

Navigating the future of icebreaking design

Aker Arctic's Managing Director, Mika Hovilainen, reflects on how evolving market demands and emerging trends are increasing vessel complexity and reshaping icebreaking ship design through new areas of technical proficiency.

Modern ships incorporate intricate systems to meet today's energy efficiency and emission requirements, including emission reduction systems, energy storage solutions, and alternative fuel options.

Compliance with stricter regulations requires more intensive technical work, such as analyses, calculations, and investigations. Optimising hull forms, machinery, and overall design to improve energy efficiency and safety have become the new standards.

"Technologically, vessels are becoming increasingly complex and even small gains in energy efficiency are valuable to save costs," Hovilainen says. "The fact is, we can no longer build the same ships as we did 20 years ago."

Growing importance of technical expertise

Hovilainen emphasises the growing importance of advanced technical expertise. With an expanding array of design options, selecting the optimal solution for each ship requires in-depth knowledge and experience.

"At Aker Arctic, completing multiple icebreaking ship design concepts annually ensures we remain at the forefront of the industry. Every project has novel features and demands which challenge us every day," Hovilainen explains.

For shipyards, streamlining the construction process will remain vital to control costs. Cooperating with an experienced ship designer helps to reduce risks related to rapid changes in technology and regulations.

"The shift to goal-based regulations will also add new aspects as requirements can be achieved with alternative technical solutions," Hovilainen says.

A lifecycle approach to cost management

Icebreakers typically have long lifespans and investment decisions consider far more than just the initial acquisition price.

"Taking into account the costs and emissions for a vessel's entire lifetime already in the concept design has become common practice," Hovilainen observes.



Finnish icebreaker Kontio at work. Photo by Topias Lehtonen, courtesy of Arctia Ltd.

"This requires a new approach to ship design where the operational understanding is highlighted."

Toward a fossil-free future

As emission regulations continually tighten to combat greenhouse gas emissions, fossil-free fuels are essential in the long-term. Through improved energy efficiency, negative impacts of alternative fuels, such as lower energy density, are reduced.

Hovilainen expects rising fuel prices to influence transportation economics. "Ships are already operating at slower speeds to comply with EEDI regulations, reduce emissions, and save fuel, and this trend will increase," he says.

Hovilainen also anticipates ship sizes to grow while transporting greater cargo volumes to achieve lower fuel consumption per cargo unit.

He points to an alternative approach: deploying small nuclear reactors. Though costly to install, they enable an opposite optimisation of marine transportation systems, as operational costs do not depend heavily on the power used.

A reliable winter navigation system

Aker Arctic is keen on addressing emissions in winter navigation, particularly for commercial shipping in the Baltic Sea.

"Finnish exports and imports rely on a smooth winter navigation system. Our mission is to ensure it continues to be efficient, sustainable, and safe," Hovilainen says. — →

Ice load monitoring for Canada's MPVs



Aker Arctic has been chosen to supply a state-of-the-art ice load monitoring system for the Canadian Coast Guard's Multi-Purpose Vessels (MPVs) programme. Aker Arctic designed the hull form and contributed to the development of the vessel concept.

The contract includes the delivery of Aker Arctic's ARC ILMS ice load monitoring measurement and analysis system for the initial six MPVs, which are a key part of Canada's National Shipbuilding Strategy (NSS). These vessels will be constructed at Seaspan Vancouver Shipyards in Canada.

→ The Baltic icebreaking fleet will require replacement within the next decade, and Aker Arctic is ready to support the development of next-generation designs for Finland, Sweden, and Estonia.

Hovilainen also stresses the need to improve the energy efficiency of cargo ships without increasing ice-breaking demands, which would shift the burden onto icebreakers.

Tools for optimisation and safety

In addition to designing icebreakers and ice-capable vessels, Aker Arctic is developing tools to optimise routes and transportations in icy conditions as part of its transit simulation services. This can help both in early decision-making and in operations.

"We are looking to integrate real-time environmental data with specific vessels to optimise routes for each

"The ARC ILMS is our platform for measuring loads that the ship's structure experiences when operating in ice-covered waters," says Rob Hindley, head of consulting and technology development at Aker Arctic.

"It utilises strain gauge sensors, specifically fibre optic gauges, to measure the hull's response when impacted by ice. Using our analysis algorithms, developed from decades of similar measurements on icebreakers, the system provides feedback to the operator on the safety level of the ship," he adds.

Fleet renewal programme

The MPVs form part of the Canadian Coast Guard's fleet renewal programme and will mainly replace the Type 1100 class built in the late 1970s and 1980s, doing the day-to-day work of supporting shipping, maintaining fairways, aids to navigation, and icebreaking.

In addition, they will perform cargo missions, bringing supplies to northern communities, carry out search & rescue, and patrol missions.

Collaboration to develop vessel concept

Aker Arctic completed the hull form and contributed to the concept development for the MPVs, using a collaborative model involving the operator and the shipyard, working jointly on creating the concept from day one. Following the conclusion of the concept development, Aker Arctic has continued to provide expert technical support to the project, especially advising on ship performance related aspects.

"We are thrilled that our Ice Load Monitoring System has been selected for implementation on the MPVs and look forward to working with Seaspan and the Canadian Coast Guard also on this project," Hindley says. ■

transportation task. The same tools also help to identify the best vessel design for a specific route," Hovilainen explains.

Recently, several new contracts for Aker Arctic's Ice Load Monitoring System (ARC ILMS) have been published. The key know-how lies not in the actual measurements but in understanding how structures respond to ice loads and calibrating the system correctly.

Strengthening leadership

Over the past two decades, Aker Arctic has designed a significant portion of the world's icebreaking vessels, each constructed and proven effective in operation.

"Our plan for the coming decade is to continue to advance our expertise, strengthening our leadership in this niche, and deliver solutions that prioritise sustainability and safety for all vessels navigating icy waters," Hovilainen summarises. ■