Boris Sokolov in successful arctic ice trials

The arctic condensate tanker *Boris Sokolov* has been delivering cargo from Sabetta to markets since January 2019. The vessel was built by GSI shipyard based on the Aker Arctic design. Ice trials are part of the comprehensive design package and these were carried out in heavy ice conditions in the Russian Arctic.

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The Aker Arctic team responsible for the testing consisted of Teemu Heinonen, Veikko Immonen, Heikki Juvani, Sami Saarinen and Alexey Shtrek. They travelled to Sabetta and boarded *Boris Sokolov* at the end of April 2019.

Tests in the Kara Sea

After loading a full cargo of gas condensate from the Arctic harbour, the RMRS Arc7 vessel departed towards the north-east to the Bay of Mikhaylov, where the first tests were conducted.

"The level ice thicknesses were measured to be 145 cm and 160 cm thick with a 30 cm of snow layer on average," says Teemu Heinonen. "The first level ice tests were performed, in which the vessel was tested ahead in the thinner ice and stern-first in both thicknesses."

From there *Boris Sokolov* headed south-west to an area close to the Kamenny Islands where the forward moving test was performed in 125 cm thick level ice as well as an astern turning test in about 150 cm thick level ice.

Design targets confirmed

"Based on the level ice tests, we concluded that the vessel fulfils its icebreaking requirements of moving ahead in 150 cm thick ice with a speed of 2 knots, and in 180 cm thick ice moving stern-first with the same speed, according to design targets," Heinonen adds. "The turning diameter of three kilometres in 150 cm thick ice was also clearly fulfilled."

> The vessel operates stern-first in heavy ice.

Boris Sokolov has been designed according to the Double-Acting Ship (DAS™) principle that allows tankers and cargo ships to operate independently without icebreaker assistance in challenging ice conditions. In moderate ice conditions and in open water, the vessel sails ahead normally, while in heavy ice conditions the vessel turns to operate stern-first.

Clearly over ridges

The next destination was a pressure ridge field off the coast from Dikson. The ridge keel depth measured to be at least 10 metres and the sail height between 2 and 3 metres. Bad weather and poor visibility limited the ridge measurements.

"The condensate tanker managed to penetrate easily through the ridge without any problems, from which we could conclude that it will clearly fulfil the design requirement of 15 metres thick ridges," Heinonen underlines.

High ice class

The tanker's ice class, RMRS Arc7, means the vessel is intended for year-round independent navigation in western parts of the Arctic Ocean and for a six-month period in summer/autumn in eastern parts of the Arctic Ocean. The vessel can also take advantage of the frequent traffic of large LNG carriers and navigate in convoy with them.

In 2017, Heinonen participated in the ice trials of the first Arc7 LNG carrier, *Christophe de Margerie*, the concept of which was also developed by Aker Arctic (read more in issue 14). The last ships in the series of fifteen exceptional tankers, capable of sailing independently through ice up to 2.1 metres thick, will be delivered this year by the South Korean shipbuilder Daewoo Shipbuilding & Marine Engineering (DSME).

From left: Alexey Shtrek, Sami Saarinen, Yamal LNG representative Alexey Chernov, Heikki Juvani, Veikko Immonen, polar bear guards Mikhail Korelskiy and Dmitry Konichev, Teemu Heinonen.

En route to Rotterdam

In addition to the Aker Arctic team, there were representatives of the owner Dynacom, the builder Guangzhou Shipyard International, the charterer Yamal LNG, the propulsion system provider ABB, and members of the Arctic and Antarctic Research Institute (AARI) who provided ice reconnaissance and indicated suitable test areas. Everyone disembarked in Murmansk on the 14th of May to return home after the successful trip.

Boris Sokolov continued on her normal route towards Rotterdam along the coast of Norway with her full cargo load. This was her fifth voyage since she began her regular work delivering gas condensate, a liquid by-product from natural gas fields, from Sabetta to Europe and Asia.

"The ice trials went very well and the vessel behaves according to design targets and manages well in the conditions she was designed for," Heinonen highlights. "The vessel was delivered on time and keeps her cargo delivery schedules, exactly as planned."

"This was our second successful co-operation project with Guangzhou Shipyard International. They also built the two heavy arctic module carriers *Audax* and *Pugnax* delivered in 2016, which have been essential in the construction of the arctic LNG plant in Sabetta."

Testing the turning diameter of three kilometres in 150 cm thick ice. All design targets were fulfilled in the test.

Aker Arctic was responsible for ice property measurements as well as measurements onboard the vessel including propulsion and navigational data measurements. In addition, Aker Arctic conducted the ice trial analyses.

DIVEC data gathering system used in ice-trials

Example of display with consolidated data using DIVEC (values are not from real vessels).

Full-scale ice trials involve gathering more data than the ice conditions. Information concerning the ship's location, speed, propulsion power, engine use and propeller rotation is vital to provide context to the ship's performance. Until now, the information has been gathered from various systems on-board, consolidated manually and then analysed. With the new DIVEC (Distributed Intelligent Vessel Components) data gathering system, the manual work will become history.

For the ice-trails of *Boris Sokolov*, the new Arctic condensate tanker, Aker Arctic's research team developed a data gathering system, which was connected to the various systems on-board the vessel and automatically gathered data from them. The data was displayed on a monitor for a clear, real-time overview, while simultaneously saving the details for later analysis of the trials.

Useful for improving performance

Research engineers Veikko Immonen and Olli Kokko are excited about the new system. "The data gathering system is not only useful for ice trials, but could be installed on any vessel wanting to improve its operational efficiency, safety or performance in ice," they say. "It can easily connect various systems, which normally wouldn't interoperate."

This could include for example analysing speed, fuel usage, engine efficiency and effectiveness of various manoeuvres. Inefficiencies could be identified, and suggestions made for improvement in operations.

"The framework allows transmitting data in all directions, which means that the information could also be available online," Kokko adds. ■