiles are used.

Let's explane it by chart in the fig. 1. In this figure a conditional mountainous terrain is shown. Here: ***A*** is a choosen observation point on the mountain (or hill), ***B*** is an enemy target point. Between ***A*** and ***B*** points along observation direction straight line by use geoinformation system (GIS) technology we draft terrain heghts profile As result, the visible (1) and invisible (2) areas are determined. Analysing obtained information in staff observation point ***A*** we can decision making that if enemy troops or war technics are located in (2) areas then its will be invisible. But if enemy forces are located in (1) areas then they will be visible from point ***A***.

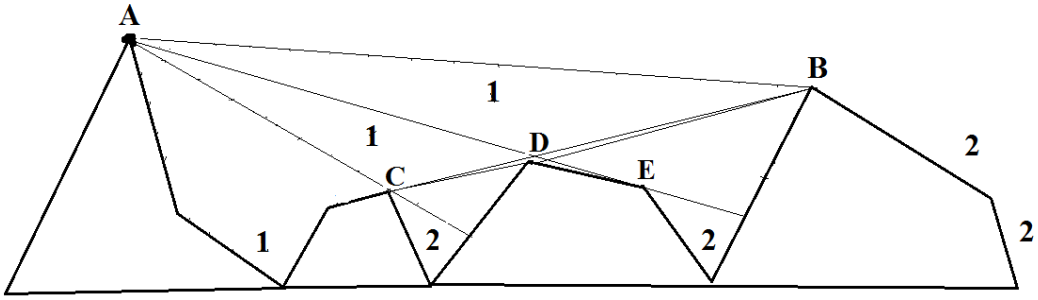

Fig. 1. The observation directions in mountainous terrain.

If C or D or E points are choosen as observation points then invisible areas will be determine the same methods: by along on CD, DE or EB lines. Such observation points in one region can be choosen on various peaks. That comandant make right decision he must take such observation point from that the sum of the invisible areas is minimum.

That invisibility level is minimum we can use drone, that is, we can control a drone flight on the ***B*** [6,9]. But in such situation the risk of drone destroy on ***B*** will be high. For safety drone use it should fly up the ***A*** side on such safety height that the invisible areas on the ***B*** side are revealed and, at the same time, drone cannot be destroy.

Let's, there are several peaks of mountain between observation point ***A*** and target point ***B*** (see fig. 2).

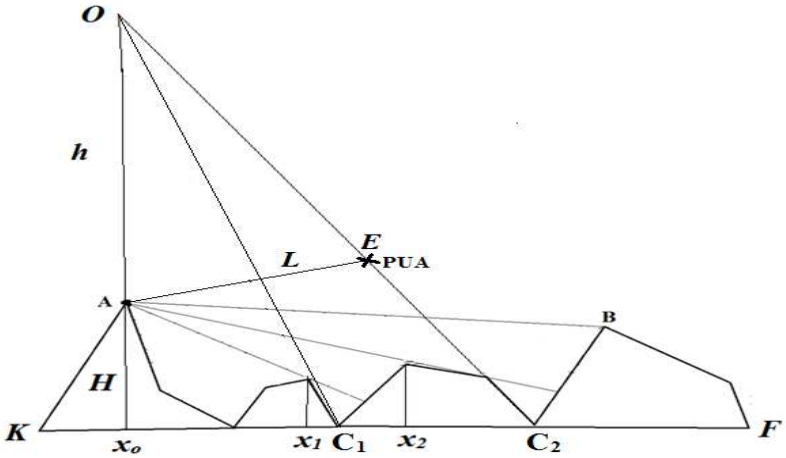

Fig. 2. Use of drone for minimum making of invisibility level of the terrain.

Let's, $\angle OC_1F=\alpha_1$, $\angle OC_2F = \alpha_2$,... $\angle OC_iF = \alpha_i$ are the mountain slopes angles, H is a heght of observation point of mountain, x_0,x_1, x_2, x_i are the coordinates of the mountain peaks (begining from observation point), h is a height of the drone flight up the observation point, $\boldsymbol{OC_i}$ are the lines draft from drone flight point ***O*** height till bottom of valley $\boldsymbol{C_i}$, L is a distance from drone flight point ***E*** to observation point ***A***:

$$L \in \{h, x_i - x_0\} \quad (1)$$

$$L = \sqrt{(x_i - x_0)^2 - h_i^2} \quad (2)$$

$$h_i = (x_i - x_0)(|tg\alpha_i| - H) \quad (3)$$

By use of (1), (2) and (3) equations, with aim of invisible from point ***A*** areas control we can determine minimal safety flight height of the drone and minimal safety flight distance:

$$\begin{cases} L \to \min \\ h \to \min \end{cases}$$

It should be note that, H, h, x_o, x_1,...x_i and $\mathrm{tg}\alpha$ values are deterined by GIS softwear for the each specific case [6].

The results of visual modelling. For vizual modeling of the revealing process of invisible spaces and military objects we have used Autodesk-3ds-max program 2016-Version [10]. Autodesk-3ds-max program system has been developed by Autodesk company and has goal to edit 3D graphics and animation of various processes. By use Autodesk-3ds-max program we recieve an image which is very much alike real visibility. This program is much used in various areas and is the most effective among 3D programs.

The results of visual modelling from one of the choosen observation point in mountainous region of the Azerbaijan Republic are represented in figures 3-5.

The angle of vision of a digital camera of the drone is 145^o. The chart of angle visibility of a drone on top of the mountain is presented in fig. 3.

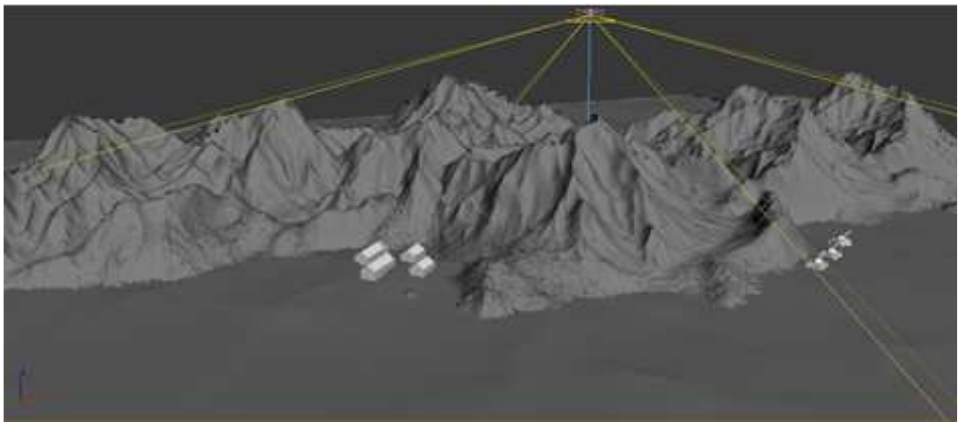

Fig. 3. The chart of angle visibility of a drone on top of the mountain.

The results of the drone flight modeling on the height h above the start point are presented in fig. 4. The visible areas from observation point are marked by green color, and invisible ones are marked by dark color.

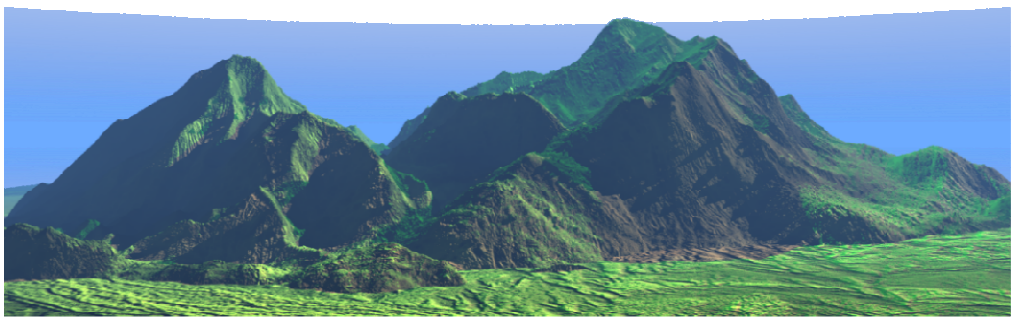

Fig. 4. The drone flight modeling on the height *h* above the start point.

The results of the drone flight modeling L away from and on the height h above the start point are presented in fig. 5. The visible areas from observation point are marked by green color, and invisible ones are marked by dark color.

We can see from figures 4 and 5, the higher and farther a drone flight from observation point to enemy direction, the less invisible areas, and the

less probability of hidden moving of the enemy battle trucks.

The preliminary modeling of a visual monitoring during a drone reconnaissance flight will help correct to determine the drone flight traffic in real situation for specific terrain with aim of maximum survey of the terrain, minimization of invisible areas and reliable identification of the enemy hidden objects.

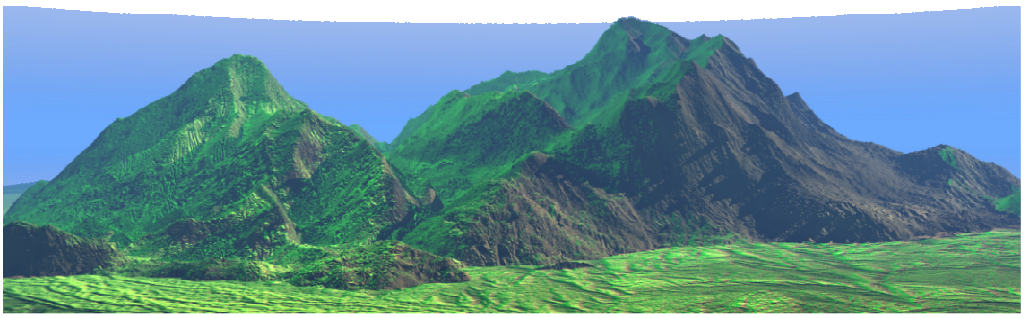

Fig. 5. The drone flight modeling *L* away from and on the height *h* above the start point.

Conclusion. So, in given paper, the results of visual modeling of the revealing process of invisible military objects from one of point of observation on the mountainous terrain of the Azerbaijan Republic by using a drone are presented. Autodesk-3ds-max program has been used for modeling.

It is shown that the higher and farther a drone flight from observation point to enemy direction, the less invisible areas, and the less probability of hidden moving or concealment from view of the enemy battle trucks and troops.

Obtained results will help correct to determine the drone flight traffic in real situation for specific terrain with aim of maximum survey of the terrain, minimization of invisible areas and reliable identification of the enemy hidden objects.

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Моделювання процесу виявлення невидимих військових об'єктів місцевості за допомогою БПЛА

Резюме. У статті представлено результати візуального моделювання процесу виявлення невидимих площ і військових об’єктів з точки спостереження обраної гірської місцевості Азербайджанської Республіки, з використанням БПЛА та програми Autodesk-3ds-max.

Ключові слова: бойові дії, невидима область, програма Autodesk-3ds-max, моделювання, безпілотний літальний апарат.

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Моделирование процесса обнаружения невидимых военных объектов местности с помощью БПЛА

Резюме. В статье представлены результаты визуального моделирования процесса обнаружения невидимых площадей и военных объектов с точки наблюдения выбранной горной местности Азербайджанской Республики с использованием БПЛА и программы Autodesk-3ds-max.

Ключевые слова: боевые действия, невидимая область, программа Autodesk-3ds-max, моделирование, беспилотный летательный аппарат.

UDK 355.746.1

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The system approach to the resolution of problem processes of the auto-technical support of the Land Forces of the Armed Forces of Ukraine

Resume. Based on the system approach, ways of analyzing military systems are identified with the aim of identifying problematic issues and resolving them. The choice of a rational way to improve the efficiency of functioning is illustrated by the example of an auto-technical support system.

Keywords: system approach, automotive recovery processes, efficiency of the auto-technical support system.

Formulation of the problem. The constant readiness of the Armed Forces of Ukraine (AFU), the complex application of various forces and means, their interaction during the implementation of measures to repel aggression, rapid response to a large extent depend on the effective use of all types of weapons and military equipment, including automotive, technical basis of combat capability of troops. A characteristic feature of conducting modern combat operations is the massive use of automotive equipment (AE) used as a vehicle for the movement of weapons and military equipment and plays a major role in the delivery of missiles and ammunition, transportation, transportation and evacuation of material and technical means, fuel and lubricants, transportation of personal composition of troops (forces). In addition to this, automotive equipment is used to perform non-specific (specific), but not less important tasks. An analysis of the implementation of measures on automotive equipment (MAE) in the context of the anti-terrorist operation (ATO) revealed a number of problem issues regarding the restoration of automotive equipment that needs to be addressed, since they significantly affect the quality of AE.

The Land Forces of the Armed Forces of Ukraine are equipped with a variety of automotive equipment, which is 70% morally and physically obsolete, has been in service for more than 25 years and needs to be upgraded (upgraded). During the antiterrorist operation on the territory of Donetsk and Luhansk regions, a number of deficiencies were identified regarding the state of readiness of automotive equipment and the system of auto-technical support for the restoration of AT. The intensive development of means and methods of conducting military actions raises the increased requirements for the system of restoration, including the movable means of restoration of automotive equipment. However, there are also problematic issues in this regard, as the available mobile means of restoration in the troops do not allow to cover all necessary repair fund of JSC, which is connected with excessive moto resource, partial inconsistency and imperfection of diagnostic and technological equipment of the existing forces and means of evacuation and repair, inconsistency of automobile inventory stocks with regard to provision of an available motor-vehicle park, increase of the range of material assets of the JSC and inconsistency of organizational staffing current quality repair bodies. The bulk of rolling stock in the troops is a set of machines of the 1980s.

Proceeding from the specified, the system of automotive support in the Armed Forces of Ukraine needs further development, and in some areas of radical reformation. Considering the scientific and methodological basis, it should be noted that the ATZ as a system is a set of automotive equipment; the personnel of units and parts that operate this technique, the personnel who performs maintenance, evacuation and repair of damaged machines, provides management of automotive equipment.

Analysis of recent research and publications. An analysis of existing theoretical models describing the recovery process has shown that mathematical models by which one can solve the problem of rational distribution of forces and means of recovery take into account the average percentage of units of stored mobility, which are directly involved in the conduct of battle and determined by the ratio of forces and efficiency fire (combat potential) and the ability to restore the system. However, in order to improve the mathematical model, it is necessary to analyze the

automotive equipment recovery system in more detail, since its effective application is one of the main factors in achieving success in battle.

Many research papers are devoted to the analysis and construction of mathematical models. In [1,2] the model of the system of diagnostics, maintenance and repair of complex military technical systems and the model of the system of diagnosing and repairing anti-aircraft missile systems as a closed mass service system (CMO) is developed and examples of organization of the system of repair and repair of anti-aircraft missile systems from application of the developed model. Further development of the diagnostic and repair model was carried out in [3], where the mathematical model of the repair system (metrological service (MLOB)) is based on a weapon of war on the basis of the fuzzy rules of queuing requirements. The research of the effectiveness of the Markov mathematical model of the repair system and the MLOB of the anti-personnel vehicle was carried out in [4], where a two-level scheme of organization of the repair system and MLOB of the military equipment was developed.

In [5, 6] the mathematical model of verification (calibration) and repair of measuring equipment (FVT) in places of deployment of military units and production facilities of outbound metrological groups are described. The question of the development of mathematical models of the operation of measuring equipment (MF) for military use is well analyzed in [7]. With the help of the theory of random Markov processes, a mathematical model of the operation of a perspective model of a mobile laboratory of military measuring equipment was constructed. But in these works only some parts of the life cycle of a model of a VT were considered, complex features were not taken into account, but the question is still not exhausted and needs to be further elaborated.

The purpose of the article. On the main system approach to determine the ways of analysis of military systems in order to identify problem issues and solve them.

Presentation of the main research material. Auto maintenance is a complex process, which includes several less complex sub processes implemented at all levels of the structure of the forces (forces), which operate on the basis of certain requirements, norms and guidelines. The complexity of automotive equipment is determined by the fact that this process, as well as the military use of troops (forces), takes place in different "situations", which are determined by the type of combat operations, the characteristics of the theater of war (TVD), the capabilities of their own troops and enemy forces, the conditions of the area and other They can change during the conduct of hostilities.

The search for ways to improve the ATP system is based on the definition and systematization of all factors that affect the functioning of the system; analysis of interconnections and assessment of their impact on the parameters of the investigated processes. On the basis of the place of origin and action, the factors influencing the system of recovery of blood pressure, can be divided into external and internal.

Externally, factors that are outside the scope of the research, have a significant impact on it, but, as a rule, are not subject to management. Such factors can only be taken into account. Internal factors that act within the object being investigated, determine its state and are subjected to targeted influence (management).

The analysis of the effectiveness of multifunctional systems for various purposes indicates that sometimes the achieved level is below the required (defined). In the event of a discrepancy between the necessary and achieved system effectiveness, there is a problem finding ways to improve it. One of the main ways to solve this problem is to justify the rational composition and structure (forces and means) of the system.

For this, the systemic view of the process being analyzed is developed (Fig. 1). Each process that occurs on the system has an input and output. The process takes place in a certain sequence with known constraints. If the output metrics do not meet the required parameters, there is a problem of increasing the efficiency (quality) of the process. It can be solved by changing the input characteristics, structure and constraints of the analyzed system, including the characteristics of its subsystems. The choice of solutions is in the field of characteristics that are subject to goal-oriented change, that is, they are manageable.

The characteristics of the entrance in the general case will be: quantity, quality, value of “product”;

Characteristics of the structure - the quantity, quality and value of its elements for the processing of raw materials;

Characteristics of constraints - the mode of operation of a higher-level system, conditional external environment, as well as the principles and rules of functioning of the system being analyzed.

Output indicators are the number, quantity and value of "product", as well as various derivatives of these indicators (relative, average).

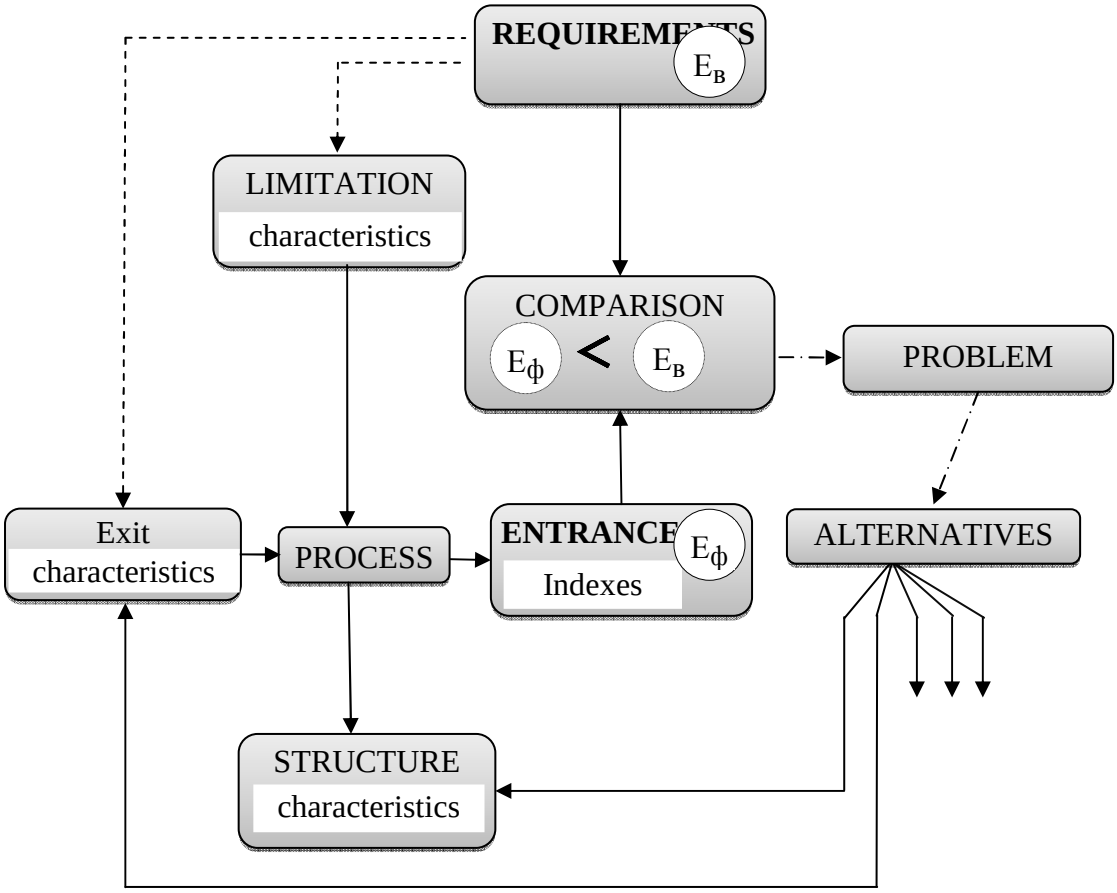

Figure 1. System appearance of the process being analyzed

The choice of a rational (optimal) solution is based on:

- experts' expert assessments;
- data analysis of the functioning of analog systems;
- on passive or active (purposeful selection of experimental indicators);
- observation of the functioning of the analyzed system;
- physical or mathematical modeling of its functioning.

In conditions of limited resources (limiting the value of the “end product”, which includes the cost of raw materials and structures) the optimal solution should be sought in coordinates:

- *efficiency-cost* (when solving a quantitative problem);
- *quality-cost* (when solving a qualitative problem).

It is also possible to graphically display several possible ways of moving the system from the efficiency level E_0 to the required (set) level E_1 (Fig. 2). The path AI will be optimal, which allows you to reach the required level with minimal cost.

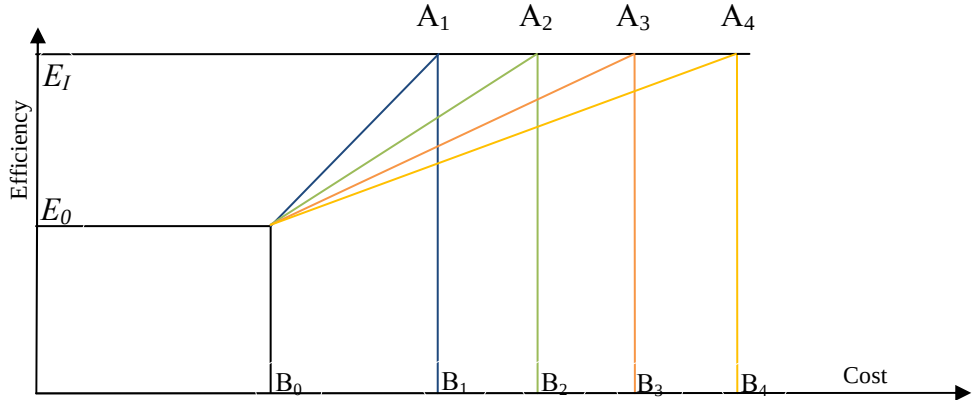

Fig. 2. Graphical representation of the choice of a rational alternative to efficiency.

Systemic methodology, as a researcher's outlook, allows us to study processes and phenomena in their dialectical unity. Without losing the integrity of the process, this methodology makes it possible to typify structures, their elements, process characteristics and requirements to it. Due to this, it is possible to apply the standard methods of analysis to the various systems by nature and the typical rules for choosing the best solutions, to consider in a unity a number of hierarchical processes and systems.

The versatility of the system methodology allows it to be used in the solution of military-technical problems, in particular, the problems of increasing the effectiveness of the technical support of troops (forces), which in the future will be conventionally called an organized automobile aggregate or a military system.

The systemic image of the functioning of an organized automobile aggregate is shown in Fig. 3 (without controls).

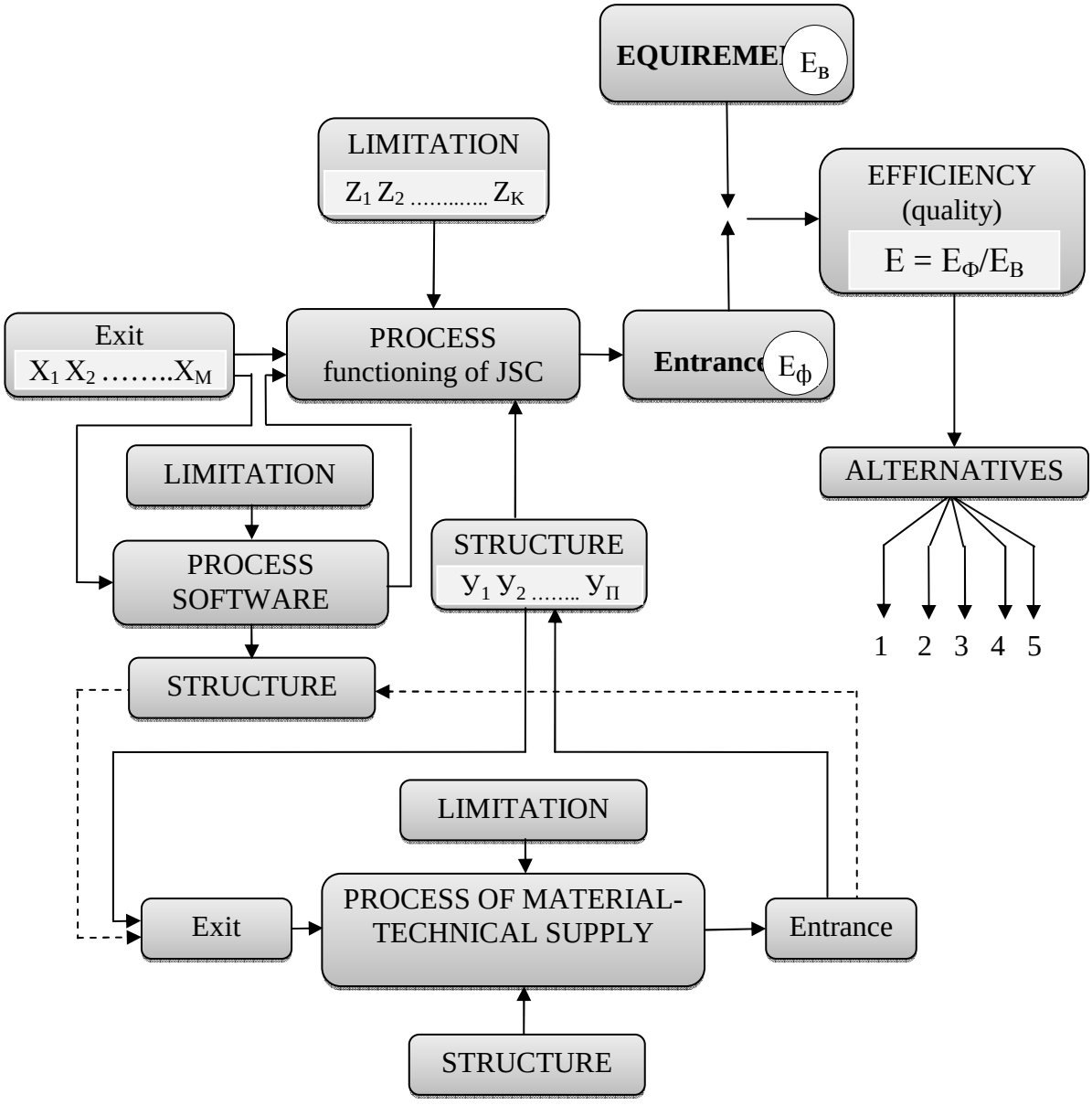

Fig. 3 System image of the functioning of an organized automobile aggregate.

The ratio of the actual and the required effect determines the effectiveness of the system, even the degree of solution to the problem in quantitative sense.

In the part of situations, a qualitative task (transportation of fuel and lubricants, ammunition, etc.) can be put. In this case, the number of transported materials is compared with the general need, which results in an assessment of the degree of performance of the task.

In general, there are three ways to increase the efficiency (quality) of the system's operation: improving the input characteristics; improvement of structure; normalization of restrictions (meaning controlled characteristics).

These paths should be considered in relation to application to individual processes. For the main process of functioning of automotive equipment they are: improving the characteristics of transportation; improvement of methods of evacuation of automotive equipment; increasing the number of blood pressure or improving quality.

The *first way* relates to the efficiency of the auxiliary process of ensuring the functioning of the JSC.

The *second way* is the tactics of the use of repair bodies.

The *third way* is realized by means of improvement of the process of provision (logistics of MTZ).

The process of providing (MTZ) is appropriate to divide the processes of technical and logistics. After analyzing the technical support of the troops, the main objective of which is to support the combat capabilities of the troops in terms of the availability of good weapons and equipment. Similarly, ATZ considers automotive equipment and assets that perform auxiliary functions.

The system in which this process is implemented consists of three typical components.

The *main* component carries out maintenance and repair of equipment. The *auxiliary* carries out evacuation and transportation of objects, and provides the supply of automobile property and spare parts.

Thus, the system of auto maintenance of troops (forces) is described as a system of higher order, which is conventionally called an organized automobile aggregate (Fig. 3). In turn, each component of such a system can be similarly detailed in the system of lower order.

Let's consider the characteristics of the automatic support of troops (forces). In accordance with Fig. 3 the input of the process (system) is the flow of applications from the main and auxiliary components of the organized automotive aggregate. *Entry characteristics* - the quantity and qualitative characteristics of vehicles requiring maintenance, their distribution in time and location. The number of machines entering the system of auto-maintenance will depend on their survivability, durability, reliability and other properties. The *qualitative characteristics* of the machines entering the system - there is an opportunity to evacuation, repair ability (restorability), the possibility of determining the location of faulty equipment (quality that is realized in the course of technical intelligence), transportability (the possibility of evacuation). *Characteristics of the structure* quantitative and qualitative characteristics of the technical means, quantity and qualitative characteristics of personnel. *Characteristics of restrictions* are listed restrictions on the use of organized car aggregate, as well as the principles and methods of auto maintenance troops (forces).

Indicators of the output of the process will be the amount of automotive equipment returned in line, the duration of repairs, labor costs and other indicators and their derivatives. As shown in Fig. 3 the stream of applications for serviced cars enters the main and auxiliary structure of the automobile aggregate. As a rule, quality requirements for car maintenance are set. If the actual performance is lower than required, then there is a problem. As for the higher system, there are three main ways of solving this: improving vehicle characteristics (input characteristics), improving the provisioning structure (hardware, personnel and organization), changing the constraints, namely, the principles and methods of technical provision of vehicles. Each of these paths consists of a number of partial solutions.

Thus, we obtain a hierarchy of interconnected systems, and, accordingly, the problems of the effectiveness of their functioning. At any level, the problem of efficiency has three directions of solution, each of which consists of a number of ways. One of these ways is the problem of the effectiveness of the functioning of the lower system.

The variety of ways to address the underlying problem in the context of resource constraints requires a sound choice of a rational alternative. Naturally, the task can be performed informally, based on a logical analysis of the structure of problems and determining the importance of each of them by a group of experts. However, along with this approach, it is advisable to provide a more objective solution because of a mathematical description of the functioning of the system.

The article highlights the main provisions of the system approach to the analysis of military systems. This approach allows you to determine the type of military system at any level and establish their interconnections.

This makes it possible to structure the goals and problems for each system. This is demonstrated by an example of a system of automotive engineering.

Under the system means an organized set of material and technical products designed to perform a specific purpose. It operates under specified conditions on the basis of established principles and rules.

The system to be analyzed is not considered separately, but as a component of the higher-level system. Thus, for each system (component) a place is determined in the system hierarchy.

Depending on the purpose, the system methodology classifies the components of the systems in the main, auxiliary, providing and managerial. Typical components are present in all systems of this kind. Each of them implements the main, auxiliary, assured or managerial processes during the operation of the system.

Conclusions. In this paper, the main provisions of the system approach are adapted to the analysis of military systems. This approach allows you to structure military systems at any level and to determine their interrelationships, which makes it possible to structure the goals and problems for each system.

The choice of rational (optimal) way to improve the efficiency of the system is based on the development and analysis of its model. In the mathematical model itself, it is necessary to take into account the input characteristics, the structure of the system and the constraints regarding its functioning.

The direction of further research is the development of a detailed mathematical model for the restoration of automotive technology.

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Системний підхід до врегулювання проблемних процесів автотехнічного забезпечення Сухопутних військ Збройних Сил України

Резюме. На основні системного підходу визначено шляхи аналізу військових систем з метою виявлення проблемних питань та їх вирішення. Вибір раціонального шляху підвищення ефективності функціонування висвітлено на прикладі системи автотехнічного забезпечення.

Ключові слова: системний підхід, процеси відновлення автомобільної техніки, ефективність функціонування системи автотехнічного забезпечення.

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Системный подход к урегулированию проблемных процессов автотехнического обеспечения Сухопутных войск Вооруженных Сил Украины

Резюме. На основе системного подхода определены пути анализа военных систем с целью выявления проблемных вопросов и их разрешения. Выбор рационального пути повышения эффективности функционирования освещены на примере системы автотехнического обеспечения.

Ключевые слова: системный подход, процессы восстановления автомобильной техники, эффективность функционирования системы автотехнического обеспечения.

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National Power as a Factor of State Stability in Conditions of Aggravation of International Conflict

Resume. In the scientific work, certain geopolitical laws of the development of states in the system of international relations are revealed. The national power is described as a factor of influence on the system of foreign political (military-political) security of the state in the conditions of crisis phenomena.

Keywords: system of international relations; laws of economic development; national power.

Statement of the problem: The strategic objective of Ukraine's national policy is to protect state sovereignty and restore the territorial integrity of our state in conditions of Russian aggression. Therefore, the improvement of existing and working out of new forms and methods of counteracting threats to the national interests of Ukraine, the preparation of effective mechanisms of protection against expansionist strategies of more influential geopolitical actors should become a priority of the activity of all subjects of ensuring the national security of the Ukrainian state. The given scientific issues were studied by Ukrainian scientists such as V. Gorbulin, G. Sitnik, M. Shevchenko, D. Molodcheko, V. Mandragel, V. Bogdanovich, V. Smolyanyuk so-called. [2, 5, 7-9] However, scientific works on this topic in the context of the synthesis of all components of state formation and development of the country, which integrate form the national power, as well as carry out systematic and integrated impact on the provision of foreign security at present is not enough.

The purpose of the article is: the study of certain patterns of development of the state on the world stage in the face of aggravation of international conflict; the disclosure of the importance of the national power of the state in ensuring foreign policy and military-political security; definition of state-building, political, economic, managerial, security, social and humanitarian components of the country's development, providing a sufficient level of national power in the evolution of crisis phenomena in the system of international relations.

Presenting main material. An international environment should be considered as a system that is developing through the interaction between the "opposites" of its subsystems. These subsystems are the states of the world, each of which has its own national values, interests and goals. States try to comprehensively ensure the protection and promotion of vital needs of national development in conditions of international (first of all, capitalist) competition. The level of effectiveness of the national goals depends heavily on the indicator of the level of national power of the state [10].

The system of international relations is a certain kind of "rules of the game", the interaction between the main participants in international relations. Such a system gets a special structure for each geopolitical period. In particular, the current global economic crisis coincides with the unresolved problem of the global political order of the world, which, after a bipolar device, has not yet been able to transform into a unipolar or multipolar model. In general, historically, similar global economic crises have always coincided with the crises of the geopolitical epochs (on the borders of Westphalia, Vienna, Versailles, Potsdam, Bialowieza, etc.) accompanied by protracted wars and conflicts and led to a change in the geopolitical balance of forces, as in the global , as well as at regional levels [4, c.631].

At the world level, national interests and goals of each country can be as contradictory as national interests and objectives of other states, or compatible (coordinated) with other subjects of the system of international relations. It defines the relation between them, starting with their identity (community) and completing their "antagonistic" opposite.

It is believed that a harmonious (relatively stable, stable) state of the international system is possible under the main conditions:

- balancing national interests and goals of countries (egg the US, EU countries, etc.);
- the existence of a corresponding systemic geopolitical equilibrium between the states or their allied blocs.

In the event of the establishment of such block entities, the Allies have balanced (coherent) national interests and objectives, however, they (to a large extent) do not coincide with the national

interests and goals of a bloc of geopolitical opponents. The equilibrium of geopolitical forces is shaped by the ratio of the collective power of geopolitical blocs. They balance each other on the principle of reciprocity (balance) of threats (for example, the US and PRC, NATO and CSTO). The block variant is more extensive in the system of equilibrium of forces, since equilibrium and stability in it depend on the power of the blocks. Each of the states tries to guarantee its security through participation in one of the alliances, unions, coalitions [3, 7, 8].

At the same time, the lack of a geopolitical balance of forces in the system of international relations is also a factor for its development. The reason is that the dynamic stability of the international system or process has a relative character, as the geopolitical and geo-economics world (external environment) is changing. In the event of international crises (geopolitical or geo-economic), the balance of interests of the states becomes fragile, as new realities require reformatting relations in connection with the change of geopolitical or geo-economic "rules of the game," as well as changes in national interests and goals of the Union countries. In the backdrop of these changes, each state tries to provide superiority over other countries in order to realize their own national interests and goals. At the same time, States are trying to take all possible measures to prevent the possibility for other countries of the international system to gain such an advantage over them. Therefore, the system of international relations is predominantly an ideal type, a reference model of the balance of forces, which makes it possible to prepare for overcoming possible crises or transition to a new sustainable development [1-2].

From the standpoint of a political and economic approach, the laws of economic development have a significant influence on the modern international system:

- interdependence of growth of needs and reduction of resources;
- growth of labor productivity due to technological progress of production methods.

Due to the effect of the first law, there is a need for a constant expansion of markets for the sale of national goods and services and the establishment of control over planetary resources. This provokes international conflict. The second law encourages the scientific, technological and innovative development of open access states (societies) (eg the US, EU), promotes their rapid adaptation to the realities of a rapidly developing economic market. At the same time, this law affects the gradual growth gap in development between highly developed countries and backward states in economic, technological, innovation, military, military-technical, information-communicative, and political spheres. This inequality leads to a geo-economics split in the world for leaders and outsiders and contributes to an imbalance in the international system [1, 6].

In addition, open access societies (USA, Canada, Great Britain, Germany, France, Italy, Australia, etc.) are characterized by a common strategic foreign policy and foreign economic goals that are connected with the integration processes of globalization in the political, economic, military, security, humanitarian, social, informational spheres. In turn, most regional states are dependent on the geopolitical world centers (US, PRC, EU, Russia) system of international relations. Regional states are compelled to give way to their national sovereignty of financial and economic expansion of the leading countries of the world in order to ensure national stability, security and development in the face of global confrontation. This factor leads to the geopolitical association of regional states around the designated satellite countries, as well as the formation of a common foreign policy with them on the principle of a "united front" in defending collective interests in the international arena. But, at the same time, the distribution of social (or planetary) benefits from such a foreign policy approach is different and not always fair, and also depends heavily on the ratio of the levels of national power of each member of the union [6].

National power is a quantitative indicator of the forces and resources of the state that can be used in relations with other subjects of international relations; a set of material and spiritual capabilities existing in the state that are used to achieve geopolitical, geo-economic or geostrategic (military-political) national goals. Modern scientific approaches based on the principles of post-industrial worldview combine it as a combination of potentials (opportunities) of political, economic, social, spiritual, military, as well as factors, without which analysis of any confrontation is impossible for demographic, geographical, organizational, managerial and others. In general, the assessment of changes in the power of the state is based on nine basic parameters: management; territory; natural resources; people; economy; culture and religion; science and education; army (armed forces, internal troops, etc.); foreign policy (geopolitical environment) [5, 9].

Taking into account the above, an attempt was made to conduct a synthesis of all state-building, political, economic, managerial, security, military, social and humanitarian components of

the country's development, which integrally form the national power. During the research, the method of decomposition of the strata (levels) of the functioning of the "state-society-man" was applied, which provides protection of their vital needs. In the maintenance of research work, components that integral form the national power were classified as follows.

At the spiritual and value level - the spiritual values of the nation; catholicity; knowledge; historical experience; religion; traditions, national culture.

At the national level - national values and interests; national ideology; self-identity of the people (nation) and its consolidation around national values and interests; the maturity and legitimacy of the national ruling elite; balance of global, national and corporate interests.

At the strategic level, strategic management (strategic analysis, forecasting and planning) in the areas of sustainable development, defending national interests and ensuring national security; balance of creative and adaptive components in national strategy regarding changes in the environment; the ability of the authorities to integrate the processes of implementation of strategic thinking, in particular, regarding the organization, consolidation and coordination of strategic management objects to achieve strategic goals; strategic culture.

At the political level, the coherence of the interests of all social groups; balance of the political system; political culture and consciousness in society; level of social justice.

At the state and managerial level, organizational and managerial culture in the system of state and social relations; balance of national goals and resources of the state; communicative links between government and civil society.

At the security level - the system of national security and its security; security of state and public administration; balance of political and economic security; military power of the country and its special services; Resistance to destructive influence of external and internal threats; the ability of the authorities to participative consolidation of the nation in solving the tasks of defending national interests and ensuring national security.

At the international level, the national presence abroad (diplomatic, political, economic, military, informational, humanitarian, cultural, ideological, scientific and technological, etc.) and the level of dominance in the international arena in defending national interests while ensuring the balance of the international relations system; the ability to impose its national will (first of all, by means of "soft power") on other states; the ability to influence the functioning of the international components of the global world (UN, IMF, TNCs, military-political blocs, intergovernmental unions, financial and banking systems, information and communication networks, international political movements, etc.), as well as the formation of ideological trends for the future development of mankind .

On the social and humanitarian level, the health of the nation; demography; welfare; education; educational activities; education, etc.

At the scientific and progressive level - science; latest technology and innovation.

At the informational level, information communications, mass media, both in the middle of the state and internationally, are consolidated around the tasks of defending national interests and ensuring national security.

At the financial and economic level, economics, finance, resources; industrial and financial-banking infrastructure both in the middle of the state and in the international arena; the level of control over planetary resources and the sales and distribution of goods and services [5, 9].

Conclusions

1. The scientific work reveals the importance of the factor of national power of the state for ensuring national security. Investigated state-building, political, economic, managerial, security, military, social and humanitarian components of the country's development, which integrally form the national power.

2. It is believed that the improvement of the foreign-policy (military-political) security of Ukraine requires the introduction of complementary approaches to the development of national turmoil on the basis of qualitative strategic management. The said complementary model should represent a single integrated state-management mechanism, whose subsystems are organically interconnected, complementary, united by a single strategic plan and functioning algorithm. Its strategic mission should be aimed at raising the level of national power of Ukraine through the integral development of its above-mentioned components. In the context of the foreign policy (military-political) security of our state, the main tasks of such a state-management mechanism should be to increase the effectiveness of the process of ensuring the beneficial impact on Ukraine's international and military-political environment, promotion and protection of national interests on the world stage; strategic stability and implementation of the strategy of containment of

external geopolitical (military-political) opponents; balance of the regional equilibrium of forces (or its changes in favor of Ukraine) in areas of key importance for ensuring national security and sustainable development of our state.

3. Some features of the development of the system of international relations in the conditions of geopolitical crises and their influence on the foreign policy security of the state are revealed. It has been established that the steady growth of the level of national power of the state provides superiority over other countries and increases the level of efficiency of realization of its own national interests and goals. At the same time, more powerful states try to take all possible measures to preserve this advantage over other subjects (opponents) of the system of international relations, including by taking comprehensive measures to weaken their international opponents, primarily in geopolitical, geo-economic, geostrategic (military-political) spheres. In turn, the strategy of "alliance" (that is, the practice of implementing the foreign policy of the state in a single strategic plan with other subjects of the system of international relations) greatly increases the effectiveness of achieving strategic national goals. However, this is possible only if the balance and consistency of national interests and goals of all the union states are balanced and coherent. At the same time, the distribution of social (or planetary) benefits from such a foreign policy approach is different and not always fair and essentially depends on the ratio of the levels of national power of the members of the Union bloc.

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Національна могутність як чинник стійкості держави в умовах загострення міжнародної конфліктності

Резюме. У науковій праці розкрито окремі геополітичні закономірності розвитку держав у системі міжнародних відносин. Охарактеризовано національну могутність як чинник впливу на систему зовнішньополітичної (воєнно-політичної) безпеки держави в умовах кризових явищ.

Ключові слова: система міжнародних відносин; закони економічного розвитку; національна могутність.

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Национальная мощь как фактор устойчивости государства в условиях обострения международной конфликтности

Резюме. В научной работе раскрыты отдельные геополитические закономерности развития государств в системе международных отношений. Охарактеризована национальная мощь как фактор влияния на систему внешнеполитической (военно-политической) безопасности государства в условиях кризисных явлений.

Ключевые слова: система международных отношений; законы экономического развития; национальная мощь.

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УДК 628. 8 - ***Times New Roman кегль – кегль 12 пт***

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Іванов В. А.[2]
Бунин В. В. д.т.н., професор[1];
Иванов В.О.[2]
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[1] - Defence Policy and Strategic planning Department, Ministry of defence of Ukraine;
[2] - Military Strategic Research Center of the National Defence Academy of Ukraine named Ivan Chernyhovskij

Матрична модель OLAP-систем (*font size 14 PT bold*)
Матричная модель OLAP-систем
Matrix model of OLAP-systems

Резюме. Розглянуті особливості матричних моделей … ***(кегль 12 пт)***
Ключові слова: модель, OLAP система, інформаційні технології.
Резюме.
Ключевые слова:
Resume.
Keywords

Statement of the problem. Numerous research works aimed at solving the problems of decrease in power consumption of pneumatic conveying systems. ...

Analysis of recent researches and publications. In works [1, 2] considered the applied methods ...

The purpose of the article. Improving the efficiency of manufacturing operations for ...

Presentation of the basic material. The author proposes the use of analytical methods of search for optimal regime

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where $\sum$ *- Times New Roman 18 font;*
X *- Times New Roman 14 font;*
N ; pk; p=1; n *- Times New Roman 10 font;*
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