## Icebreaking bow Saimaa and tug Calypso in ice trials



On a sunny week in late March, shortly after the Saimaa Canal had been re-opened for traffic after its annual winter closure, Aker Arctic conducted full-scale trials for the self-propelled detachable icebreaking bow *Saimaa* and the pusher tug *Calypso*. The tests were carried out together with Turku Repair Yard, the Finnish Transport Infrastructure Agency, Alfons Håkans and Danfoss.

The target for development engineer Teemu Heinonen and his team was to test how the icebreaking bow-pusher combination works together in icebreaking duties, and to ensure that it fulfils its specified icebreaking requirements. The ice trials were conducted during the period when the ice conditions are at their most challenging in Lake Saimaa.

## Three days of performance tests

The first level ice tests were performed on Lake Paasselkä, in southern Savonia, Finland, where a suitable level ice field with a thickness of approximately 60 cm was found. After the ahead test, in which a speed of 4.7 knots was achieved, flexural strength and compressive strength were measured from the ice.

The turning tests at various angles showed excellent manoeuvrability.

"The combination of a wide bow, the pusher's azimuthing thrusters, and four propulsion units in total provide excellent manoeuvrability," Heinonen says.



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Over the next two days, performance in ice channels was tested at Pyhäselkä, near Joensuu. The channel tests demonstrated that the combination fulfils the 7-knot speed requirement in a 150-cm-thick unconsolidated channel.

Additional level ice tests were performed in approximately 50-cm-thick level ice, in which a speed of 6.5 knots was achieved. Finally, operability in astern mode was tested, although the combination is designed to operate mainly in ahead mode.

"The bow is wider than the pusher and the main operational direction of the combination is ahead. However, we could demonstrate that it can manage even 50 cm of level ice in astern mode, if necessary," Heinonen explains.



Ice thickness, flexural strength and compressive strength are measured from the ice during the test.

## Vast measurements

Aker Arctic has delivered the complete shaft lines with propellers for the detachable bow and the ice-strengthened bronze propellers for the tugboat.

The shafts and the connector pins used to couple *Saimaa* and *Calypso* are all instrumented and connected to a data gathering system developed by Aker Arctic, which consolidates all the information on one display. Real-time thrust, torque, propulsion power, engine use and pin connection forces were followed from the display throughout the tests and valuable information was gathered.

"With the help of the Distributed Intelligent Vessel Components (DIVEC) data gathering system we received abundant amounts of detailed information, which would not have been possible without the system," Heinonen says.

The Aker Arctic Ice Load Monitoring System (ILMS) was installed during construction. It saves and transmits data from the ice loads on both sets of shaft lines (the bow and the pusher) as well as monitoring shaft line power. The ILMS is also connected to the yard-delivered pin force sensors transferring the loads from the connection between the bow and the pusher to the ship's automation system. This provides the crew with important real-time operational information. Valuable



Sensors installed on the hull and the shaft lines send information to a central computer for real-time processing. This data is available on a monitor on the ship's bridge, as well as online remotely. This is an example of a typical view.

data about this innovative vessel concept is also gathered for possible future projects.

## **Successful tests**

The test programme was successfully completed showing that the pusher-bow combination *Calypso* and *Saimaa* fulfils the icebreaking requirements and will improve icebreaking and ice management operations in the Lake Saimaa area and Saimaa Canal during wintertime, just as intended.

"This is the first self-propelled icebreaking bow ever built and it functions well," adds Heinonen.

"We are very pleased with the test results," says llari Rainio, Maritime Specialist at the Finnish Transport Infrastructure Agency and responsible for icebreaking in the Lake Saimaa area and Saimaa Canal. The area stretches from the Brusnitchnoe Lock all the way up to Joensuu and Siilinjärvi, with ten locks in total. There are eight locks in the Saimaa Canal with a height difference of 76 metres.

"Aker Arctic performed the tests in an excellent manner. It was a pleasure to follow their professional work and easy to cooperate with them from the start to the end," Rainio adds.

"The first season went well with positive feedback from Calypso's crew, the Masters of the assisted vessels, as well as the nautical pilots. We are already looking forward to next winter."