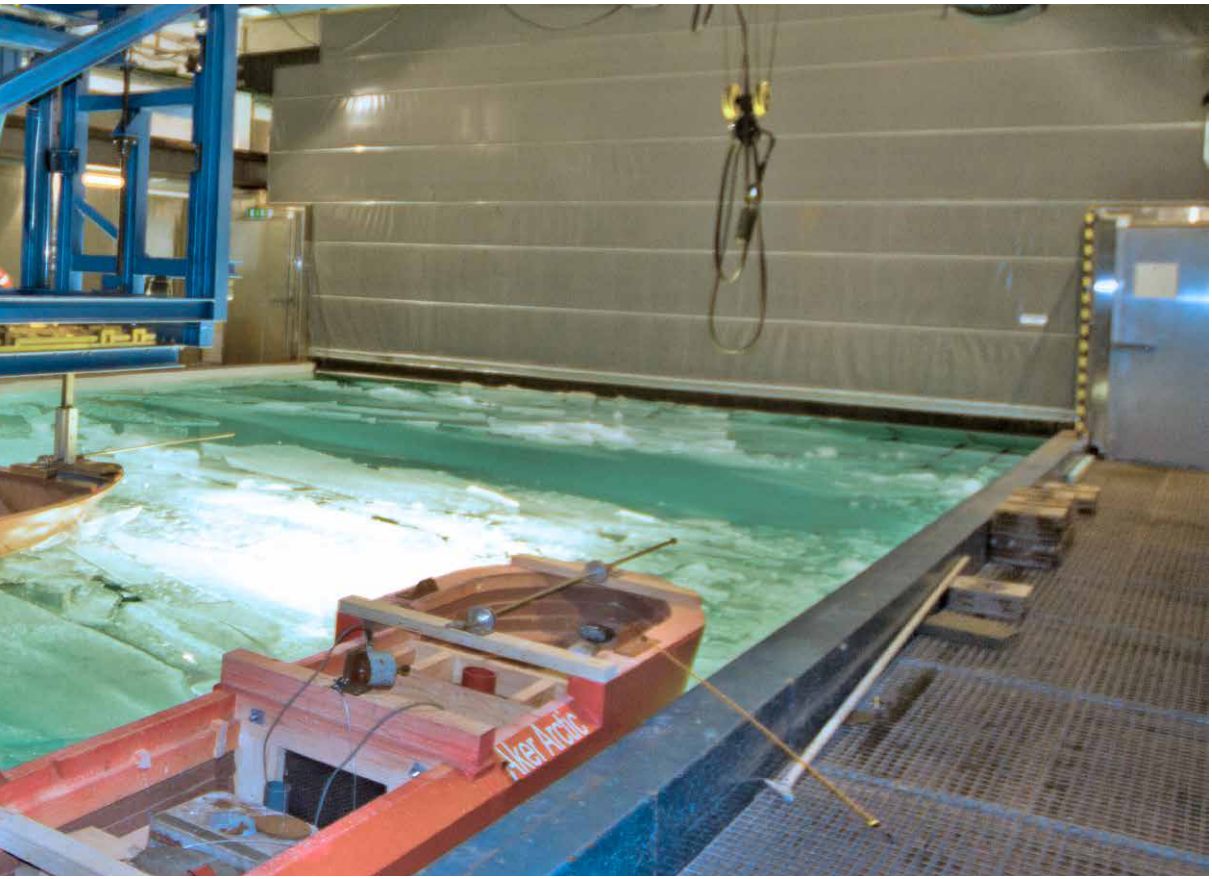
Accelerated icebreaker development

Imagine a ship owner having the right to refuse to take delivery of a new container vessel if it does not sail at 2 knots in 1.5-meter thick ice. Would anyone guarantee the performance of a new, innovative vessel in advance?



This is not a theoretical example but a real-life situation. Aker Arctic Technology Inc. is probably one-of-a-kind in giving such a guarantee. The owner is Norilsk Nickel, the world's largest exporter of nickel and palladium and in need of an ice-breaking container ship.

As a so-called double acting ship, this type of vessel is designed to lead the way in open water and thin ice, then turn around and proceed astern (backwards) in heavy ice conditions, sucking the ice in under the ship with its Azipod® thrusters. Such ships can operate independently in severe ice conditions without icebreaker assistance, while performing better in open waters compared with traditional ice-breaking vessels.

Confident predictions

"We are quite confident about our predictions for new vessel designs," says Arto Uuskallio, Sales & Marketing Manager at Aker Arctic Technology. The organization has a long history in researching and developing maritime ice technologies and a unique set of groundbreaking achievements to go with it.

"Computer simulations estimate how much power a vessel will need to meet specific ice conditions," says Uuskallio, adding that these need to be verified in model testing.

Model testing is done in our ice tank, which is 75 meters long and 8 meters wide, with a water depth of up to 2.1 meters. We can also do tests in Aalto University's ice tank, which is 40 by 40 meters and more suitable for testing maneuverability.

When water is sprayed into the air as a mist during model testing, small water particles freeze and form the model ice layer by layer when they land on the water surface, explains Uuskallio. Temperature control in the room and the salinity of the water give the ice layer its desired strength. When working with a

Oblique icebreaker. Illustration: Arctech helsinki Shipyard

The Aker Arctic ice lab test models in scale 1:25

The ice tank is 75 meters long and 8 meters wide, with a water depth of up to 2.1 meters.

1:25 scale model, everything needs to be kept in line with the scale laws of the test. Even time is scaled; the captain has to make decisions at five times the normal speed.

Combining models and real-world data

Testing new hull forms and propulsion systems against various ice conditions in a computer model or a scale model is just part of the job for Aker Arctic, which analyzes the trade pattern of the vessel and the possible variations in ice conditions to arrive at the right design.

“We do our own ice research in the field and collect data from a large pool of vessels in operation to verify our models,” says Uuskallio.

He emphasizes the importance of understanding the correlation between model-scale predictions and real-life experience. Long-term measurements to determine how the fleet of a vessel is performing is also important because rubble, ridges and different kinds of ice formations at sea always differ from standard test conditions in the lab.

Exporting through ice

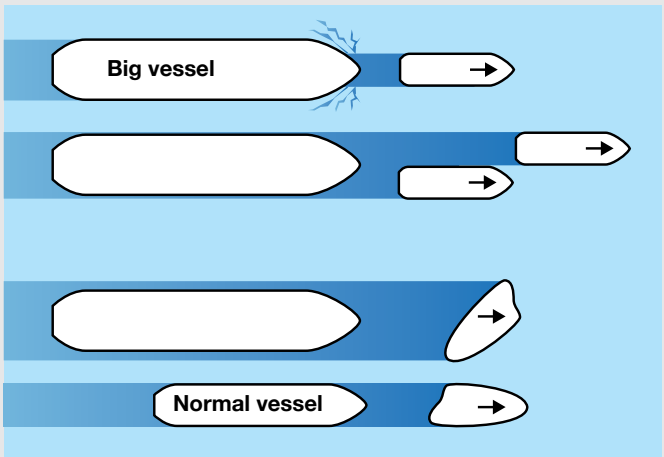
Aker Arctic is located in Finland, bordering Russia and Norway – the world’s two largest exporters of natural gas, and the second and sixth biggest exporters of oil, respectively. Finnish shipyards have also built about 60 percent of the world’s icebreaker fleet.

Because of climate change and the development of Arctic oil and gas resources, the idea of a possible seaway opening up that connects the Atlantic and the Pacific does not seem as distant now as when it was first put forward by the Russian diplomat and philologist Dmitry Gerasimov in 1525.

The recent developments in Arctic shipping means that double-acting vessels, such as ice-breaking tankers and container ships, can operate year-round without waiting for assistance from specialized icebreakers.

Not only do the extremely harsh ice conditions of the Artic create a need for new icebreakers, but environmental regulations and energy efficiency requirements also demand new solutions. In particular, increasing oil shipments through the Gulf of Finland are spurring new developments for uninterrupted and environmentally safe oil transport.

The “oblique icebreaker” goes sideways to do the job of two conventional icebreakers.



The problem
The channel is too narrow for a big vessel

The present solution
Two icebreakers assist one big vessel

The innovation
One “oblique icebreaker” breaks channel wide enought for a big vessel

Breaking channels of normal width is no problem

Icebreakers on oil-spill recovery missions

The Finnish Transport Agency recently contracted Aker Arctic Technology to design a new icebreaker for the Finnish government. It will be equipped for oil-spill response operations at wave heights of up to 2 meters and will include tanks and heating capacities that can handle at least 1,500 cubic meters of recovered oil.

Aker Artic is far from the only ice model test facility in the world, but its research and testing capabilities combined with its design and engineering expertise is hard to match. By combining all disciplines needed to develop new ice-breaking vessels time-to-market is shortened.

The oblique icebreaker concept

A new design that stands out as a big leap forward is Aker Arctic’s oblique icebreaker, a special type of icebreaker designed to operate not only ahead and astern, but also obliquely (sideways).

Ships are rarely asymmetric, but this one is – for good reason. Whereas, in the past, a second icebreaker was needed to break a channel for large ships, the oblique icebreaker now goes sideways to clear a channel wide enough for tankers and other large ships. This takes the already well-known double-acting ice-breaking method one step further by making the ship capable of breaking an ice channel 50 meters wide as it moves ahead with its side first.

Scan the code to watch a video interview with Arto Uuskallio

Not only can this small ship do the job of two conventional icebreakers, but it can also carry out emergency towing, oil-spill recovery missions, firefighting and ecological monitoring in between performing ice-breaking operations.

Text: Johs Ensby