

AVIATION TRANSPORT

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COMPLEX OPERATION OF TYPES OF TRANSPORT IN THE CONDITIONS OF MILITARY INTERNATIONAL TRANSPORTATION

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Abstract—The article identifies the priority approaches to the technical and technological modernization of the main modes of transport of Ukraine and allied countries to ensure high-quality transportation of various goods, especially military goods, in the conditions of hostilities and during the period of economic recovery. The author proposes an algorithm for the formation of logistics chains for the delivery of military cargoes according to two schemes (from the United States and Western Europe). The necessity of creating a unified transport system, addressing the issue of further proportional development of the unified transport system and each of its components (modes of transport, structural units) is described. The main aspects that will affect the prospects for the development of a unified transport system are identified. The main tasks of the transport system that need to be solved to meet the needs of the state economy and the population in transportation are described. It is determined that when establishing the priority and order of restoration of the economic and social sectors destroyed by the war, it is necessary, first of all, to direct all resources (financial and material) to the restoration and development of transport, primarily rail and air transport. This is the only approach to solving the complex problem of improving the quality of transport. The complexity of its solution lies in ensuring, taking into account the actual volumes of transportation, the proportional development of each element of the transport modes.

Index Terms—Military cargo; integrated use of modes of transport; international transportation; airfields; airports; border crossings; capacity; economic efficiency.

I. INTRODUCTION

In the transport sector of Ukraine during the transformation period, an extremely difficult situation developed, which endangered the quick and successful exit of the society from the long-term crisis. The standard of living of the population is low, it worsened even more due to the military aggression from the side of the Russian Federation, which led to the conduct of brutal hostilities, almost throughout the territory of our state, including the border areas. Besides the enemy prevails our state by 7 times in terms of territory, more than 3 times in terms of population, and several times in terms of various types of weapons and military equipment, thus it has a significant advantage in almost all parameters.

The unstable situation that appeared in the work of state management bodies during the past decades

did not contribute to the strengthening of the economic situation of Ukraine, negatively reflected on the level of prosperity and well-being of the population and the economic growth of the state as a whole. The important macroeconomic indicator of the state's development – the gross domestic product (GDP) – in 2021, reached a small level, namely: 200.1 billion dollars. The USA, which is less than a similar indicator, for example, in Poland by more than 3 times, while the Russian Federation exceeded this indicator, compared to the Ukrainian one by 8.8 times, and the GDP of the USA exceeded our indicator by 115 times. In 2022, GDP fell by 30.4% in comparison to 2021. The given data demonstrate a stable and significant economic decline in the state in conditions of total destruction by the enemy not only of the military potential, but also of the civilian infrastructure with the civilian population.

For the successful completion of military operations, the material and financial support of the Ukrainian people, fantastic efforts are being made by the Armed Forces of Ukraine together with our partners, which causes an increase in the quantity of transporting of military goods and humanitarian aid to our citizens in conditions of considerable length of transportation routes from different countries of the world. This mission is responsibly and timely performed by more than 50 countries of the world. It is practically impossible for Ukraine to achieve military success without such systematic, timely and large-scale aid. Almost all types of transport take part in the logistical support of hostilities from the side of the Armed Forces of Ukraine. After our victory over a strong and cruel enemy, the state will face difficult tasks to restore the almost destroyed social economy of the state, leading countries of Europe and other continents will participate in this. The qualitative work of various types of transport of different countries in the conditions of the implementation of huge volumes of transportation will help us quickly create favorable conditions for the growth of the standard of living of citizens, the restoration of the destroyed economy and the military-industrial complex (MK).

Thanks to the great help of our partners, international and intercontinental cargo flows are being established and developed, they will have communication routes from many countries of the world to Ukraine using various types of transport, which can complicate the transportation of cargo, and its transfer through junction points between different states and modes of transport.

II. PROBLEM STATEMENT

Formalize the process of building a unified transport system. Develop an algorithm for optimal selection of logistics chains for cargo delivery.

III. MAIN PART

Connection with important legal acts and scientific and practical tasks.

The results of the analysis of the participation of the transport of Ukraine in cargo transportation, the conclusions regarding the implementation of which are given in the article were received according to the priority directions of the development of transport, determined by the order of the Ministry of Ukraine dated 04.07.2021 No. 321-r " About the approval of the National transport strategy of Ukraine for the period until 2030" , the recommendations given in the article correspond to the statements set forth in the Resolution of the Ministry of Ukraine dated November 9, 2000 No. 1684 "About Approval of the

Concept of Reforming the Transport Sector of the Economy", as well as Directive No. 91/440/EUS dated July 29, 1991 "About the Development of Community Railways", orders and normative documents of the Armed Forces of Ukraine, the Ministry of Defense of Ukraine and the Ministry of Infrastructure of Ukraine.

IV. ANALYSIS OF RESEARCH AND PUBLICATIONS

Significant results regarding the improvement of the transport process and the substantiation of proposals for the purpose of implementation at the modern level and at all stages of the process of transportation of goods and passengers have been achieved by Yev. Alshynskyi, V. Bobrovskyi, T. Butko, M. Galatchenko, I. Zhukovytskyi, K. Marintseva, I. Gerasimenko, I. Vysotska, V. Voitsechovskyi, I. Vasylenko, I. Gabriellova, M. Ilovayskyi, A. Kotenok, D. Kozachenko, F. Kochnevyy, V. Koryachko, V. Kulyeshov, Yu. Kulaev, O. Lavrukhin, D. Lomotko, V. Myronenko, Yu. Myha, Y. Nagornyy, O. Ogar, etc.

The result of the analysis of scientific works, the modern level of the practical organization of the transport process, the great variety of real conditions of service of the customers for transportation shows that the whole problem of rationalization of the functioning of border points is solved thanks to the implementation of operations without overloading in conditions of different widths of railway tracks and is relevant not only for transport structures and enterprises – cargo owners, and especially for military transports. It is very important for them, due to the high activity and intensity of hostilities, to ensure the quick delivery of modern military equipment, ammunition and other military-technical property from our foreign partners. The significant delays of such cargoes at border points lead to a shortage of such types of equipment and material support at the front line, which does not contribute to achieving the desired success during the military operations of the armed forces.

V. BASIC MATERIAL

That state in the economy as a whole and in the transport sector in particular, appeared due to long-term and continuous technical and technological underdevelopment during the transformation period, which was accompanied by low efficiency of important for the state branches of the economy, which had the great impact on the defense and industrial complex of the state.

Gross domestic product, which constantly decreased during the period of market transformations, led to a deterioration in the technical

and technological aspects of the functioning of transport as a whole, due to which it cooperates with the spheres of production and consumption in the state without its own development, which complicates the work of the defense industry of Ukraine.

Therefore, in the conditions of reforming Ukraine during military aggression, the destruction of infrastructure and military equipment, which occupied a high place in international rankings, without the help of partner countries, as well as the formation of a modern unified transport system (ETS), is almost impossible.

In modern conditions, the success of military operations in any corner of the world depends on the level of their logistical support. For the Armed Forces of Ukraine the provision is complicated by the fact that Ukraine was not ready for a large-scale military aggression by the Russian Federation. Thus, a system of logistical support with the participation of partner countries is being created from the first day of the war. The complication of this process takes place even now due to the fact that the needs of the Armed Forces of Ukraine consist of a wide range of modern weapons and military equipment; it is necessary that the delivery of all military goods to Ukraine takes place continuously in large quantities from various points in Europe and other continents; the implementation of the delivery must be carried out in a short period of time without delays on the route. The most effective in such transportation is air transport, which can quickly deliver a wide range of weapons and military equipment. But taking into account the threat to aircraft within our state due to hostilities, delivery to the territory of our country is complicated. Also, the obsolescence of the state aviation park, its small number, is a big problem in the implementation of the logistical support of the Armed Forces. On the other hand, the infrastructure of our airfields with trained aviation and technical personnel must be appropriately equipped to receive foreign aircrafts. Taking into account the above, it is necessary to begin the integration of civil and military transport infrastructure in accordance with modern European requirements, taking into account the future re-equipment of the Armed Forces with modern weapons of NATO countries' examples of the own and foreign production.

Therefore, the primary task is to carry out a comprehensive reorganization of military transport aviation, which should provide for the constant modernization of military airfields and civilian airports in order to enable a full cycle of service for foreign aircrafts that will deliver military cargo. During hostilities, foreign aircrafts cannot fly to any of our country's airfields, so cargo will be delivered to the territory of neighboring partner states. After

that, military goods will be delivered to the territory of Ukraine by rail (road) transport to a specific destination on the railways of Ukraine. Further to the combat zone, transportation is carried out by road transport.

Logistics in modern conditions of conducting military operations becomes an effective tool in the management of military cargo flows. This is facilitated by the extremely advantageous transport location of Ukraine and the developed transport network of communication routes in various regions. The implementation of the logistics concept in the field of military cargo transportation provides an opportunity to rationalize the whole process of delivery by various states using effective modes of transport, which helps to timely identify "bottlenecks" and significantly reduce the time interval between the moment of receipt of the cargo on the transport and the moment of its arrival at the consignee. So, the task of timely delivery of weapons and military equipment to the contact line is successfully solved while meeting the minimum delivery time, which strengthens the position of the Armed Forces. For this, in practice, it is necessary to implement rational logistics chains for the delivery of each consignment of goods (LCDG) depending on the specific conditions and possibilities of implementing transport links between specific points of the partner countries and in Ukraine (Fig. 1).

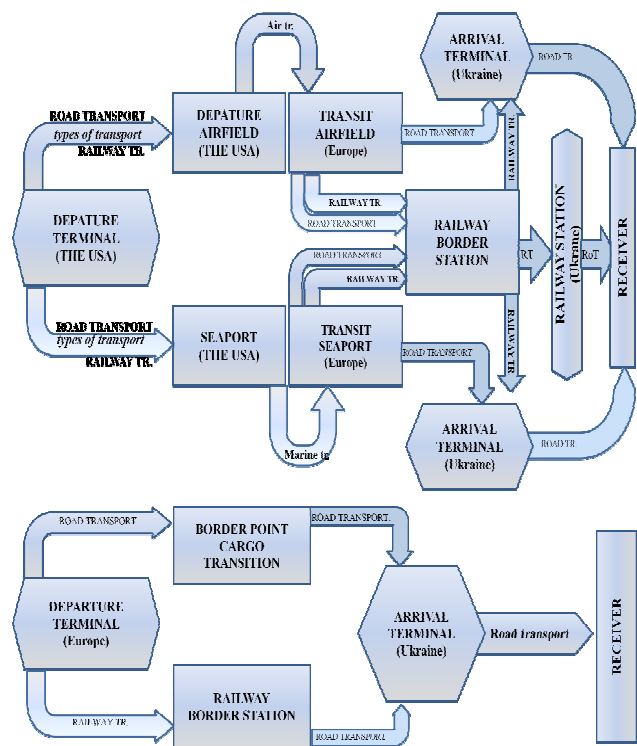


Fig. 1. Logistics chains of delivery of consignments of military goods (LCDG) from the USA and partner countries from Western Europe

Logistic principles are widely applied in economic activity not only at various enterprises - producers and consumers of various products (on the micro and macro level), which ensures optimal formation and effective management of product, information and financial flows between the spheres of supply, production and sale of various goods. In the broadest sense, with a high-quality domestic logistics system "production-transport-consumption" based on the data of a detailed study of demand, the following tasks are successfully solved for consumers: preparation for the transportation of a specific product (cargo) is provided; the required product has a certain quality; it is available in a certain amount for consumption; delivery will be made with certain logical services; the product is received by a certain consumer; the consumer will have certain costs. The listed tasks are also solved during the transportation of military goods.

State transport (all its types) is a complex production system that produces only one type of product (carries out the logistics process of transporting goods and passengers) with the participation of many different enterprises (technical means of various types – wagons, locomotives, tracks, highways, technical equipment of water communications, means of energy supply, aeronautical equipment and other control subsystems). The failure of any element or its details and due to this deterioration of its work does not ensure the normal functioning of the transport and its transportation process in general, which is manifested by the impossibility of realizing the maximum (theoretically justified) throughput (carrying) capacity of a specific element and leads to unsatisfactory maintenance of the economy and defense sector of the state.

The solution to the issue of the future development of the unified transport system and each of its components (transport modes) will emerge sharply after the end of the war. At the same time, it is important to ensure the proportional development of all its subsystems (types of transport) and its structural subdivisions. In addition, establishing the priority and sequence of restoration of the sectors of the economy and social sphere destroyed by the war, it is necessary, first of all, to direct all resources (financial and material) to the restoration and development of transport, especially railway and air transport.

This is the only approach to solving the complex problem of improving the quality of transport operation. It will give the desired effect in the economy, social sphere and in the defense sector. Unfortunately, this task has not yet been

comprehensively solved in Ukraine. The complexity of its solution consists in ensuring, taking into account the real volumes of transportation, the proportional development of each element of the types of transport:

- total productivity of the fleet of vehicles (locomotives, wagons, cars, ships, planes);
- effective capacity of highways, waterways, air communications and railway lines (stations, means of transport, power supply, wagon, locomotive and other facilities).

When developing logistics chains for cargo delivery for military purposes in international communication (with the participation of Western partner states), it is necessary to implement comprehensive approach in the above-mentioned two directions for all participants in the transport process (states, types of transport, specific border points). It is especially necessary to pay attention to the conformity (equality) of the throughput (transportation) capacities of different states at each border point in terms of their use for the passage, without delays, of specific volumes of military cargo through it, in compliance with technical and technological conditions (Fig. 2).

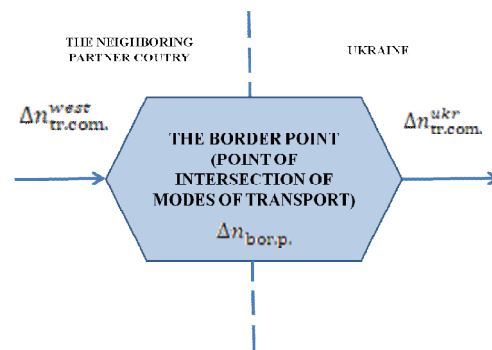


Fig. 2. Mutual agreement on the capacity of transport communications of Ukraine and neighboring partner states at the interstate border crossing

$$\Delta n_{tr.com}^{west} \leq \Delta n_{bor.p} \leq \Delta n_{tr.com}^{ukr} \quad (1)$$

where $\Delta n_{tr.com}^{west}$ is a part of the effective throughput (carrying) capacity of the transport communications of the neighboring state – partner at the some border point, allocated for the passage of military cargo; $\Delta n_{bor.p}$ is the part of the effective throughput (carrying) capacity of the border point, which will be used for the passage of military cargo; $\Delta n_{tr.com}^{ukr}$ is the part of the effective throughput (carrying) capacity of Ukrainian transport communications on the route of foreign military cargo from the border point to the consumer.

The important task of the transport system of our state in modern conditions is the timely and high-quality satisfaction of the needs of the economy and the population in transportation, increasing the efficiency of its work, including in the defense of the state. To solve these tasks, you need to focus on the following:

- improve the quality of transport services;
- to ensure the implementation of optimal proportional development of all types of transport and support them during operation;
- to optimize the network of communication routes in the regions based on promising cargo flows, taking into account the requirements of the defense sector;
- to choose a rational phasing of the formation of the structure of the regional network of communication routes;
- to ensure full compliance of prospective volumes of transportation with the available throughput (carrying) capacity of transport communications and the overall national structure of transport hubs, taking into account defense requirements;
- to increase the speed of movement of transport units (trains, airplanes, ships);
- to improve modes of interaction of various types of transport at border crossing points and junctions to minimize the duration of cargo stay there (especially for military purposes);
- to improve the transport management system and the transport complex as a whole.

Special attention should be paid to solving the problem of choosing the optimal proportions of development among individual modes of transport in the regions and subdivisions of each of them, depending on demand and the level of efficiency of use. Besides, it is necessary to take into account the uncertainty (probabilistic nature) of transport processes, as well as the economy of transport, taking into account all transport costs associated with storage, preparation of goods for transport, waiting for transport, etc. at all stages of the transport process.

Significant attention in modern conditions must be paid, after the war, to the development of general plans taking into account the interests of the defense sector, the presence of probabilistic factors must be taken into account in the calculations.

The existing methods of technological calculations, as a rule, do not take into account the probable regularities of the work of the components of unified transport system but replace them with functional dependencies. As a result of such

calculations, the only solution is obtained, which does not take into account all the changes that occur in real conditions, real technology of work, the state of equipment, the structure of cargo flows, the accuracy of forecasts, etc. Therefore, the results obtained on the basis of such calculations do not provide the necessary accuracy. The certain failure to take into account the probable factor in transport processes can lead to an incorrect definition of "bottlenecks", and as a result - to a decrease in the effectiveness of the suggested measures. An important task for the long-term improvement of the operation of various types of transport in the economic regions of the state is the substantiation of the system of strategic development of industrial nodes, due to the presence of the following faults:

- in last decades, disparities in the development of transport and production have been growing due to a steady decrease in production;
- the distribution of suburban areas between transport and production is unjustified;
- chaotic construction is being carried out in large cities without modern general plans;
- elements of transport often do not have sufficient conditions for prospective development in existing places because of the lack of free spaces.

Therefore, it is necessary to increase work on finding reserves for transport hubs and their prospective development. In order to optimize the development of transport in the state and in the regions, it is necessary to carry out a systematic analysis of real conditions and qualitatively forecast cargo and passenger flows for the implementation of rational measures. Errors in forecasts are difficult to eliminate and lead to financial losses for transport and the economy as a whole.

Volumes of transport flows are needed to identify and eliminate real "bottlenecks" in the operation of any type of transport in specific regions, thanks to which the effective operation of any element of the transport system is ensured. But forecasting depends significantly on the territorial placement of elements of the transport system; the predicted flow model for some regions takes a simple form and gives a smaller error, while for other regions completely different results are obtained. In such cases, they implement a differentiated approach to developing forecasts for each region with optimization studies using the obtained forecast data.

When developing LCDGs that will go through the systems of different regions, it is necessary to take into account the existing random fluctuations in cargo flows. It should also be taken into account that flow fluctuations are affected by reducing their

inequality in the places where these flows are formed. Thanks to this, they establish why inequality occurs in transport. It is possible to prevent the negative impact of inequality only by creating additional reserves of throughput and delivery capacity of elements of the transport system, which leads to an increase in transport costs. The nature of the work of industrial enterprises has a significant influence on the increase in inequality.

The important task of improving the work of the components of a unified transport system is the implementation of complex optimization of the parameters of various modes of transport in order to ensure a clear conformity of the throughput capacities of interacting modes of transport, which is important for ensuring an easy transition, without delays, at junctions between modes of transport, flows from one mode of transport to another. There was a need to create typical technological processes of the operation of transport hubs. The important task is the development of automated control systems (ACS) for types of transport, taking into account their interaction at nodes and within individual regions. But the departmental approach to the development of the ACS by various types of transport, which is observed today, is wrong because in the future it led to great material losses. Coordination of the work of various types of transport is becoming more and more important in modern conditions as the volume of cargo and passenger transportation increases, the importance of which will increase significantly in the post-war period due to the increase in the load on the components of the unified transport system. The transportation process represents the movement of cargo from the point of production (for the military, from the terminal) to the point of consumption. Various options for moving goods from warehouse to warehouse are possible. Several types of transport are often involved in these movements: road, rail, air, sea.

The determination of the throughput capacity of transport systems can be applied to all types of transport.

The throughput capacity of a linear element of the transport system is the largest number of transport units (applications) that can be served by the system in a unit of time with its technical equipment and advanced work technology:

$$\bar{n} = \int(T_p, \bar{t}), \quad (2)$$

where T_p is the calculation time period used for servicing transport units (applications); \bar{t} is the duration of service of one unit of transport flow with equal and continuous use of the system during the calculation period.

The deterministic approach is justified only for transport systems that operate without interruption during the day and serve each unit of traffic flow during a certain period of time \bar{t} . In the real life this is very rare because the transport process is often stochastic. This process is characterized by inequalities of its operation during the calculation period. It is characterized by non-homogeneous traffic flows, different duration of maintenance of transport units, random nature and different failure periods of technical devices, etc. Therefore, it is desirable to use a probabilistic-statistical approach to determining the throughput capacity of the transport system.

Aircrafts performing transport work, are in the following environments:

- in the air: stages of take-off, cruise flight, approach, landing;
- on the ground (airport) during the performance of two groups of operations: the first group – performance of certain maintenance and repair operations, disembarkation (unloading) of passengers (cargo), technological operations (provision of power supply of the aircraft, external inspection of the aircraft, refueling, system maintenance drinking water, maintenance of the toilet system, internal cleaning, boarding (loading) of passengers (cargo), centering the aircraft, preparation for departure, pre-flight and technical inspection, anti-icing treatment, etc.); the second group – towing, taxiing, take-off stages, landing stages.

Therefore, when performing transport work, the aircraft is in two environments: in the air during flight and on the ground during certain operations. When environments change, the only aircraft may be on one runway. Therefore, the air traffic control system in the "airport – airspace" system is an element that limits the movement of air traffic control. When determining the carrying capacity, it should be taken into account that the air traffic control system always limits it, which gives us the opportunity to quantitatively assess the carrying capacity of the airfield (airport).

Based on the above characteristics of operations performed by air traffic control and the types of work performed by air traffic control, it can be stated that they are all interconnected and influence each other, which is reflected in the effective throughput (carrying) capacity of the airfield (airport). Taking into account the complex interrelationship and mutual influence of the entire complex of operations and types of work and the probability of their nature of flow, it is almost impossible to establish exact analytical dependences of throughput (carrying) capacity on the main parameters. The bandwidth of the network can be determined as follows:

$$n_{RW} = 1440 \cdot \int (T_{\text{cons}}, \mathcal{I}_{\text{min}}), \quad (3)$$

where T_{cons} is the duration of execution per day in permanent maintenance operations; \mathcal{I}_{min} is the value of the minimum possible interval of take-off and landing aircrafts on runways.

Taking into account the possible loss of capacity during the performance of various operations at the airfield, as well as due to unforeseen constructions during the flight of aircrafts at certain stages of the flight with the probability of their nature, the real number of aircraft that can be in the air and at the airfield with military cargo will be less n_{RW} than the value determined from dependence (3). The loss of airfield capacity can be determined using a probabilistic-statistical approach using real statistical data on the failure of air traffic control operations at the airfield.

The important stage in the planning of military transports in international communication is the justification of rational transport routes, which provide for the establishment of rational transport routes and the effective participation in their phased implementation of all participants in the transport process (types of transport). Current regulatory documents direct military units and structures when carrying out transportation to the maximum use of the carrying capacity of vehicles and the realization during transportation of the maximum speed of delivery. Certainly compliance with the minimum value of the term of delivery of military property and equipment to military units is an important condition for the success of the Armed Forces at the front line. Therefore, at the points of departure, representatives of the Armed Forces of Ukraine (Commandant's Office of Military Communications) must be very responsible for compliance with the norms of loading vehicles together with representatives of transport structures, plan transportation and control them in order to realize the highest speed of transportation. To comply with the above requirements, it is advisable to use, if possible, air transport. In modern practice, aviation is used together with other types of transport to provide the Armed Forces of Ukraine with effective western-style weapons.

In connection with the fact that the planning of the implementation of each shipment must be carried out in certain terms with minimal costs, the economic efficiency of the use of air transport (the amount of costs for its implementation) when justifying a specific LCDG should be determined by the formula:

$$E_a = E_n \cdot K_a + \frac{\mathcal{L}_a}{v_a} \cdot C_h^{\text{fly}} + t_{n.c}^c \cdot C_h^c + t_{n.c}^n \cdot C_h^n, \quad (4)$$

where E_n is the regulatory efficiency ratio of capital investments; K_a is the specific capital investments for the transportation of military goods by air transport; \mathcal{L}_a is the distance of transportation performed by air transport; v_a is the speed of transportation by air transport; C_h^{fly} is the cost of an airplane-hour of flight; $t_{n.c}^c$ is the normative duration of cargo loading and storage at the airport of departure; C_h^c is the cost of an hour of the aircraft being at the airport of departure while waiting for the flight and going through all flight procedures during maintenance, repair, etc.; $t_{n.c}^n$ at the airport of destination; C_h^n also at the destination airport.

Because of the complexity of the structure of road transport (long distance of transportation, the participation of specific transportation of various types of transport, a significant number of different intermediate points on the route (airports, railway stations, sea and river ports, highways, etc.), the overall economic efficiency of road transport should be separately determined similarly according to formula (4) on specific parts of the entire transport route, the operation of each type of transport, taking into account all the diversity of real conditions.

VI. CONCLUSIONS

The difficult economic situation of Ukraine before and during the hostilities, insufficient readiness of the state to the war during the peaceful period, weak indicators of gross domestic product and the defense sector, the significant advantage of the Russian Federation in the military-industrial complex requires great efforts of our state in order to achieve victory, expansion of the cooperation with Western partners regarding the armament of the Armed Forces of Ukraine.

During the delivery of military goods from the USA and Europe, it is necessary to use several types of transport: sea-rail-road; marine automobile and railway; aviation-railway-automotive; aviation-automotive-railway, etc., which, in turn, requires the perfect planning from the point of view of both transport and warehouse logistics. A large theater of hostilities with the Russian Federation requires a great need for weapons and military equipment, continuous provision of what is necessary for the Ukrainian people, which leads to a constant increase in the volume of military transporting from Western partners.

In order to ensure the rational use of the resources provided by partners, there is the task of using them with great benefit accordingly, for each shipment of military cargo, it is necessary to develop an logistics chains for cargo delivery with a detailed consideration and study of the entire complex of problematic issues in the implementation of the difficult transport process.

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Д. О. Шевчук, П. О. Яновський, Ю. Б. Добровольський, І. О. Целіщев. Комплексна експлуатація видів транспорту в умовах військових міжнародних перевезень

У статті визначено пріоритетні підходи до технічної та технологічної модернізації основних видів транспорту України та країн-союзників для забезпечення якісного транспортування різноманітних вантажів, а особливо вантажів військового призначення в умовах ведення бойових дій та в період відновлення економіки держави. Запропоновано алгоритм формування логістичних ланцюгів доставки військових вантажів за двома схемами (із США та Західної Європи). Описано необхідність створення єдиної транспортної системи, вирішення питання подальшого пропорційного розвитку єдиної транспортної системи та кожної з її складових (видів транспорту, структурних підрозділів). Визначено основні аспекти, які будуть впливати на перспективи розвитку єдиної транспортної системи. Описано основні задачі транспортної системи, які необхідно вирішувати для якісного задоволення потреб економіки держави та населення в транспортуванні. Визначено, що встановлюючи пріоритетність і черговість відновлення зруйнованих війною галузей економіки і соціальної сфери, необхідно, в першу чергу, всі ресурси (фінансові та матеріальні) спрямовувати на відновлення і розвиток транспорту, насамперед залізничного та авіаційного. Це єдиний підхід до вирішення комплексної проблеми підвищення якості роботи транспорту. Складність її вирішення полягає в забезпеченні, з урахуванням реальних обсягів перевезень, пропорційного розвитку кожного елемента видів транспорту.

Ключові слова: військові вантажі; комплексне використання видів транспорту; міжнародні перевезення; аеродроми; аеропорти; прикордонні пункти; пропускна спроможність; економічна ефективність.

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