

First LNG icebreaker *Polaris*



The construction of Finland's new icebreaker has been completed at Arctech Helsinki Shipyard. The vessel, *Polaris*, will be owned and operated by Arctia Ltd., a Finnish state owned company providing icebreaking services. She is the world's first LNG-fuelled icebreaker, which also makes her the most environmentally friendly icebreaker ever built. *Polaris* is based on the Aker ARC 130 concept developed by Aker Arctic in cooperation with ILS and the Finnish Transport Agency.

Polaris in sea trials in spring 2016 outside Helsinki.

Polaris is an exceptional icebreaker, as she can exceed the performance of even the highly regarded Finnish icebreakers *Urho* and *Sisu* built in the 1970s, which have been widely recognised as the most capable icebreakers in northern Baltic conditions. The main purpose of *Polaris* is icebreaking and assisting other vessels in difficult ice conditions in the northern Gulf of Bothnia, where ice ridges can grow to over ten metres thick due to strong winds. It is common that ridge formations are deeper than the draft of the icebreakers.

Towing needs will increase

During the design phase, two propulsion concepts were compared: a more traditional twin-azimuth concept and a triple-azimuth concept with two propulsion units in the stern and one in the bow. The triple-azimuth concept was chosen as it turned out to be only slightly more expensive, but significantly improved the icebreaking performance and lowered operational costs.

"The Energy Efficiency Design Index (EEDI) is expected to change

commercial vessels sailing on the Baltic Sea in terms of size and engine power," project manager Mika Hovilainen says. "Most likely, vessels will become longer and slimmer and be equipped with smaller engines. In difficult ice conditions, these vessels will need more assistance and towing needs will increase in the future."

In the most challenging ice conditions such as heavy ridges, contact towing is usually needed. The benefit of the chosen concept with a bow propulsion unit is that *Polaris* will have exceptional steering capability and performance in ridge fields, even when she is attached to the vessel she is towing.

She is also able to perform oil spill response operations, emergency towing and rescue operations on the open sea all year round.

Fifty years of service

Her planned service life is fifty years—twice that of typical commercial vessels — and this long service life has been taken into account in the design. By way of comparison, her predecessors *Urho*

and *Sisu* are now forty years of age.

The ice belt is made of compound steel with a stainless steel outer lining. It requires less service and saves fuel due to reduced corrosion when compared to normal steel coated with abrasion-resistant paint. All the basic work in manufacturing the hull has been done with the long service life in mind and everything is made in accordance with the highest quality standards. Spaces for machinery and equipment are additionally planned so that it will be easy to upgrade and make changes when it becomes necessary.

Polaris is equipped with Wärtsilä 34DF series dual fuel engines. They are equivalent of typical diesel engines, but can also use LNG as fuel with significantly reduced emissions as a result.

"The two 400 m³ LNG tanks carry enough fuel for ten days independent operations in demanding ice conditions. Apart from LNG, low-sulphur marine diesel can also be used to continue the autonomy time," Hovilainen adds.



The ice belt is made of compound steel covered with a stainless steel layer to reduce ice resistance and maintenance costs.

Arctech Helsinki Shipyard



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Mika Hovilainen is convinced that the new vessel will shine.

"Polaris is the world's most environmentally friendly icebreaker, she can use LNG and she has enough power and manoeuvrability for all her tasks. Her special hull form and propulsion arrangement will minimise ice resistance and maximise the icebreaking capacity of the vessel. I believe she will become the best and most efficient icebreaker in the Finnish fleet!"

"Extensive full-scale testing has been done during sea trials," states Jarkko Toivola, Head of Winter Navigation Unit at the Finnish Transport Agency. "Course stability of Polaris going ahead and especially going astern is better than in previous icebreakers with azimuth propulsion units, but still manoeuvrability is exceptional. Open water speed and bollard pull in both directions exceed specified requirements. Also response of the power plant is quick regardless of used fuel type; LNG or MDO."

The main engines are installed on the main deck level. The vertical LNG tanks in the background can hold enough gas fuel for 10 days of independent operation.

Polaris has three Azipod propulsion units, one of which is in the bow of the icebreaker

Main tasks and features:

- Icebreaking and escort operations in all prevailing ice conditions in the Baltic Sea
- Oil spill response with Lamor's built-in mechanical recovery system and 1 200 m³ tanks for recovered oil
- High bollard pull and emergency towing capability also in heavy seas
- "No compromise" approach to icebreaking operations; performance superior to all existing Finnish icebreakers

Aker Arctic's design responsibilities:

- Concept design including technical documentation for shipbuilding contract
- Hull form and propulsion system development
- Model tests in open water and ice
- Initial design of hull structure and machinery
- In co-operation with ILS Oy and The Finnish Transport Agency
- Technical support in procurement process

General characteristics		
Tonnage:	3,000 DWT	Speed: 17 knots (31 km/h; 20 mph)
Length:	110 m (360 ft)	(open water), 4 knots
Beam:	24 m (79 ft)	(7.4 km/h; 4.6 mph) in 1.8 m
Draft:	8 m (26 ft) (design)	(6 ft) ice
	9 m (30 ft) (max)	Endurance: 10 days on LNG
Ice class:	PC 4 Icebreaker(+)	20 days on fuel oil
Installed power:	2 × Wärtsilä 9L34DF (2 × 4,500 kW), 2 × Wärtsilä 12V34DF (2 × 6,000 kW), 1 × Wärtsilä 8L20DF (1,408 kW)	Crew: 16
Propulsion:	Diesel-electric; three ABB Azipod units, 1 × 6 MW (bow), 2 × 6.5 MW (stern)	Builder: Arctech Helsinki Shipyard, 2016