Annotation Bulettin of the Volga State Academy of Water Transport №61 – 2019

Section I
Waterways, ports and hydraulic engineering constructions

Vostryakova D.V., Kapustin I.A., Molkov A.A., Ermakov S.A.
Field studies of riverbed and wind flows characteristics in the southern part of the Gorky reservoir

Key words: *ADCP measurements, flow characteristics, inland water bodies, water flow, wind effect, whirlpools, Gorky reservoir.*

Annotation*: The paper presents the results of a study of currents in the southern part of the Gorky reservoir using the Acoustic Doppler Current Profiler (ADCP). Similar work was systematically carried out in the water area of the reservoir in the 60-80s of the twentieth century and the previously obtained data are still used to solve a number of practical problems. The lack of fresh data on the currents served as the motivation for this work. Study of the flow structure has been carried out. An analysis of the data showed that the structure of the flows is characterized by significant heterogeneity. Features of the flow structure have been identified at the weak south wind conditions and the low water flow through the Nizhny Novgorod hydroelectric station. The formation of the whirlpool observed in the upper layer of the reservoir was shown. Probably the possible features of the flow structure are determined by bathymetry in the floodplain of the reservoir with the relatively large water flow through the hydroelectric station and the north wind conditions.*

Molkov A.A., Kapustin I.A., Ermakov S.A, Leshchev G.V.
Research of the mixing area between Volga river and inflows from Nizhny Novgorod to Kozmodemyansk according to the bbe moldaenke fluorometer data

Key words: *mixing zone, mixing of water masses, inflows, fluorometry, fluorometer, BBE Moldaenke, Volga River, Cheboksary reservoir*

The results of the detection and research of the mixing zones between the Volga River and its largest inflows (Oka, Kudma, Kerzhenets, Sundovik, Sura, Vetluga) in the region from Nizhny Novgorod to Kozmodemyansk according to the data of the BBE Moldaenke submersible fluorometer are presented in this paper. Spatial distributions and vertical profiles of water temperature and its transparency, as well as concentrations of key bio-optical characteristics of water like chlorophyll a and colored dissolved organic matter are investigated. Based on the obtained data, it was found that the mixing zone of the Volga and Oka rivers was traced most strongly. The mixing zones of the Volga River with other inflows were traced less expressively and not always clearly. The obtained results expand the existing understanding of mixing zones of the Volga waters with general inflows in the Cheboksary reservoir.

Sitnov A.N., Voronina Y.E.
Estimation of free surface and depths dynamics in downstream of Nizhny Novgorod hydropower complex when constructing the third line of locks or their third stage

Keywords: *water level landing, dredging, third lock line, hydraulically permissible depth, riverbed canalization*

The shipping locks of the Nizhny Novgorod hydropower complex and the Gorodets-Nizhny Novgorod section limit shipping in the Integrated Deep Water System. Dredging, carried out since the 1970s to maintain design depth, has had a great impact on the water level in the downstream of the Nizhny Novgorod hydropower station. The solution of the problem of shallow depths on the site and the passage of the Gorodets locks by the vessels is possible by building a low-pressure hydroelectric complex in the area of B. Kozino. In order to estimate the impact of the construction of the third lock line, as another alternative solution of the problem proposed by a number of authors, hydraulic calculations of the behavior of water free surface at the site and at depths were performed. The movement of the water flow in the riverbed was described by a system of differential equations of motion. As a result of the calculations, it was found that the free surface curve at a flow velocity in the range of 800–1500 m^3/s does not reach the position of the curve at the design level. This indicates the insecurity of the design shipping depth on the site. Alternatives to hydraulic structures in the form of the third line of Gorodets locks or the third stage in the approach channel will not provide the necessary navigation depth. Downstream channel will be radically deformed, and additional dredging in the downstream site will lead to the water levels landing on the sills of existing locks No. 15–16 and the site.

Section II
Shipbuilding, ship repair, and ecological safety of the ship

Zuev V.A., Kalinina N.V., Prokofev S.A.
Use of a rotary-screw propulsion unit for a self-propelled hovercraft ice-breaking platform

Key words: *hovercraft ice-breaking platform, rotary-screw propulsion unit, search for the optimal propulsion unit, ice channel laying, ice penetration curve, channel laying efficiency in solid ice.*

Annotation. *The article considers the extension of navigation on the sea and inland waterways of the Russian Federation. To conduct icebreaking operations in ports, not only a powerful icebreaking fleet, but also other auxiliary means are needed. The aim of the work is to the design of a self- propelled hovercraft icebreaker platform as an effective technical means for the ice cover breaking, the ice channel laying, as well as the choice of an universal propulsion system for movement on the ground with a weak load-bearing capacity, which includes snow and ice. The architectural and structural type and main characteristics of the platform are described. Rotary-screw propulsion unit, which is lowered from the platform by means of a portal mechanism, is proposed. The concept of the choice of propulsion and steering complex for the ship, the results of 3D modeling of rotary-screw propulsion unit and its parameters are given. The curves of icebreaking capability of the platform with a rotary-screw propulsion unit, in combination with the icebreaker of project 1108 «Captain Izmailov» and in combination with the tug of project PE65 are constructed. It is shown that hovercraft icebreaking platform with rotary-screw propulsion unit is more economical than any other transport means for the navigation extension on sea and inland waterways in winter, in shallow areas of the Arctic shelf, where the use of ordinary icebreakers is difficult.*

Fevralskikh A.V.
Numerical investigation of aerodunamic interference of wing in ground effect and power augmented ram on takeoff motion mode

Keywords: *wing in ground effect vehicle, power augmented ram, aerodynamics numerical simulation, ANSYS CFD*

Annotation. *The Power Augmented Ram (PAR) effects on the aerodynamic characteristics of Lightweight Wing in Ground (LWIG) effect vehicle layout on the take-off motion mode is investigated. The technology of numerical simulation of ground effect aerodynamics (CFD-simulation) is exploited as a research instrument. In present study CFD-simulation is based on solving of Reynolds averaged Navier-Stokes equations for viscous turbulence incompressible flow, with k –ω SST turbulence model. The full-scale aerodynamic layout of LWIG-vehicle with take-off weight 0,5-1 tones used for CFD-simulation includes wing and PAR-system consisting of a propeller, an annular nozzle, straightening vanes and a pylon for attaching to the fuselage. The mesh model created in ANSYS Fluent Meshing contains 33.7 million finite elements. The annular nozzle limits the region containing the rotor blades in which the condition for the rotation of the air is specified. In CFD-simulations for different values of LWIG vehicle motion speed the ground clearance is applied as a constant with 0,05 wing chord lengths. Using the results of CFD-simulation the thrust coefficient versus advance ratio, the drag coefficient and the lift-to-drag ratio of LWIG layout versus velocity dependency graphs are plotted. The dependency of the thrust coefficient versus advance ratio of propeller in the layout composition are in good agreement with the theoretical data. The dependencies of the drag coefficient and the lift-to-drag ratio versus velocity are non-linear, whereas the lift-to-drag ratio belongs to the range from 8 to 16 units. The diagrams of the aerodynamic flow speed distribution in a vertical section along the propeller axis at different values of motion velocity are presented. The diagrams show that with the increasing of LWIG velocity motion the PAR generated flow will be directed from bottom to upper surface of wing as a result of the aerodynamic interference of counterflux and PAR generated flow. It seems possible to neutralize this effect leading to lift-to-drag ratio and PAR efficiency decreasing by using the mechanism, which can change the installation angle of PAR in motion process.*

Section III
Financial and accounting-analytical problems of the modern economy

Krainova V.V., Upadysheva E.V.
Modern aspects of financial control of the budgetary sphere in terms of compliance with the principle of financial independence of local budgets

Keywords*: budget, revenues, expenses, tax revenues, financial control, efficiency, municipal program.*

Annotation. *The article deals with the issues of financial control over the correctness of the formation and efficiency of the use of budget funds. The main forms and methods of financial control are listed, their applicability on the example of budgets of municipalities of the Nizhny Novgorod region is considered. The calculations of indicators established by law, which are a control measure for the effectiveness of the formation of the revenue and expenditure of municipal budgets. According to the results of the calculation and analysis of the existing system of financial control, it is established that all the indicators of financial control used in this evaluation system allow to determine the efficiency of spending budget funds, but do not provide a relationship and an assessment of the dependence of the efficiency of budget revenues and the efficiency of spending budget funds. The authors suggest that this interdependence can be established by introducing an indicator of the proportions of the distribution of budget expenditures (per inhabitant) for municipal programs grouped by main activities. According to the results of the analysis of the formation of budgets of municipalities using the program-target approach in the financial control of the effectiveness of the programs themselves revealed a significant predominance of the share of expenditures on social programs and national issues over the costs of financing infrastructure programs and programs of development of the real sector of the economy. In this regard, the authors proposed to introduce the indicator «Share of budget expenditures for support and development of the real sector of the economy» into the system of assessing the effectiveness of local governments.*

Skobeleva I.P., Bunakova E.V., Kotov S.A.
Financial and investment potential of integrated corporate structures in Russian water transport

Keywords: *integrated corporate structures, financial potential, investment potential, synergy, sea and river transport*

Annotation. *The article discusses the issues of identification and the role of financial and investment potential in ensuring the development of integrated water transport structures, analyzes the impact of various forms of synergy on the formation of this potential. To accomplish the task, the authors use the methods of content analysis, synthesis, comparative analysis and verbal models reproduced in tabular form.*
The article contains the formalization and analysis of the term «financial and investment potential», including the study of the factors forming this potential in various forms of business integration, as well as an assessment of the impact of these processes on the risks and financial and economic efficiency of shipping companies. It indicates the importance of business flexibility in the construction of modern integrated corporate structures to ensure the effect of responding to environmental challenges.
The materials present an analysis of a number of financial ratios of the largest Russian shipping companies that are actively involved in updating their fleet and are part of integrated structures, indicating a positive effect of integration processes on risk and return factors in the implementation of financial and investment potential. The moral and technical obsolescence of the Russian fleet, despite the urgency and attention to the problem from the state and business over the last decade, has only intensified, which requires an increase in activity in the investment sphere.
The weakness of market mechanisms for the implementation of financial and investment potential increases the importance of state support in the implementation of projects for the development of sea and river transport, primarily through reducing the risks of investment activities for fleet renewal. At the same time, the Russian transport business is forced to optimize its business portfolios, reducing dependence on highly risky and low-margin activities and focusing financial resources on the most sought-after areas in the current market situation. The best mechanism for the implementation of this task is the separation of business units according to the functional principle, which allows them to respond more flexibly to changes in their financial and investment potential.

Section IV
Economics, logistics and transport management

Veselov G.V., Kuzmichev I.K., Mineev V.I., Novikov A.V.
River fleet modernization in the conditions of investments shortage

Keywords: *modernization, re-equipment, competitiveness, the river fleet renewal*

Annotation. *The average transport fleet age on the shipping companies balance is approximately forty years. The outdated fleet operation leads to the effectiveness and competitiveness decrease comcerning the shipping companies and the branch itself.The new fleet construction is far behind the shipowners needs.In recent years fleet retirement 20 times exceeded new vessels commissioning. Shipping companies ability to secure investments in the new fleet construction is extremely limited due to the shipping business low profitability.In these conditions the fleet modernization will create a certain time reserve to replace the outdated vessels with the competitive ones. As practice shows the new vessels construction is three times higher than the modernization costs.*

Kapranov A.V., Korshunov D.A.
the analysis of the interaction level between the customs authorities and the foerign trade activity participants in the distributed customs control implimentation and its improvement recommendations

Keywords: *customs, interaction, customs control, electronic Declaration.*

The article is based on the long-term practice of foreign trade goods supplies customs clearance study considering the customs control existing rules.The interaction between foreign economic activity participants and customs authorities is becoming more formal and opportunities for direct effective interaction are reduced. This entails significant delays in deliveries, a lot of time is lost to understand the errors in the design of delivery in electronic form. The authors analyse the existing problems and offer ways to solve the problem on the basis of improving information technologies concerning the interation between customs and foreign trade participants.In particular , there are three main theses on the development of the customs control system aimed at reducing the goods release, the use of automatic mechanisms for checking customs declarations and improving information technology, to improve the interaction level and efficiency between all the interested parties.

Kegenbekov Z.K., Berdibekova Z.R.
Comparative analysis of the results of the strategy of the Chinese People's Republic and the Republic of Kazakhstan in the revival of a new silk road

Key words: *«One Belt, One Road» initiative, transit potential, infrastructure, coverage route.*

Abstract*. The article presents a systematic analysis of the China's and Kazakhstan's policies towards reviving the Silk Road through the prism of the new initiatives adopted by the two countries recently. At first, the authors scrutinise the China's «One Belt and One Road» initiative adopted by the China's government in 2013. The authors consider that China has already committed 250 billion USD into the development of new factories, rail roads, pipelines, airports etc. along the road in countries in Africa, South-East Asia and Central Asia and is expected to spend 1 trillion USD onto these projects during the next 10 years. Following the depiction of China's approach the author turns to the Kazakhstani's policies aimed at reviving the ancient Silk Road trade. The authors claim that China and Kazakhstan have many commonalities in terms of strategies adopted toward this goal. To substantiate this point, the authors point to the strategy «Nurly Zhol» which was launched by the Kazakh government in response to China's BRI initiative. Due to the Nurly Zhol policy – so the authors - the implementation of China's BRI is expected to progress much faster and more effectively in Kazakhstan than in other Central Asian countries.*
Taken together the article provides a solid analysis of the strategies adopted by the governments of China and Kazakhstan respectively. Overall, the article provides a more optimistic view of Chinese and Kazakh strategies towards the Silk Road, leaving the impression that the implementation of the strategy is set to have positive and lasting effect on countries' economies. Although this impression might be correct in a short term perspective, a more nuanced and comprehensive assessment of the challenges associated with the implementation of the strategy in future, the role of international markets, as well as the complex geopolitical situation in wider Eurasia could have benefited the article.

Kostrov V.N., Mordovchenkov N.V., Sirotkin A.A.
Conceptual approach to forwarding competences formation and development

Keywords: *qualification, training, transportations, student, forwarding service, forwarding agent*

Annotation*: The article is devoted to the complex (systematic) solution of the problem concerning forwarding sphere competence management in the conditions of market economy.During the conducted scientific research the express analysis of model and means of railway, automobile and water transport forwarding agents training is done and also the existing approaches to theoretical and practical future forwarding agents training are reflected. At the same time,the authors of the article have revealed reserves and trajectories of forwarding agents professional development (additional education) in the conditions of the competitive environment and clients requirements to quality and variety of forwarding services transformation are defined. Besides in the article the modular programs of professional development which are innovative professional products in education market (innovative educational products) are offered. At the end of the articles the relevant conclusions have beeen made.*

Mineev V.I., Sereda A.V.
Synergetic approach in the economic justification of passenger traffic flow

Key words: *transport mobility of the population, passenger traffic flow, methodology, method, synergy, need, motivation.*

Annotation. *Passenger transport in the life support of society has a significant socio-economic importance that has an impact on the development of administrative-territorial entities and the state as a whole. The dynamics of the transport market in the sphere of passenger transportation services has a vector of the transport system, which is aimed at full satisfaction of the population in passenger transportation. At the same time, competition in the passenger transportation market requires not only the improvement of rolling stock, but also the appropriate methods of passenger traffic survey, reflecting the actual value of passenger traffic. Existing methods of passenger traffic survey do not meet the criteria for a systematic approach.*
The use of a new scientific method of research of the XX century – synergetics, will ensure the development of new methods for determining the numerical value of passenger traffic, and a new look in the methodology of passenger traffic research will give economic justification of the passenger transport complex.
Existing methods for passenger flow do not meet the criteria for a systematic approach, which is based on the technical support of rolling stock with the involvement of human resources. The proposed method of passenger traffic flows justification takes into account operational environment of the society and ways to meet needs.

Mosintsev A.V.
Optimization of the property leasing process as a direction to improve the efficiency of the enterprise activity

Keywords: *income, optimization, rent, valuation, market value, motivational fund, property owner, execution of contracts*

Annotation. *This work is devoted to solving the problem of reducing the company costs for the maintenance of unused facilities, as well as increasing revenues by optimizing the procedures for transferring property for rent. The purpose of the work is to determine the directions of the enterprise when drawing up agreements with tenants of objects. To date, the transfer of property for rent on the basis of the signed agreement is carried out after assessing of the market value and organizing competitive procedures, and can take (for a number of objects) up to 53 days. The paper proposes to work out the issue of using the mechanism of hourly rent, methods of rents calculating. It is necessary to create a motivational fund when transferring assets for rent. The implementation of these proposals on the Gorky Railway made it possible to receive income from the lease of property 592.0 million rubles over the past five years.*

Radostina E.A., Kostrov V.N., Sukharev D.N., Glotova I.V.
Logistics of lean production in the system of material and technical supply of Water transport

Keywords: *water transport, supply, lean manufacturing, logistics, stocks, maintenance, kaizen, standardization.*

Annotation. *The relevance of the study is due to the relatively high costs in the fleet maintenance and supply system and the need to eliminate or minimize them in order to prevent significant financial and reputation losses for the shipping company.*
The article considers the experience of applying the concept of lean manufacturing at Russian industrial and transport enterprises. The authors analyze the applicability of the methodological approaches of lean production to solving urgent issues of material and technical supply in water transport. The main types of losses arising in the system of maintenance and supply of shipping companies and ports are identified. The article contains practical suggestions for the development of measures to eliminate these losses using approaches and tools of lean manufacturing. Directions for further elaboration of measures to optimize the logistics system and supply are formulated.

Telegin A.I., Nichiporuk A.O., Goncharova N.V.
Development of a determination method of cargo transportation safety standard indicators

Key words: *standards, nomenclature, rules for transportation of goods, quality indicators, safety of transportation, transport*
The article presents the main requirements of the state national standard and the developed method for determining standard indicators of cargo transportation, taking into account all factors of safe transportation. The analysis of a number of research works of domestic scientists and foreign sources in the field of cargo transportation quality indicators has been carried out. It has shown the lack of a comprehensive record of all indicators of safe transportation in the proposed approaches using the analytical determination method of cargo transportation safety standard indicators.
The analytical determination method of cargo transportation safety indicators proposed by the authors, can be used in industry standards, rules for transportation of goods, as well as in the standards of transport organizations with their subsequent use in contractual relations with shippers and consignees.

Trukhinova O.L.
Formation of a system assessment of customer satisfaction in the process of choosing an investment cruise ship

Keywords: *shipbuilding, cruise fleet, system analysis, customer satisfaction, ship comfort, investment project, multi-criteria choice, a problem situation type, concept of consumer expectations.*

Annotation. *In the process of choosing an investment project for a cruise ship, there is a problem of systematic assessment of ship-building products' customer satisfaction. For its solution, the goal to develop basic approaches to assessing customer requirements satisfaction from a systemic perspective was set. The current procedure for assessing satisfaction is not sufficiently underpinned and structured, based on a variety of disparate indicators that are applied haphazardly. Using the system methodology made it possible to develop a criterion space of customer satisfaction indicators regarding cruise fleet. The features of assessing probabilistic representation of consumer expectations in various types of problem situations formulated by the author were revealed. The research novelty consists in a comprehensive approach to investment choice using the criterion of «satisfaction» alongside with the criteria of «efficiency» and «effectiveness», ranked in accordance with the type of problem situation. It allows to further formalize the algorithm of choosing an investment project. The research results have wide opportunities of practical application in the shipbuilding industry.*

Section V
Operation of water transport, navigation and safety of navigation

Vinogradov V.N., Ivanovsky N.V., Goryatchev I.S.
Synthesis of the vessel traffic control algorithm in specified waters based on the current

Keywords: *safety of navigation, risk assessment, mathematical model of a marine vessel, automatic control.*

The article considers the problem of synthesis of the ship control algorithm according to the criterion of the RMS value of the risk of safe passage through a narrow strait in conditions of a current, and its subsequent analysis is carried out. As an example, for the synthesized algorithm the statistical modeling of calculation of safe strait passage risk was performed. The calculation of safe narrow strait passage risk was carried out for various random parameters in conditions of a current. It should be noted that even with the maximum value of random parameters divergence (maximum risk), the optimal control system ensures that the vessel's traffic characteristics are found within the specified (safe) limits.
The application of the obtained research results will reduce the human factor impact on decision - making in solving the tasks of navigating a marine vessel. The research results given in this paper can be used to design automatic control systems.

Lobanov V.A.
The impact of the ship shape and draught on ices distribution in the zone of its propulsion-steering complex

Keywords: *vessel's hull shape, ship draught, propulsion-steering complex, ice conditions, ice channel, CAE-system, finite element modeling.*

The article deals with the study of the nature of interaction of a travelling vessel's hull with ice cakes and small ice cakes of different thickness and concentration in the ice channel with the use of CAE technologies. The focus is on studying the distribution of ices in the area of traditional propulsion-steering complex location at variation of dimensions, hull shapes and ship draught.Qualitative features of such interaction of the vessel with the water ice environment are noted. The statistical analysis of the obtained experimental data on the assessment of design, dynamic and ice factors impact on ices concentration in the area of their contact with a propulsion-steering complex was carried out. The quantitative forecast of such an impact in the form of the multifactorial regression equation is given.

Timoshek E.S., Chuikova S.E.
Determination of the zone of effective use of transport fleet in the Arctic region on the example of the «marintek» vessel group

Keywords: *maritime transport, fleet management, container shipment, graphical method, optimal vessel selection.*

Annotation*: The article considers the issues related to optimization of the supplies' delivery process to the eastern part of the Arctic coast. The research subject is the freight forwarding activity of the company LLC «MarinTEK». As a tool for making managerial decisions, a graphical method is proposed for determining the zones of effective use of vessels. Practical application of the proposed method allows to ensure optimal management of coastal transportation in a transport complex, to evaluate the efficiency of vessel's use on a specific section of the transport network. The article also outlines the problems of loading and unloading operations in the roadstead, and defines an additional task to be solved within further researches: the optimal use of auxiliary floating craft for delivering cargo to an unequipped shore.*

Section VI
Operation of ship power equipment

Ruban I.N., Bulgakov V.P., Uksusov S.S.

Stabilization of mechanical properties and dimensions of the internal combustion engine piston made of AlSi12Cu2MgNi (Al25) alloy

Keywords: *chemical heterogeneity, casting, segregation, alloy, heat gap, thermal expansion coefficient, heat conductivity, equilibrium diagram, solid solution, quenching, tempering, annealing, mechanical properties, dimensions and properties stabilization.*

Annotation. *The objective of the paper: the technology of stabilization of mechanical properties and dimensions of the piston made of AL25 alloy by reducing the influence of chemical heterogeneity in the casting and obtaining an equilibrium metal structure in the piston operating temperature range. When the complex alloyed alloy AL25 solidifies, in the casting the chemical heterogeneity occurs in the direction of the piston axis from the top to the bottom, in the radial direction from the outer surface to the center, when moving around a circle in a horizontal section. Segregation results in the change of metal's mechanical and physical properties: density, thermal expansion coefficient, heat conductivity; causes different amounts of the heat gap between the piston and the sleeve from the head to the skirt. The segregation harmful effect on properties uniformity within the piston is possible by increasing the structure uniformity through reducing overheating over the liquidus line and reducing the metal exposure on the stand before casting. Heat treatment does not completely eliminate the segregation effect, but stabilizes piston's mechanical properties and dimensions. Hardening at the temperature close to the melting temperature has reduced the chemical heterogeneity and made solid solution of aluminum alloys saturated with alloying elements resistant to cyclic overheating. Tempering has completed the aging process - the allocation of the second phase, has stabilized metal's hardness and ductility. Annealing has eliminated the signs of aging completely, has coagulated and increased the grain size of the alloy. As a result, the mechanical properties have been stabilized; strength and ductility have been increased at temperatures up to 300^0C. The linear expansion coefficient has been stabilized; the irreversible change of the piston dimensions in the range of the engine operating temperatures has been eliminated.*