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Keywords: Marine Technologies, Sustainability, Waters, Multimodal, Transport, Navigation, Analysis.

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## MULTIMODAL LINER SHIPPING OF CARGO WAYS OF IMPROVEMENT IN GEORGIAN PORTS

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*The paper analyzes the transport logistics system of Georgia in terms of multimodal line shipments of goods. Analysts and experts working in the field agree on the issue that Georgia should be considered as a single transport logistics system-hub. The solution to the issue of the construction of the deep-water port of Anaklia has put on the agenda the question of whether we should consider it as a feeder port or not. If we rely on the research conducted by many international organizations, including the World Bank, the Asian Development Bank, the head office of "Traceca" and others, we can say that with the start of the construction of the Anaklia port, the issues of the organization of liner shipping will be on the agenda of both the Black and Mediterranean ports. In this direction, this principle is directly useful for the development of "short-range sailing".*

*The concept, in which the need to develop line routes from Georgian ports, fits perfectly.*

*When we talk about liner shipping, here and hereafter, we mean intermodal, container shipping. In the Georgian transport and logistics reality, the absence of a deep-water port and low container turnover*

*Due to the indicators, the development of linear directions was not on the agenda. This is what determines the relevance of the topic presented by us. Based on the analysis of the existing statistics of Georgian ports, we tried to develop and systematize, on the one hand, the main directions in which cargoes move through Georgian ports and are considered as probable traffic for liner ships, as well as to analyze*

*All the technologies that can be used in intermodal shipping on these destinations. As a result of these studies and analysis, a number of problems that Georgian ports may face in the process of solving these issues have emerged, especially if we take into account the fact that the ports of Batumi and Poti are not state owned.*

*We analyzed the current reality in Georgian sea ports in terms of cargo turnover on the one hand and management on the other hand, we presented our vision of how the state, port management and international organizations should work together in the system, and we formulated a list of measures for the organization of multimodal liner shipping in order to*

*The ports of Georgia should have a real chance to increase cargo turnover as much as possible under the conditions of line shipping.*

*Of course, when we talk about multimodal and intermodal transportation of cargo in line directions, we mainly focus on the Anaklia port under construction, however, we also take into account the fact that in the Traseka corridor, in addition to the Europe-Asia port and the Anaklia port in the reverse direction, it is also possible to consider lower capacity line directions in the direction of the ports of Batumi and Poti.*

**Keywords:** *Multimodal and intermodal shipments, cargo, ports*

## CAUSE-AND-EFFECT RELATIONSHIPS OF ACCIDENTS AND EMERGENCY SITUATIONS ON MARINE TRANSPORT

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*There is a very close connection between the level of accidents of vehicles and their technical condition, as well as between the level of accidents, the technologies used and the level of professional training of operators (specialists).*

*Any dangerous situation in transport is caused by certain reasons, which in turn can cause accidents or accidents. Therefore, knowledge of possible expected dangers or pre-guessing allows us to guess the reasons that contribute to the realization of accidents on transport. There is a cause-and-effect relationship between released accidents and their causes; An accident is the result of several causes, which in turn are the result of other causes, etc.*

*Risk is a measure of a dangerous situation. The numerical value of the risk level characterizes the degree of occurrence of a dangerous event and the losses associated with it. According to this definition, the risk of occurrence of a traffic accident is a measure of the danger of occurrence of a traffic accident. As the last definition does not include the loss related to a dangerous event, it is logical to introduce another definition - "risk of loss", ie "foreseeable material loss". Predictable total material damage - this is a mathematical expectation of the amount of material damage caused to property and the environment as a result of the occurrence of a traffic accident by marine, road and railway technical means.*

*The system "human - vehicle - environment" can be released from the stationary/working state by the influence of three main factors - internal errors, external force and human error. These factors may act separately or jointly in different proportions.*

**Keywords:** *loss, an accident, Emergency situations*

## **NAVIGATION IN FLOODED AND CONFINED WATERS**

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*Freedom of navigation on the seas, or the right of peaceful passage, whereby the captain of a ship can act as he sees fit, has come under considerable public scrutiny in recent years. This control led to increasing intervention by authorities on land to restrict traditional freedoms by regulating the flow of ship traffic.*

*This review therefore examines the reasons for public scrutiny and provides a history of the development of shore-based regulation of ship navigation, with examples of international, national and local measures adopted. The effectiveness of such measures in terms of reducing accidents is discussed, based on the results of studies conducted in several countries.*

*This, in turn, offers criteria for determining the degree and type of shore intervention appropriate for a given navigable water and allows some conclusions to be drawn.*

*Finally, future developments that are now under consideration are described, with comments on further developments that are now possible with the introduction of modern technology.*

***Keywords:*** *Sailing, National, Captain of the ship*

## REVIEW OF MARITIME LOGISTICS: TRENDS AND RESEARCH AGENDA

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*The growing importance of maritime transport in overall logistics flows has increased the interest in maritime logistics. Despite the growing body of literature on this emerging discipline, there is a lack of detailed examination of categorization and emerging themes. The main purpose of this study is to analyze the advances in the literature and to propose a research agenda for this concept by exploring the main research areas of this phenomenon. To achieve these goals, this study uses a content analysis-based review method to explore concept and citation analysis to explore the hidden structure of maritime logistics. Research streams were obtained through two databases; Major themes, emergent themes, and related analytical categories were explored through content analysis.*

*A citation and co-citation analysis was conducted to understand the intellectual structure of the studies and the relationship between analytical categories. The study is a comprehensive synthesis of existing research, offering a systematic source of information for both scholars and practitioners, shaping the future research agenda. The findings indicate that there is an increasing emphasis on the design, optimization and planning of port and ship operations, while sustainability and marketing perspectives are somewhat neglected in research.*

**Keywords:** *Content analysis, Maritime logistics, concept*



## **ECOLOGICAL MODERNIZATION AND MULTILATERAL MANAGEMENT IN MARITIME TRANSPORT FOR SUSTAINABLE DEVELOPMENT**

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*Ecological modernization (EM) is often a method for making societies and the key industries they depend on environmentally and economically sustainable.*

*This article focuses on the main factors that contribute to the development of EM in the shipping industry. The applied theoretical view is based on critical studies in the fields of economic development and corporate social responsibility.*

*The analysis aims to prove the unrealistic assumptions of EM from a political point of view and thereby contribute to the understanding of potential barriers to EM projects.*

*The empirical results presented in the article are based on the analysis of Finnish and Danish maritime strategy documents and interviews conducted in Finland in 2014–2016.*

*Analysis of policy documents shows a link between weak EM and strong technological frameworks for maritime sustainability in Danish and Finnish maritime policies. The analysis of the interviews shows how during the economic downturn the positive EM perspectives highlighted in the Danish and Finnish maritime strategy documents are challenged by economic obstacles at the company level.*

*In conclusion, it is emphasized that achieving the sustainability of maritime transport requires expanding the scope of sustainable development beyond emission control and the role of transport in society, considering how maritime business operations are carried out in specific locations around the world.*

**STUDY AND ANALYSIS OF THE MODEL OF INTERACTION OF WIND WAVES  
WITH SEA CURRENTS**

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*The paper discusses the construction of a mathematical model of the influence of currents coming from the depths on the field of surface wind waves. By analogy with the work, the integro-differential equation is derived for the magnitude of the deviation of the free surface of water from its equilibrium position. Next, the asymptotic analysis of this integro-differential equation is carried out based on the assumption that the velocity of the flow field disturbance is small compared to the velocity of the moving flow, which, interacting with downstream disturbances, causes the flow disturbance.*

*An asymptotic analysis using the Fourier transform leads to a clear formula for the deformation of the wind wave spectrum with a perturbed flow reaching the surface. The spectrum of surface waves is deformed in a wide range from millimeter waves to meter waves, the deformation zone takes a stable shape, and signs of seabed disturbances are visible in the deformation zone.*

*Previously, the problem of deformation of the ocean surface under the influence of currents passing through uneven surfaces of the sea floor has been considered in many works. Our work presents a new asymptotic approach to the perturbation of the wind wave under the action of the subsurface ocean surface current. A clear formula for the deformation of the spectrum of the surface through the Fourier transformation of the current velocity reaching the surface is obtained.*

*To investigate the possibility of observing the deformation of the sea surface using convenient non-contact measuring tools, namely the representation of deformed surfaces in spectral form, since the modeling of the fluctuations of the signals received for radiometers and radars is so convenient to perform. Formulas for calculating the disturbance signals from radiometers*

*and radars are given in various studies. There is also a great deal of experimental evidence for the relationship between ocean current disturbances, bottom heterogeneity with radar and surface radiometric images.*

**Keywords:** *investigate; construction; radiometric*

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## **IMPORTANCE OF GEORGIAN MARITIME TRANSPORT IN THE INTERNATIONAL MARITIME INDUSTRY**

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*Among the problems that arose during the period of transition to the market economy in Georgia, the crisis situation created due to objective and subjective reasons in the field of maritime transport is important. Overcoming it is and will be of special importance in the independent state construction of Georgia, the development of foreign trade and economic relations and the integration of the economy of Georgia with the world economy.*

*At the turn of the 20th-21st centuries and in a more distant perspective, the future of the development of the main transport of Georgia and the entire transport complex of the country is closely and organically connected with the perspective of the revival of the historical Great Silk Road, the future of the development of Trasek as a Europe-Asia transport corridor, the task and purpose of its operation. Therefore, the functioning of maritime transport and the entire transport system acquires special relevance in the period of transition and independence of the country - at the stage of economic reforms, restructuring of individual sectors of the economy, including transport, establishment of political sovereignty and economic independence of the country.*

*The issues of maritime transport development of Georgia, both in the past (retrospective) and in the current state and perspective, are directly related to the problems of the construction and effective functioning of the Caucasus transport corridor, which gives it special relevance.*

*In economic science, it is established that transport belongs to the branches of material origin and non-production sphere at the same time. It connects industrial enterprises and sources of raw materials, economy, production, market of different regions and cities of the country. Maritime*

*transport is the basis of the world economy and market, international economic integration, a necessary condition for their development.*

*Without developed transport links, the normal development of productive forces, economy, national market, and its integration with the world economy is impossible in any country, including Georgia. Along with enterprise-economic functions, maritime transport plays a major role in political security, military and socio-cultural spheres, in everyday life.*

*The maritime space and maritime transport of Georgia was in the past and will be one of the leading and active components in the common system of the Caucasus transport corridor. In the seaports of Georgia, the world's sea cargoes coming from the West will be unloaded, which will then be sent to different countries through the Caucasus transport system. Land cargoes coming from Caucasus and Asiatic countries will be loaded on various ships of the world in the mentioned ports.*

*The countries participating in the TRASECA project have recognized the Black Sea region as a part of the Pan-European transport area. With the implementation of the Traseka project, the transport system of Georgia is integrated into the pan-European transport system. The current Great Silk Road has become the future landmark of Georgian transport. It also has a complex impact on the transport system of Georgia and its integration with international transport, on the economic, social and political development of the country as a whole.*

**Keywords:** *Traseka, market economy, sea transport*

**THE MAIN DIRECTIONS OF IMPROVEMENT OF FREIGHT  
TRANSPORTATION IN GEORGIA**

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*Georgia is located in one of the most important and complex geopolitical regions of the world, at the key point of the Great Silk Road, which has historically played a major role in the development and relations between Europe and Asia. After Georgia freed itself from the geopolitical captivity of the Soviet Union, the country became a new geo-economic center between Europe and Asia, between Russia and the Middle East, due to its geographical space, historical past, political importance and economic opportunities. Accordingly, there has been a growing interest in Georgia as a new center of geo-economic attraction, both in the regional and international arenas.*

*Although in the last period the so-called Cargo flows in the transit corridor of the "New Silk Road" have been significantly activated, the potential opportunities of the said corridor have not yet been fully utilized. The full realization of the mentioned potential is closely related to the effective resolution of the institutional, structural and strategic challenges, due to the unresolved nature of which, the "New Silk Road" transit corridor is less competitive compared to alternative corridors. In accordance with its favorable geographical location, Georgia has the opportunity to perform a key function in the mentioned transit corridor, to deeply integrate its own transport and logistics system into international logistics systems, and thereby contribute to the overall economic development of the country.*

*The paper analyzes the experience of all types of vehicles during container shipments in Georgian ports; The development of an imitation model representing the organization of the transportation process at the nodes of the transport network in the Black Sea region of Georgia is given; Determination*

*and preparation of data for modeling the container handling process, involving all types of transport; Adequacy assessment and translation of the experimental simulation model is done; The selection of the optimization model for the operation of all types of transport in transport hubs located on the Black Sea coast of Georgia has been made.*

**Keywords:** *Georgia ; Black Sea; Transport; Corridor*

## LOGISTICAL MANAGEMENT OF ENVIRONMENTAL SAFETY OF ROAD TRANSPORT

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*The development of the market economy has in many ways expanded the directions of road transport in the area of intensive traffic and pedestrian flows, which is mainly characteristic of large cities and industrial centers. Transportation of cargo and passengers Driving not only increases the risk of traffic accidents, but also increases the effectiveness of negative environmental impact on the environment. Therefore, reducing the negative impact of road transport on human health and the environment is an actual scientific and methodological problem.*

*Despite the world-wide research - in industrial centers, in areas of intensive transport and passenger flows, the problems of air pollution have not been solved yet. The long-term program developed by the USA and a number of European countries envisages not only the development of expensive transport infrastructure, but also the formation of environmentally-oriented transport service measures in traffic areas.*

*If we take into account the fact that the main share of the traffic flow in large and regional cities comes from  $M_1$  and  $M_2$  category vehicles, it is easy to imagine the role of these types of facilities. also in the direction of traffic pollution of the environment. On the basis of the reference report conducted according to the theoretical norms of permissible pollutants in the combustion products of internal combustion engines, it is established that in the case of average annual mileage, 70-80% of the city's traffic pollution comes from vehicles of this category.*

*It is worth noting that the operation of the outdated automobile fleet in Georgia, during the implementation of automobile transportation, in terms of releasing  $CO$ ,  $NO_x$ ,  $C_x H_y$  into the atmosphere, increases the ecological quality*



*of the atmosphere. security problems. If we take into account that the renewal of the aging fleet at the current rates is a long period (15-20 years) and even increasing the number of new environmentally friendly vehicles in the traffic flow cannot reduce the mass of fine dispersed particles such as tires, brake pads and road surface wear, a number of measures are necessary spend.*

*This reality creates the necessity of systematic and targeted On the basis of logistics basics, in large cities, ecologically oriented technologies should be integrated into the processes of managing road transport.*

*Therefore, when motor transport moves in city conditions, the environmental impact of the flow is determined both by the intensity of the traffic and the composition of the flow, as well as by the degree of traffic regulation and the qualification of the driver. The logistics of the task For a solution with approaches, it is necessary: 1) logistic planning of transport flows for managing road transport processes should be carried out taking into account ecological safety criteria; 2) in the stream The selection of the type of vehicles and the assessment of the economic efficiency should be carried out taking into account the indicators of ecological safety.*

**Keywords:** *transport, exhaust, Ecology*

## **DIALECTICS AND INSTITUTIONAL LEVELS OF MODERN ECONOMIC DEVELOPMENT DIPLOMACY**

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*Considering in the previous section the essence of economic diplomacy, its theoretical foundations and conditions for the formation of its mechanism, we practically ignored the level of its development, focusing mainly on the bilateral format of relations between countries. Nevertheless, to avoid false*

*idea of economic diplomacy as a phenomenon of a purely bilateral nature, we consider it necessary to remind that in the realities of today the bilateral nature of interstate relations is only one of the manifestations of international (including economic) relations. Thus, after the end of the Second World War, multilateral contacts in the world were sharply intensified, and the mechanism of economic diplomacy of national states was replenished with the means and methods of collective diplomacy.*

*The main feature of modern international relations is the absence of a single, central core of power and management. They are built on the principles of polycentrism and polyhierarchy. Therefore, spontaneous processes and subjective factors play an important role in international relations. As a result, this category acts as a space where they intersect and interact on various forces (state, military, economic, political, social, intellectual, etc.) at different levels (global, regional, multilateral and bilateral).*

*As practice shows, each of the mentioned levels, along with common features, also has its own peculiarities of the organization of cooperation and interaction. There is also a specific feature of finding mutually acceptable solutions, compromises, reaching agreed solutions, preventing the emergence and resolution of already existing.*

*International or world politics and economics are the core of international relations. Today, a significant number of participants participate in international relations, but the view that its main subjects are states and interstate associations remains widespread. In addition, at the beginning of the XXI century. the tendency to increase their number was clearly manifested. Thus, international organizations began to acquire more and more importance. contradictions and hot issues. That is, there are appropriate levels of diplomacy in interstate economic relations.*

**Keywords:** *International; Economic Diplomacy; Considering.*

**ANALYSIS AND SYNTHESIS OF ALGORITHMS FOR HIGH-PRECISION  
MARINE NAVIGATION ACROSS GEOPHYSICAL FIELDS**

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*Reliable navigation support for ships is important for the safety of their navigation, efficient operation and prevention of environmental disasters. The specifics of the work of sea, river and fishing fleets determine the need to use such navigation aids that would, at a minimum cost, ensure the satisfaction of modern and future requirements imposed by consumers in any region of the globe.*

*The issues of reliable, high-precision control over the position of a vessel acquire particular importance when sailing in the coastal zone, on approach routes, in narrows, canals and in port waters, where the consequences of a ship accident are largely associated with the risk of environmental pollution. To meet modern requirements for navigation support for navigation, qualitatively new navigation aids are being introduced, including satellite navigation systems (SNS).*

*Currently, SNS GPS and Glonass most fully satisfy the requirements for navigation support for navigation when used in normal and differential operating modes. The main advantages of these systems when using standard accuracy signals in normal operation are the global working area, high availability, accuracy and reliability with continuity of navigation determinations, and in the differential mode - the ability to increase the accuracy and reliability of navigation determinations in the working area of the differential subsystem. The errors in determining the location of the Glonass and GPS systems when using standard accuracy signals in normal mode do not exceed 40 m and 100 m, respectively, and in differential mode, the probability is 95%.*

*Currently used navigation systems (relative and absolute Doppler logs, path calculator) do not meet the requirements for them, first of all, in terms of*

*the accuracy of determining coordinates, as well as in the efficiency of preparing the complex for working condition. At the same time, as a rule, the high-precision modes of the complex require significant preparation time, which does not allow their use in operational mode.*

*In this regard, the problem of creating means for making navigation determinations that allow, in the event of insufficient and uncertain initial data, to give sufficiently accurate estimates of the current location is very relevant, with additional requirements being offline operation and sufficient efficiency in preparing the navigation complex for working condition.*

*In practice, there are two main problems of assessing the state of systems, the filtering problem, the solution of which is carried out in real time, i.e. using measurement information obtained only at the current point in time, and the interpolation problem, the solution of which is carried out using measurement information with both earlier and later time references relative to the moment at which the assessment is made.*

*Relevance of the topic. Successfully solving the problem of making accurate navigational determinations is a decisive factor in ensuring the safety of navigation in modern conditions. At the same time, the currently used on-board navigation systems do not meet a number of requirements for modern systems, both in terms of accuracy and efficiency of preparation for operating mode. The development and practical implementation of navigation algorithms for geophysical fields can significantly increase the safety of navigation when using data from navigation systems as backup. At the same time, the issues of information and algorithmic support for navigation tasks in geophysical fields are currently open, including issues of preparation, storage and effective use of large data sets of reference maps, assessment of the knowledge and applicability of measurement data of geophysical fields in various regions of the Moraine Ocean, as well as assessment of what is achievable with this accuracy of location determinations. The systems developed to date are intended for use by the air force; there are practically no examples of the practical use of such systems in maritime navigation.*

**Keywords:** *determining coordinates; maritime navigation; solving*

**THEORETICAL SUBSTANTIATION OF METHODS AND MEANS OF ENSURING NAVIGATIONAL SAFETY OF NAVIGATION**

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*Long-term statistical materials on the accident rate of ships in the maritime and fishing fleet indicate that every third or fourth vessel, with a gross tonnage of 500 register tons or more suffers an accident annually. Accounting for accidents and operational damage significantly expands this list.*

*Fishing with trawls and other fishing gear, production activities associated with cargo and mooring operations on the high seas, create additional preconditions for the occurrence of accidents, increasing production risk and associated losses. The problems of fishing and simply sailing are often aggravated by stormy weather conditions. Analysis of the ability to withstand the negative influence of pitching and flooding, especially of fishing vessels, is important from the point of view of the rational deployment of the fleet in fishing areas, as well as from the point of view of further improvement of vessels, systems and mechanisms.*

*The International Maritime Organization IMO developed the "Accuracy standard for navigation" for the purpose of preventing groundings and adopted it by resolution A 529 (13) of November 17, 1983. It would seem that this document should have become the basis for the development of state regulations, aimed at improving the safety of navigation, but this did not happen. Moreover, in maritime educational institutions, students and cadets should be taught to strictly comply with this Standard when conducting laying, however, this is not in reality.*

*Indirectly, the Standard qualifies technical means of navigation, but no one called a spade a spade in accordance with the requirements of the*

*Standard. All this provides grounds for a comprehensive analysis of the effectiveness of the IMO Navigation Accuracy Standard, which was carried out in this work.*

*The safety of navigation to a very large extent depends on primary information sensors - gyrocompasses and magnetic compasses, logs, instruments and systems for determining the position of the vessel. However, the issues of priority and systematic use of navigation devices are so poorly developed today that often modern expensive devices and systems are used absolutely ineffectively, and the simplest and most reliable means are unreasonably ignored.*

*To prevent collisions, very advanced ARPA systems have been created today. In these systems, the alarm signal is given automatically in accordance with the permissible time of approach to the distance of the shortest approach and the permissible distance of the shortest approach set by the navigator. This means that the boatmaster chooses the safety criteria himself. Naturally, each navigator will have his own assessment of the situation depending on his training, experience, and individual character traits, and this in turn means that there is no common understanding of safety problems. An objective assessment of the situation, and therefore the correct decision, can only take place on the basis of assessing the degree of confidence in radar information using probabilistic methods.*

*Different navigation tasks are solved using different technical means and methods of navigation, and the needs for raising funds often conflict. The optimal solution to these problems in work is carried out along the paths of system analysis.*

*The purpose of the work is to theoretically substantiate ways and means of increasing navigation safety by assessing the real state of affairs in this matter and developing new conceptual provisions in matters of standardizing the work of the navigator, equipping the vessel with technical means of navigation and ensuring their high reliability, developing effective assessment criteria and ensuring navigation safety.*

**Keywords:** *Navigation; IMO; Technical*

**METHODS AND SYSTEMS FOR INCREASING NAVIGATION SAFETY  
BASED ON HYDROACOUSTIC NAVIGATION DEVICES  
WITH LINEAR BASE DIRECTIONAL RECEIVERS**

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*Currently, it is generally accepted that it is necessary to solve a complex of major scientific and technical problems to increase navigation safety in modern shipping conditions. In the general complex of problems, an important link is the development of autonomous passive and active navigation systems, which include hydroacoustic navigation systems, and methods of their use.*

*Experts in the field of navigation pay great attention to the practical use of logs (methods of measuring absolute and relative speeds, determining and accounting for log corrections, calculation methods methodological and instrumental errors of logs, as well as their compensation, minimization and accounting during navigation).*

*Theoretical and experimental studies carried out with the aim of further improving and developing autonomous navigation equipment have led, in the opinion of domestic and foreign experts, to the development of quite promising correlation and interpolation speed meters, as well as correlation-extreme navigation systems. Navigation systems with interpolation processing of echo signals are not classified as correlation-extreme.*

*When solving the scientific problems, methods of the theory of hydroacoustics, correlation and spectral analysis of random processes, simulation modeling and full-scale experiment, provisions of the theory of automatic control and correlation extremal systems.*

*Based on the research performed, the following main scientific results and conclusions were obtained: Information and physical models of a promising hydroacoustic navigation system and hydroacoustic log with linear bases of directional receivers are proposed, taking into account the specifics of*



*their application. The main processes that occur during the operation of such systems are identified, and the phenomenon of decorrelation of echo signals due to the influence of volumetric reverberation signals is confirmed. A mathematical model of echo signals received by the log antenna system is proposed.*

**Keywords:** *Navigation safety; Subsystem; Experimental studies.*

**THEORETICAL JUSTIFICATION OF METHODS AND MEANS OF ENSURING NAVIGATION SAFETY**

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*Long-term statistical data on ship accidents in the marine and fishing fleets show that every third to fourth ship with a gross tonnage of 500 registered tons or more suffers an accident every year. Accounting for accidents and operational damages significantly expands this list.*

*Fishing with trawls and other fishing gear, production activities together with cargo and bulk operations in the open sea create additional conditions for the occurrence of accidents (AS), increasing production risk and related losses. The problems of fishing and easy sailing are often aggravated by stormy weather conditions. Analysis of the ability to resist the negative impact of duck flooding, especially of commercial vessels, is important both in terms of the rational arrangement of the fleet in fishing areas, and in terms of further improvement. Vessels, systems and mechanisms.*

*The International Maritime Organization (IMO) developed a "Navigation Accuracy Standard" to prevent grounding and adopted it in Resolution A 529 (13) of 17 November 1983. It seems that this document was supposed to become the basis for the development of state regulations aimed at increasing the safety of navigation, but this did not happen. Moreover, students and cadets in naval educational institutions should be taught to strictly adhere to this standard when laying, although in reality this is not the case.*

*Indirectly, the standard qualifies the technical means of navigation, but no one calls a spade a spade according to the requirements of the standard. All this provides the basis for a comprehensive analysis of the effectiveness of the IMO navigation accuracy standard, which was carried out in this work.*

*The safety of navigation largely depends on primary information sensors - gyrocompasses and magnetic compasses, logs, instruments and*

*systems for determining the position of the ship. However, issues of priority and systematic use of navigation devices are so poorly developed today that often modern expensive devices and systems are used absolutely ineffectively, and the simplest and most reliable means are unjustifiably neglected.*

*The SOLAS convention establishes minimum requirements for navigation equipment and it is clear that their implementation does not guarantee the optimality of the process. In order to ensure optimality, it is necessary to have adequate criteria for the assessment of navigation safety, taking into account economic, social and other indicators. Automation of navigation-related processes also requires reliable scientific data and mathematical description of navigation processes, reliable safety criteria.*

*To avoid collisions, very advanced ARPA systems have been developed today. In these systems, the warning signal is automatically issued according to the minimum approach time allowed and the shortest approach distance set by the navigator. This means that the boat chooses its own safety criteria. Naturally, each navigator will have his own assessment of the situation based on his training, experience and individual character traits, and this in turn means that there is no common understanding of safety issues. An objective assessment of the situation and, accordingly, the correct decision can be made only on the basis of the assessment of the degree of reliability of radar information, using probabilistic methods.*

*Different navigation tasks are solved using different navigation techniques and methods, and fundraising needs often conflict. In the works, the optimal solution of these problems is carried out on the paths of system analysis.*

*Based on the updated concept of the standard, the priorities in technical means and methods of navigation were evaluated and the priority directions of development of technical means of navigation were shown.*

*A mathematical description of the reliability of radar information used in ship ranging and environmental monitoring was carried out, and the adequacy of generally accepted concepts of observation, maneuvering and over-proximity zones was evaluated. The obtained results can be used in ARPA systems to determine the degree of danger of future ships.*

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