INTELLIGENT SUPPORT OF THE USER OF THE E-NAVIGATION MARINE ERGATIC SYSTEM

Anatoliy Popov
PhD., the Head of the Water Transport Operation and Navigation Faculty
of Admiral Ushakov Maritime State University (AUMSU)
Irina Makashina
DSc., Professor of the English Department
of Admiral Ushakov Maritime State University (AUMSU)
Novorossiysk, Russia
e-mail: irmak@inbox.ru
Alexey Kondratiev
PhD., the Head of the Professional Development Institute
of Admiral Ushakov Maritime State University (AUMSU)

Abstract. The article proves that the issue of effective operation of the ergatic control systems in the period of digitalization of the maritime transport industry continues to be relevant. Despite the mandatory use of various navigation systems, navigation errors as a result of the human factor are one of the main causes of marine accidents. In this regard, the intelligent support of the user of the marine ergatic system E-Navigation based on the information approach requires more attention from both developers of navigation systems and educational organizations, which are to ensure the proper level of training of specialists serving this industry. Technological advancements in the field of creating visualization means and software for designing various objects and environments currently allow us to create artificial environments with any content that are indistinguishable in their impact on the human senses from physical reality, which largely contributes to the adoption of the right decision in any production process. Taking into account the increased interest in computer interfaces, the authors attempted to explain and illustrate the need to develop an intelligent interface in a mixed reality environment, which in the future will allow the user to obtain aggregated information to make the right decision intuitively. The authors consider the navigator as one of the main participants of the marine ergatic system, grounding on the fact that the human factor is decisive both in the process of creating risks for the crew, the ship, its cargo and the environment, and in making decisions to avoid or reduce these risks. The paper provides analysis of virtual educational technologies such as: computer training systems, advanced software programs, simulation tools, and associated hardware, which enable education institutions to package and deliver a range of different programs and learning options, including those traditionally considered as obligatory within regulated Certificate of Competency (CoC) courses, thus providing the flexibility that compliments the life style of modern seafarers, as well as promoting self-directed learning. The advantages and disadvantages of virtualization of the education process are disclosed. The paper shows that in spite of understanding of effectiveness of simulators for skill acquisition, considerably less attention is devoted to evaluation of the education/training methods engaged in simulation training, which indicated the needs to investigate the current methodologies with attempt to improve and enhance the effectiveness of simulator-based training. The authors prove that the quality of the simulation modeling on training equipment is largely determined by the introduction of "through" digital technologies of virtual and augmented reality. The paper stipulates the reasons why simulation in combination with real world cadet shipping experience is the most affective mean for training. The results show that the revised training method provides trainees with improved operative performance, which can be further developed and implemented as a means for ensuring proficiency.
Keywords: maritime education, virtualization, Augmented Reality, human element, interface, etc.

Introduction

The interest in the design of the ergatic technological systems is explained by the constant development and introduction of modern technologies into production and the need for the participation of a human operator in it. Solutions associated with the emergence of new tasks require accounting of a wide range of psychophysiological, psychological, biomechanical and other characteristics that ensure the professional activity of a human operator, i.e., consideration the activities of the sea industry as the ergatic system, i.e., the system «man-machine-production environment». Ignoring mentioned features can lead to a strong disruption of the normal operation of complicated technological complexes, loss of reliability and quality of their functioning, and as a result, to serious man-made (техногенным) consequences. In the shipping industry, the human element is recognized as the main source of risk for safe and efficient shipping. The most cited definition of the «human factor» applied in shipping was adopted by IMO in resolution A. 947 (23) in 2003: «The human element is a complex multi-dimensional issue that affects maritime safety, security and marine environmental protection. It involves the entire spectrum of human activities performed by ships. crews, shore-based management, regulatory bodies, recognized organizations, shipyards, legislators, and other relevant parties, all of whom need to co-operate to address human element issues effectively» [1].

The growing dependence on complex systems in the operation of ships imposes certain requirements and limitations on a human operator, whose training process can be successful only with a deep understanding of the principles of the electronic systems functioning at all levels of interaction of various elements of this system. The rational arrangement of human-operator interaction with technical means in ergatic systems contributes to the further development of communication forms between them. The neglect of didactics, the lack of understanding of its role in solving this issue is unacceptable, because the task of improving the efficiency and safety of modern commercial shipping cannot be solved only by means of widespread introduction of new equipment and technologies. Despite the use of knowledge-intensive technologies, a high level of automation in all areas of the industry, a person continues to be an active participant in the modern production process and he must be prepared for this, and he must be taught. This state of affairs forces the organizers of the educational process to look for new ways to train a specialist who can solve not only the production tasks of today, but also be ready for tomorrow.

2. The E-Navigation ergatic system as new reality

According to numerous researches, the ergatic system is a purposeful complex system consisting of a human operator, an instrument of activity, an object of activity, and an internal environment [2; 3; 4; 5]. The sea ergatic system of E-Navigation the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment. [MSC 85/26/Add.1 [6]. Among the potential users of E-Navigation, there are two groups: ship-based (different types of vessels) and shore-based users (ashore services and organizations providing the operation of ships) users.

Among the main user needs, document MSC 85/26 Add. 1 Annex 20 highlights: common maritime information data structure; automated and standardized reporting functions; effective and robust communications; human-centered presentation needs; human-machine interface; data and system integrity; maritime safety information; operational issues, etc.) [6]. Based on the identified user needs and accident analysis, the IMO Sub-committee on Safety NAV 57 decided to conduct a gap analysis to determine E-Navigation solutions to meet user needs, accounting the results of the Human Element Analysis, and document NAV58/6 was presented as the result of this analysis. This document also provides a list of practical solutions for E-Navigation in four areas: operational (efficiency/procedures/automation); technical («human element»/machinery/equipment); regulatory (rules, standards); training (marine, ashore specialists) [7].

In realization E-Navigation concept, special attention is paid to human element, both on the level of technical solution design (interface, and others) and in the aspect of seafarer training. The recommended volume of the article does not allow to disclose each of mentioned needs fully, so we will focus only on issues related to the support of the human-machine interface.

E-Navigation is a concept designed to facilitate the work of a human operator (navigator) by means of convenience and standardization of the user interface of the system. It is assumed that the user of the system will be able to control a ship or a group of ships from another ship or from the shore in the near future due to the use of smart digital technologies (artificial intelligence, augmented reality, etc.) [4; 8; 9]. This concept also includes the transition to autonomous navigation. The developed E-Navigation services, due to the introduction of communication elements of the fifth generation, are aimed at ensuring the processing of the required information flows. At the same time, it is advisable to rely on an information approach that allows us to consider the human operator as a complex computer-like system for processing input sensory information. This process can be considered as sequential or parallel stages, each of which performs specific operations to transform information. The ultimate goal of the information approach in perception is to create a structural and functional model consisting of separate blocks that perform a function similar to the construction of a perceptual image by the human operator's mind. The maritime intelligent E-Navigation system involves digitalization, integration and automation of network ship and ashore systems of marine navigation, and depending on the level of complexity of the current situation, a human operator makes a decision either independently (experience, intuition), or asks an expert for advice (pilot, captain, artificial intelligence). A technological breakthrough in the field of creating visualization tools, software for designing various objects and environments currently allows to create artificial environments with any content, indistinguishable in their impact on the human senses from physical reality, which largely contributes to making the right decision in any production process. Despite the technological advances, the decision is still made by a person, so we consider the navigator as one of the main participant of the marine ergatic system.

3. The navigator as the main component of the marine ergatic system

The peculiarity of the current moment in modern shipping is that information technologies (IT) are beginning to intensively penetrate in the shipping and the port infrastructure. However, despite the introduction of new technical means of navigation, the issue of the "human element" remains important. The most promising direction of using IT to solve the above issue is the above-mentioned concept of E-Navigation, which involves the use of modern technologies of artificial intelligence (AI) and augmented reality (AR), for example, in case of the intellectualization of the user interface. The correct use of artificial intelligence and augmented reality will allow to reach a new level of interaction of a human operator (navigator) with navigation data in a digital environment. But to improve the interaction of the user of E-Navigation with the data of the digital environment, an intelligent interface in a mixed reality environment is needed, by means of which the navigator will intuitively receive aggregated information with a large thesaurus to prepare for decision-making. To implement the concept of «human-environment» interaction, the user of E-Navigation will need to work with Big Data, where the most suitable data transfer technologies for implementing human-operator interaction with data in the augmented reality environment are wireless technologies that ensure the mobility of both users and network nodes, as well as the reliability and trustiness of data transmission. Currently, there is a trend of increasing the amount of navigation information and reducing the number of crew members on a modern merchant ship. At the same time, for a long time, the displays of technical means of navigation remain the means of displaying information for the human operator. As a result, the navigator has to constantly distract himself from monitoring the current navigation situation (the control zone) in order to analyze and compare the data of the real environment with the data displayed on the screens of navigation devices. It is obvious that the value of human operator (navigator) error is constantly growing, and, consequently, it is the navigator who needs an intelligent user interface. In this regard, it is advisable to use the «human-oriented interface» methodology, which includes the definition of the information environment that contributes to the implementation of the idea of an information approach in relation to marine intelligent systems and the development of an information standard that provides the necessary conditions for the processing of a new type of information and the development of a regulatory framework that allows the use of this concept on convention ships.

The need to introduce additional useful information into the field of perception of the human operator (navigator) was expressed by various scientists who were engaged in the analysis of emergency situations in maritime transport. For example, according to Russian scientists, one of the causes for the incorrect interpretation of SARP information by navigators is the lack of information about the nature of the manoeuvrability [10]. Therefore, there is a need to introduce more useful (from the point of view of navigation safety) information into the field of perception. This task is solved in an augmented reality (AR) environment, where the information of the virtual world (digital) is imposed on the picture of the real world (analog information). In this regard, the human operator (navigator) has an informational advantage due to the fact that digital information contains more data than analog information. Much technical means of navigation (ARPA, SARP, ECDIS, AIS, and others) on board of a modern ship causes a gap between the psychophysiological capabilities of a human operator (navigator) and a constantly increasing amount of information that needs to be processed in a short time to make the right decisions in various situations. The processing of information received by the navigator is a complex process [3; 4; 8; 9; 10; 11]. Therefore, the use of the above-mentioned technical means of navigation will give the expected effect only if the volume and nature of the information received by the human operator are consistent with his psychophysiological capabilities.

Effective use of information is possible only if its processing is automated and presented to the navigator in a form that is convenient for perception and subsequent decision-making [4; 8; 9; 11]. Therefore, it is necessary to evaluate the quality of perception in the augmented reality system. The lack of generally accepted standards for the information environment of the augmented reality and methods for assessing the quality of perception of navigation data, opens up additional opportunities for finding new solutions, for example, modifying the user interface from the category "human-machine" to the category "human-mixed reality environment". However, for a human operator (navigator), as one of the elements of the marine ergatic system, the key parameter is the quality of perception – QoE (Quality of Experience).

In augmented reality systems, the user's assessment comes out on top, because it is associated with the main errors that affect the accident rate as a whole, on the one hand, and on the other, its purpose is to create a sense of the real world (believability), which is upgraded (supplemented) to improve certain characteristics of the world around us (real environment). This can be used to improve the control of a large-capacity sea ship when maneuvering in special conditions (limited visibility, sailing in ice, etc.). Thus, in the AR environment, data must be processed quickly, displayed in time, incoming signals from sensors must be transmitted without errors, and the movements of objects must be familiar to the human eye. So, it is necessary to establish a relationship between the quality of service and the quality of perception, complementing the qualitative assessment of the environment of perception and processing of information with a quantitative assessment, with the possibility of modifying the real-virtual continuum as a whole. In this context, the user interface, which is a set of programs that implement the user's dialogue with the information system at all stages of its functioning, is of particular importance. The human-machine interface used today does not guarantee the navigator an accurate interpretation of the data, and, nevertheless, it performs the function of informing. The complex activity of the navigator requires a very responsible attitude of those who provide the level of training of such specialists.

4. Training facilities with virtual and augmented reality for future and current navigators

An important place in the training of navigators belongs to simulators that simulate conditions designed for a specific situation of a certain type of activity of a human operator and carried out with the help of automated means of presenting and processing information and electronic computing equipment. Their wide application allows to save the engine life of machines, ships and devices, fuel; it permits to simulate extreme and emergency situations that can be dangerous in a real environment, and allows to acquire the skills of correct actions in critical situations that can’t be obtained on real ships, but can only be practiced on simulators [3; 4; 11; 12].

As a rule, the effectiveness of simulator training is determined by the following indicators: the effectiveness of the training methodology; quality and adequacy of the curriculum; high professional level of the instructor staff; the effectiveness of the simulator used; the entrance qualification level of the student; the quality of the organization of the educational process, etc.

In international practice, simulator training is provided by the use of two types of simulators that differ in the principle of manufacturing and execution: computer simulators based on mathematical modeling, using advanced information technologies in a mixed reality environment and model simulators that use full-scale models made in a given scale and used in real environment. The simulation and training complex of the ship's control system is a complex hardware and software complex that includes a control center, a control and managing system, a visual environment simulation system, and an acoustic noise simulation system. The development of information and communication technologies, as well as significant methodological and didactic experience in the use of technical training tools, currently requires the implementation of new types of training equipment with elements of artificial intelligence and mixed reality [3; 4; 8; 12; 13]. The visualization system of the simulation and training complex is one of the main ones. It synthesizes the image of 3 D-space on special screens, which in the surrounding environment are represented by the portholes of the navigation bridge of a seagoing vessel. The features of existing marine simulators often include: excessive complexity; incomplete accounting of psychological and cognitive characteristics of students; limited number and efficiency of tasks to be solved; insufficient didactic capabilities of simulators as technical training tools; lag in the application of the existing advantages of info-communication technologies (artificial intelligence, augmented reality, and others) in existing marine simulators [3; 11; 13; 14; 15; 16]. Working with simulators, the learner gets the opportunity to interact with objects and their data in a virtual environment, but, unfortunately, the didactic features of the activity in immersive educational environments are often ignored.

5. Immersive learning and professional environments in ergatic systems

As a rule, educational/learning environments (in this case, they are synonyms) exist in the form of cognitive models, interpretations of theoretical and practical aspects of pedagogy. In comparison with the system, the environment often involves the inclusion of heterogeneous elements of different systems, while the functional connections among them are only partially assigned. This is due to the fact that educated learning environments, as an integrative phenomenon, acquire the qualities or features of integrated systems, and give rise to their own integrative characteristics. The main purpose of learning environments is to change the behavior of the learner in order to obtain an educational effect. The same situation arises when we mean the concept of «professional environment», which is used in various contexts related to a person engaged in labor activity. A common characteristic of training and professional environments is the fact that they are relatively passive and represent a set of external and internal conditions of activity in which a person solves educational and professional tasks. However, this is not enough for designing the effective training and professional ergatic systems that implement complex forms of human relations with the world. Immersive learning environments are referred to ergatic learning environments [2; 5]. The main idea here is the modeling of complex conditions of professional activity conditions, and the more uncertain they are, the more effective the implementation of the concept of the immersive learning environment itself.

Immersive environment is created with the help of simulators widely used in the process of learning in the Maritime universities. Simulators with low and medium immersiveness (immersion effect), as a rule, show high interactivity, which indicates the ability of operators to act in the simulator environment in ways similar to those that exist in real professional activities. This approach allows operators who have been trained on simulators to feel more prepared and confident when transporting into real professional conditions. While carrying out educational activities, the student is immersed in the environment formed by virtual reality technologies, which displays artificially created conditions, but at the same time he solves purely professional tasks. The interface offered to the learner characterizes the properties and technology of human-machine communication, which not only ensures the activity of a person in a technical or training system, but also creates conditions similar to real professional ones. Taking into account the impracticability of training navigators or ship engineers on real equipment in real activities for technical, economic and psychological reasons and the widespread use of training equipment that imitates professional environments in this regard, it is also necessary to note the fact that such equipment (computer programs, simulators, etc.) is mostly created by engineering design methods, without taking into account the psychological and even more so the pedagogical components of professional and learning environments.

Great achievements in computer modeling of poly-modal environments and the introduction of virtual reality and artificial intelligence technologies in the human-machine interface systems of the modern ergatic systems also determine the interest in computer interfaces and research on the impact of environmental content on the efficiency of operators. A modern interface often has a hierarchical organization of the image, when other fragments are placed inside one image fragment, and this hierarchy changes depending on the current state. The information systems used on board a modern ship and simulated on simulators allow to consider the whole complex of relations "man-machine" (in our case – navigator-ship). This system can be represented as the interaction of two information processors: a human and a computer, trying to communicate using the interface. It is obvious that a properly designed interface does not guarantee the correct actions of the navigator. To avoid mistakes, training in immersive environments is required, allowing the operators to immerse themselves in the proposed conditions and work out the necessary skills for several times. First of all, we assume that immersive learning environments include objects that are the conditions for the existence of education. According to I.Marichev, «... education itself is an interaction consisting of actions, and actions are distinguished by a set of features that appear in the structure of their logical connections» [17]. The consideration of the essential organizational educational actions in the learning immersive environment on the basis of educational activity of the involved parties, suggests the consideration of two groups. The first group includes the conditions for performing the leading action by an Educator, including the presence of the Educator; the presence of the trainee and the object of study; the availability of educational aids; the availability of organizational conditions for guidance; the availability of opportunities for evaluating results.

The second group assumes the presence of conditions for the implementation of the decisive action by the trainee, including: the presence of the trainee; the availability of opportunities to accept information; the presence of the object of study; the availability of tools for transforming the object of study and opportunities to identify changes in it; the availability of opportunities for correct evaluation of the results of actions. It is important to remember that always in any educational situation, the leading participant is the Educator, who uses the conditions available in the space to perform the actions of directing the trainee to actions which ensure the appearance and development of the necessary traits and personality qualities provided for by the program, the set goal, etc. [12;13; 17].

A special place in this system is given to feedback, which exists within any managed system. Issues concerning feedback have long been the focus of attention of different scientists and different sciences. We fully agree with the position of N.Wiener, according to whom «... feedback is a method of controlling the system by means of including in it the results of the previous performance of its tasks. If these results are used simply as digital data for the calculation of the system and its regulation, then we have a simple feedback carried out by the operator. However, if the information received is considered as a result of the performing or not performing tasks by machine and it is able to change the general method and form of performing tasks, then we get a process that can be called the learning process» [18, 68]. Taking into account the above said, we can assert that information exchange is not only an opportunity to receive a message from outside, but also an opportunity to influence the circumstances. And the more useful information, the more effective the decision made by the operator.

In the arrangement of training and professional immersive environments for the training of future navigators, we rely on the approach worked out by E.Malinochka, who developed a system for providing training with automated feedback, consisting of organizational, methodological and technical support. The feedback in the learning process, according to the scientist, is that its intermediate results affect its process, the fulfilment of the actions of learning, teaching and studying. Automation of feedback consists in connecting technical tools for accepting formalized information about intermediate results of activity and issuing signals that are estimation of these results [19]. The above mentioned statement helps to understand that the widespread use of immersive learning environments is based on the results of research in the field of virtual environments impact on learning effectiveness. The creation of a presence effect, the possibility of interactive and social interaction, as well as multisensory, affect the effectiveness of training.

At the same time, it is necessary to take into account the influence of the created conditions on the cognitive processes and the emotional state of a student. And, in this case, the achievement of the result can be arguable one, e.g. a high level of cognitive pressure affects the degree of multisensory and interactivity, causing stress (dizziness, increased blood pressure and heart rate, general discomfort, fatigue, difficulty concentrating and blurred vision, etc.), so it (the level) should be justified and clearly defined. Otherwise, ignoring the fact of limited cognitive processing capabilities, and therefore an excess of sensory stimuli or distractions, can negatively affect learning outcomes. Consequently, an immersive environment with a high level of immersion can increase extraneous cognitive pressure and lead to a negative effect.

The speed at which changes in maritime industry have taken place over the past few years is too high. The same is true of the nature of these changes [20; 21; 22]. In this context, it is quite appropriate and natural to prepare a specialist to work in one of the most complex ergatic systems, it is necessary to pay great attention to training immersive environments that allow to simulate future professional conditions and form professional qualities that can be transferred to real activities.

6. Conclusion

The importance of intellectual support for the user of the E-Navigation marine ergatic system based on the information approach is stipulated for the current state of the shipping industry, including, among other things, the spread of E-Navigation, which supposes improvement and increasing of traditional aids in shipping by means of human and machines opportunities integration. The use of high-tech technologies, a high level of automation, and intensive implementation of information technologies in all areas of the industry, including management, requires the presence of competent specialists who can serve it. Despite the complexity of the information technologies implemented in the industry, the prerogative of solving tasks remains with the human operator. In this regard, presented in the paper ideas on the designing the user interface, which provides not only the efficiency of the user's work, but also stimulates his personal and intellectual development due to informativeness and ergonomics, can be considered by educators. This paper covers the pedagogy and research based foundation of immersive educational environments, new opportunities to engage students in the learning process that in result can transfer the maritime education on a higher level.

References

[1] IMO in resolution A. 947 (23) in 2003 ttps://puc.overheld.nl/nsi/doc/PUC_1424_14/1/30.05.2018

[2] Sergeev S.F. Ergonomics of immersive environments: methodology, theory and practice. SPb. 2010, - 42 p.
[3] Makashina I., Popov A., Kondratiev, A. E-Navigation as a concept of international cooperation in the field of marine technology. Conference proceedings: 3d ICMPTE. Shanghai MUSU. – China, 2018, - pp. 130-139.
[4] Popov A. N., Kondratiev A. I., Subanov R. E. Forecasting algorithm for the prevention of collisions of ships at sea in relation to the " intellectual water area of e-Navigation. Operation of Maritime Transport, № 1 (86). - Novorossiysk: AUMSU, 2018. - P. 69-74.
[5] Zarakovskiy G.M. Laws of the ergatic systems functioning. M.: Radio, 1987. - 267 p.
[6] IMO Resolution MSC 85/26 Add.1 Annex 20. Strategy for the development and implementation of E-navigation. Maritime Safety Committee, IMO, London, 2008.
[7] ECDIS operating anomalies – guidance issued by Sub-Committee on Safety of Navigation NAV58/6. London. 2012.
[8] Loginovsky V. Risk assessment, as a competence of maritime professional// 20th AGA of the IAMU, Tokyo, 2019. - P.36.
[9] Hagen, J.E. Implementing e-Navigation, Artech House, 2017, - 220 p.
[10] Rivkin B.S. E-Navigation–ten years //Gyroscopy and navigation. 2015. № 4. pp.173-191.
[11] Singh, M.P. Augmented reality interfaces. Natural web-interfaces IEEE internet computing, 2013, - P. 66 -70.
[12] Makashina I. System of pedagogical support of training of managers for merchant shipping. – Novorossiysk. AUMSU. 2011, - 228 p.
[13] Makashina I., Marichev I. Methodological and Theoretical basis of the formation and development of maritime education in Russia (historical and pedagogical analysis) – Novorossiysk. AUMSU. 2021, - 144p.
[14] Gilmartin, T. D. Gal and E.A. O’Connor. VR Training Videos: Using Immersive Technologies to support Experiential Learning Methods in Maritime Education // 20th AGA of the IAMU, Tokyo, 2019.- P.168-174.
[15] Popov A. E-Navigation mixed reality interface//20th AGA of the IAMU, Tokyo, 2019.- P.40-41.
[16]. M. Kitada and P. Baum-Talmor. Maritime Digitisation and Its impact on Seafarers’ Employment from a Career Perspective // 20th AGA of the IAMU, Tokyo, 2019. P.259-267.
[17] Marichev I. Systemic arrangement of the educational space. – Novorossiysk. AUMSU. 2013, 216 p.
[18] Wiener N. the Creator and the Future: transl. from English. – M.: AST PH, 2003, 732 p.
[19] Malinochka E. Actual issues of pedagogics. – Novorossiysk, MSA named after adm. F.F.Ushakov, 2007, 196 p.
[20] M. Schaub, G. Finger, C. Krüger, G. Tuschling, M. Baldauf and K. Benedict. Quantifying Fuel Consumption & Emission in Ship Handling Simulation for Sustainable and Safe Ship Operation in Harbour Areas //20th AGA of the IAMU, Tokyo, 2019.- P.56-72.
[21] T. Fonseca, K. Lagdami and J-U. Schroder-Hinrichs. Emergent technologies and maritime transport: challenges and opportunities //20th AGA of the IAMU, Tokyo, 2019.- P.115-128.
[22] M. A. Fattah Omar, Z.A.Fattah Badway. Advanced navigation system in the Mediterrian sea “Regional Project for management control system” //17th AGA of the IAMU, Vietnam, 2016.- P.431-439.

Anatoliy Popov
PhD., the Head of the Water Transport Operation and Navigation Faculty of Admiral Ushakov Maritime State University. The author of more than 50 scientific and methodological works.
The field of research is the new information environment in the E-Navigation, which involves the use of modern technologies of artificial intelligence and augmented reality. Currently works with the issue of development of new information standard.

Irina Makashina– got the degree of Doctor of Science (pedagogics) in 2011, Russia; in 2011 got the status of the Academician of the Academy of Pedagogical and Social Sciences; the author of more than 200 publications, including 25 tutorials and 10 monographs; at present works on position of the professor of the English Department and the Head of the Distance professional retraining center at Admiral Ushakov Maritime State University, Novorossiysk, Russia.
The field of research is professional pedagogics and Maritime Education.

Alexey Kondratiev - PhD., the Head of the Professional Development Institute of Admiral Ushakov Maritime State University. The author of more than 30 scientific and methodological works.
The field of research is the Distance Learning System in the Professional Development Institute, accounting requirements of STCW allows to expand the range of educational services.