New autonomous navigation technologies to enhance maritime sustainability

A-NAVIGATION

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Industry transformation and benefits

Along with decarbonization, autonomous navigation is one of the key technological trends for the global merchant fleet. The introduction of new technology will lead to industry transformation due to new opportunities:

- **Increasing the safety of navigation.** The human factor remains the main cause of incidents at sea. According to Allianz Global Corporate & Specialty AG, the cost of losses in shipping due to human errors in 2017 amounted to US$1.6 billion (Allianz Global Corporate & Specialty SE’s “Safety and shipping review”, 2018).

- **Reduction of onboard crew number.** The direct costs of shipping companies for the crew on board, including ensuring its life and safety, needs on board, are estimated as average 30-40% of ship operation costs.

- **Improving personnel policy.** In accordance with IMO analysis, there is 20% deficit of qualified officers of the global merchant fleet and this gap is growing due to hard conditions of work at sea.

- **Better transport safety control.** Permanent and real-time control allows to prevent and to react immediately on cases of illegal traffic, piracy, poaching and violations of environmental legislation


For the first time in decades, shipowners will not have to pay additional costs for additional safety, but will instead be able to increase safety while reducing operating costs.
Autonomous navigation becomes a reality

The IMO approved roadmap for MASS regulation with the MASS Code to be bring to the experience-building phase by the first half of 2026 as non-mandatory instrument and from January 1, 2032 as a mandatory one. MSC, LEG, FAL are involved with MASS Joint Working Group established.

The global industry comes to the stage of wide use of autonomous ships in real commercial conditions
2019-2021: the world largest trial project

In 2019 the group of technology and shipping companies joined efforts to make possible wide practical operation of autonomous navigation in the maritime transport in the nearest future.

The strategic goal of the project is to develop and to implement technical and legal conditions for wide MASS trial operation by any shipping company starting from 2021.

Key challenges:
1. The systems shall be predictable and transparent for all participants
2. The solutions shall fit to the existing international regulation
3. The technologies shall be affordable for shipping companies

Submission to IMO MSC 102/5/29б, 10 March 2020
The principle of CFE implies fulfillment in automatic and remote modes of those functions that are now prescribed to be performed by a human on board as per current international safety regulations: STCW, SOLAS, COLREGS.

This guarantees that MASS, when interacting with other actors, will be guided by and perform well-known and mandatory for functions. This makes MASS operation predictable and understandable for everyone.

It also allows for MASS operation to fit within the existing framework of international regulation as is, without requiring any immediate change pre-implementation.

As a ground we used a set of functions in line with the standards of competence of crew members set out in Chapter II of Part A of the **STCW Code**.

Submission to IMO MSC 103/5/12, 16 March 2021
In December 2020 the Government of Russia approved the national experiment on wide MASS trial operation based on Interim Guidelines for MASS trials adopted by the Circular MSC.1/Circ.1604.

In January 2021 Federal Agency for Maritime and River Transport has issued Guidelines for COLREG-72 application for MASS, interpreting the existing provisions of COLREG-72 in a determined way which allows to define the scenarios (algorithms) of MASS movements in a every given situation, as well as the limits for the use.

In July 2023 the Federal Law No. 294-FZ was adopted for regulating legal relations when using autonomous ships.

Federal Law introduces the changes to a number of national documents aimed to creating a legal framework allowing the operation of autonomous ships.

Submission to IMO MSC 102/5/14, 11 February 2020, MSC 103/5/7-8, 16 March 2021, LEG 111/10/7, 15 February 2024

**Federal Law is planned to come into force in 2024**
### Extensive trials in real conditions

The trials program includes remote operation (via ROC), with permanent contact with the supervising crew onboard), automatic navigation (using autonomous navigation system under the supervision of the crew onboard and additional control by the remote operator), and automatic navigation in heavy traffic areas.

- More than 10,000 hours of operation recorded
- Over 100,000 simulated tests are provided
- More than 70 voyages with autonomous navigation trials

**June – August 2020**
- Preliminary tests of systems on shore using simulators

**from September 2020**
- Collection of field data from ships and analysis of systems operation without possibility to control the ships

**December 2020**
- Approval in Principle by Russian Maritime Register of Shipping

**from February 2021**
- Tests of automated and remote operation of ships in real conditions under control of the crew

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**National experiment on a-Navigation**

Submission to IMO MSC 102/5/29, 10 March 2020
Two Russian largest railway/vehicle ferries Marshal Rokossovsky and General Chernyahkovsky now is the first ships officially certified with MASS category with onboard crew reduction. Certificates were issued at September 25 and 29, 2023.

The carriers operate on more than 500 miles route between the ports of Ust-Luga and Baltiisk on Baltic Sea. Each vessel is about 200 meters of LOA. MASS category by RS is RC_{MC-MC_{DS}} that allows autonomous navigation under remote control with manual control override capability when moving at sea and manual control with the use of a-Navigation systems for decision support when moving in restricted waters and at the entrance to the port.

The vessels are controlled remotely from the first Remote Operation Center located in Saint Petersburg Passenger Port.

Autonomous ferries contributes to better transport connectivity of the Russian Federation.

Within the national experiment any shipping company is allowed to equip with autonomous navigation systems any vessel under the State Flag of the Russian Federation and legally operates this MASS in commercial conditions.
Simulators training for MASS and ROC officers

The extension of commercial operation of MASS flying the Russian flag and the importance of the Human Element for safe MASS operation require qualified personnel for MASS use.

To support the training process the proper simulator is developed for simulation of navigational conditions, MASS systems and ROC that allow to train MASS personnel for various conditions and scenarios.

The first simulator, including VR/AR version, was deployed in the Russian University of Transport in 2022. The collision avoidance intellectual system of the simulator is based on COLREGs72 requirements and ensures safe navigation in traffic environment with up to 50 navigation hazards in the AIS control area.

The second a-Navigation and e-Navigation simulator was designed, constructed and deployed in October 2023 at Admiral Makarov State University of Maritime and Inland Shipping.

By the end of 2023 The Russian University of Transport successfully trained and issued certificates for 40 ROC operators and masters of remotely controlled with crew onboard MASS.

Submission to IMO MSC 108/4/3, 31 January 2024
Thank you!

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