

Innovative activities and R&D

Areas of innovative activities

Sovcomflot is a world leader in developing and implementing innovations in the field of maritime transport. The Group is actively and consistently improving technologies and equipment, implementing international best practices, improving fleet management and enhancing the scientific potential of employees, including seafarers and land-based specialists.

Sovcomflot Group's innovative activities are carried out in accordance with the requirements and methodological guidelines of the Federal Agency for State Property Management (Rosimushchestvo), the Russian Ministry of Economic Development and the Council for Economic Modernisation and Innovative Development under the President of the Russian Federation. Priority directions for innovative development of the Group are determined in accordance with Decree No. 899 of the President of the Russian Federation dated 7 July 2011.

Sovcomflot is developing its own engineering school. SCF's engineering, operations and training centres have been integrated at the St. Petersburg headquarter, creating a unique blend of knowledge and practical experience accumulated by the company and giving an additional impulse to the development of unique industrial projects with an ice component.

The main areas of innovative activities and scientific, R&D and technological projects of Sovcomflot Group in 2020 were as follows:

1. Exploring opportunities for improving energy efficiency and reducing carbon, sulphur and nitrogen oxides emissions:
 - using a boil-off gas reliquefaction system to return boil-off gas to the cargo tanks or use it as a fuel for the ship power plant on gas carriers (implemented as part of the construction of SCF *La Perouse*-class vessels);
 - using a hull air bubble lubrication system to reduce the resistance and increase the speed of the ship for SCF *La Perouse*-class LNG carriers (implemented as part of the construction of the fourth vessel of the series);
 - installing direct-drive permanent magnet shaft generators (the generator rotor is integrated in the shaft line) to reduce fuel consumption for power generation for LNG carriers (implemented as part of the construction of the fourth SCF *La Perouse*-class vessel);
 - fitting rotor sails to LNG-fuelled Aframax vessels (the solution has not been implemented at this stage, has been preliminarily worked through and is being considered in the context of future projects).
2. Working on projects for new types of LNG-fuelled vessels - Aframax and VLCC tankers, bulk and dry-cargo carriers.
3. Preliminary assessment of prospects for using alternative low-carbon and zero-carbon fuels on vessels ordered by the Group.
4. Preliminary working-through of innovative technical solutions from the viewpoint of prospects for using them on the company's vessels (for example, stabilisers of different types).
5. Participating in the development of automated and remote control technologies for large-capacity commercial vessels, which involves creating and validating technical tools and drafting requirements to be incorporated into Russian and international legal and technical regulations that create conditions for operating unmanned vessels. In 2020 SCF Group masters participated as part of an expert council in preparations for the first stage of pilot operation, which includes the testing of the basic automated and remote control algorithms on shore test-bed based on the array of data received from vessels.
6. Participation of SCF Group employees in research, conducting calculations and experiments to select optimal parameters for ship power plants in terms of compliance with conventional requirements.
7. In the reporting period specialists of the SCF training centre in St. Petersburg participated in the modelling of vessel marine operations in the port water area and on the approaches to the port to determine critical hydrometeorological conditions in the area of marine transshipment centres in the Murmansk Region (Kildin Strait, Gulf of Ura) and to identify opportunities and conditions (constraints) for the safe manoeuvring of vessels in the transshipment centre water area in the Kamchatka Krai.
8. Employees from the SCF training centre continued to take part in the research work on the development of regulations for bunkering ships with LNG, which involves the development of national level standards



The Arc7 shuttle tanker *Shturman Albanov* operating on the Novy Port project (Kara Sea)

that set uniform requirements for all participants in the open market for LNG bunkering services.

9. During 2020 the SCF training centre developed and introduced a set of tasks for the software system designed to test the knowledge of vessel crew members on LNG bunkering in accordance with requirements of the Seafarers Training, Certification, and Watchkeeping Code (the STCW Code), as well as a new cybersecurity training programme.

Sovcomflot stimulates professional development among its staff and encourages employees to pursue additional education in order to gain in-depth knowledge of modern technologies in fleet management. SCF's engineering staff have very high scientific capabilities: currently, 15 seafarers, who have completed post-graduate studies and received the title of Candidate of Technical Sciences or are preparing to defend their theses, work in the Company's fleet.



SCF operational centre for vessel tracking

The operational centre for real-time vessel tracking, which was opened at the Sovcomflot headquarters in St. Petersburg in 2018, was actively developing during 2020. The first steps were made to integrate SCF and Atomflot operational centres, Gazprom Neft analytical centre and the Arctic and Antarctic Research Institute. The project partners began to receive data on ice conditions from Ice Observer, a mobile application which is part of the

Ice Portal, as well as vessels' movement parameters and photos of ice conditions from vessel cameras.

The main challenge in 2020 was preparing and providing information support for three experimental transit voyages of the LNG carrier *Christophe de Margerie* along the Northern Sea Route. This task was successfully accomplished through many years of work on analysing ice conditions and accumulating the experience gained by SCF crews in the Arctic and the satellite data analysis methodologies developed over the years. All this knowledge was applied in the Ice Portal developed through joint efforts of SCF and Scanex.

The centre's equipment allows for the following tasks to be performed:

- controlling and analysing navigation safety data;
- optimising ship routes taking into account ice conditions, weather conditions, and business objectives;
- monitoring the ship's operation in real time (collecting and processing the ship's navigation and technical performance parameters, video feeds from surveillance cameras);
- special Arctic navigation control capabilities: analysis of ice conditions and movements of ships, identification of dangerous ice formations and areas with complex ice conditions, development of recommendations for masters and determination of the safest route in ice conditions;
- control and analysis of the performance of the ship's systems in terms of energy efficiency, bunker consumption, etc.;
- remote access to the ship's systems, log of faults, etc. for onshore specialists to analyse the technical condition of the ship in case of malfunctions in ship systems and help crews to fix faults.

Key achievements in innovation and R&D

- The LNG carrier *Christophe de Margerie* became the first ever large-capacity cargo vessel to complete an eastward passage through the Northern Sea Route (NSR) in May 2020, two months earlier than when summer navigation in the eastern part of the Russian Arctic traditionally commences. Thus, the NSR transit window has been significantly extended, as navigation in this part of the NSR commences traditionally only in July. The voyage took 21 days, the travelled distance was 6,047 nautical miles, average speed was 11.7 knots. During the voyage a massive dataset regarding ice conditions in the eastern part of the NSR was collected, which will be taken into account while planning the logistics of future Arctic projects and designing next generations of Arctic vessels, including icebreakers and high ice-class vessels.
- The accumulated experience in vessel operations in the extreme conditions of the Gulf of Ob and the Kara Sea in 2020 formed the basis for two new training manuals, which continued the series of books containing practical recommendations by SCF Group captains for steering vessels in ice conditions. Practical Recommendations

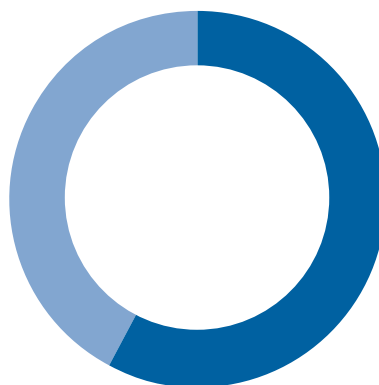
for Steering a Vessel with three Azipod Propulsion Units in Ice Conditions in Relation to the Yamal LNG Project were published. The training manual summarizes the experience in steering icebreaking vessels with a powerful power plant accumulated in the Yamal LNG project. Special attention was paid to navigation in the most difficult area - the outlet of the Ob River to the Kara Sea, where large-capacity vessels have to sail along the long and narrow Sea Channel in conditions of constant ice drift. The second training manual is a joint publication of SCF and Scanex dedicated to the analysis of ice conditions based on satellite data. Both manuals were distributed to the SCF fleet and cadets of Russian maritime universities with which Sovcomflot cooperates.

- The use of gas engine fuel (LNG) as the primary fuel for six green tankers of the *Gagarin Prospect* series made it possible to significantly reduce carbon dioxide emissions (by 33,257 tonnes or 19.5%) in 2020 compared to similar tankers running on diesel fuel.
- In 2020, Sovcomflot Group received the award for 'Shipping Company of the Year' at Seatrade Maritime Awards International. An independent jury, which included representatives of industry associations, financial and research institutions, and classification societies, paid particular attention to the SCF efforts to improve environmental safety and energy efficiency of the fleet, implement advanced technologies and engineering solutions, develop navigation in difficult climatic conditions, and ensure an uninterrupted operation of the company amid the pandemic.
- A credit facility agreement concluded by Sovcomflot with three international banks to refinance LNG tankers *Grand Aniva* and *Grand Elena*, which was one of the first in the shipping industry to incorporate the Poseidon Principles¹ (an international environmental initiative to reduce carbon footprint from ships), was named 'Project Financing Deal of the Year' by the jury at Marine Money Awards.

Financing of innovative activities

The financing of R&D, engineering activities, professional training, retraining and skill improvement of PAO Sovcomflot personnel in 2020 amounted to US\$2.7 million.

Structure of R&D expenses, (%)



- 58 ■ R&D for the construction of new ships
- 42 ■ Targeted personnel training, retraining and skill improvement

¹ For more detailed information about the Poseidon Principles, see the Sustainable development section of this Annual Report