Aker Arctic
The Ice Technology Partner

Arctic Passion News

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The Canadian Polar Icebreaker project is proceeding. Aker Arctic has continued to provide its expertise in Arctic ship design to ensure the vessel meets the latest technical developments in icebreaking. The Polar Icebreaker will be an incredibly complex ship, designed to operate in the Arctic's ice-covered waters, and will play a critical role in enabling the Canadian Coast Guard to transit and protect more than 162,000 km of Arctic coastline.

Read more on page 4.

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Meet us at these events in 2024

February	28 – 29.2. Offshore Wind Transmission Europe, Amsterdam, Netherlands
March	5 – 6.3. ASNE, Baltimore, USA
May	14.5. Wind Finland Offshore 2024, Helsinki, Finland 15 –16.5. Navigate Maritime Trade Fair, Turku, Finland
September	3 – 6.9. SMM, Hamburg, Germany
October	1.10. Wind Finland 2024, Helsinki, Finland
November	4 – 7.11. Euronaval Navy, Paris, France.

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Arctic Passion News 1 / 2024

Dear Reader,

This is my final editorial for Arctic Passion News. The decision to leave Aker Arctic has not been an easy one, as I have been part of the company for many years, and I have truly enjoyed my time here.

I am proud of Aker Arctic

and of the company's achievements over the past years and decades. Even more importantly, it has been a privilege to have been able to work with all our clients, designing and developing icebreaking ships for you.

The exceptional results were only made possible through the close cooperation between our highly motivated and passionate personnel and demanding clients, with whom it has always been a pleasure to work. Exceeding a client's expectations and bringing something new to the table always felt personally rewarding.

Although climate change

is influencing the icebreaking business in various ways, we are once again reminded of the cold weather and difficult winter conditions in the Baltic Sea as I write this in late January. All the Finnish and Swedish icebreakers are currently in operation.

Naturally, this reminds us of not only the necessity of icebreaking but also the challenges for the design of future vessels. How can we achieve the tightening environmental needs of tomorrow while maintaining safe and effective winter navigation? I believe this is one of the key development areas for icy regions relying on sea transportation.

Recent years have been globally dramatic,

leading to changes in our business environment. Therefore, at Aker Arctic, we have added some new directions to our strategy that build upon our unique ice know-how and capabilities. Continuing the company's development towards these targets will be an important focus for the new management.

The foundation is solid, as we have reached a position as the leading company in our business segment. The financial situation is excellent, the order book is healthy, and most importantly, the expertise of our employees is at a very high level.

I would like to thank all of my colleagues, our customers, and stakeholders for these magnificent years working together on icebreaking issues at Aker Arctic.

I feel confident passing the helm

to the new interim Managing Director, Mika Hovilainen. He has worked at Aker Arctic for many years, most recently leading our ship design activities, ensuring a smooth transition for the company.

Sincerely yours,

Reko-Antti Suojanen
(Managing Director of Aker Arctic 2014 – 2024)

Aker Arctic provides ice expertise for Canadian Polar Icebreaker

The Polar Icebreaker will be an incredibly complex ship, designed to operate in the Arctic's ice-covered waters, and will play a critical role in enabling the Canadian Coast Guard to transit and protect more than 162,000 km of Arctic coastline.

The Canadian Polar Icebreaker project, originally initiated in 2012, resumed three years ago. Aker Arctic has continued to provide its expertise in Arctic ship design to ensure the vessel meets the latest technical developments in icebreaking.

The Government of Canada is moving forward with the construction of two Polar Icebreakers that will replace Canada's existing largest icebreaker, the *CCGS Louis S. St-Laurent*. The first Polar Icebreaker is due for delivery in 2030 and will be built by Seaspan Vancouver Shipyards.

Larger and more powerful than current Canadian icebreakers and, in fact, one of the most capable icebreakers in the world, the new vessels will enable the Canadian Coast Guard to conduct year-round operations in Canada's Arctic. Their improved capabilities will ensure they can operate at higher latitudes for longer periods, allowing better support for northern Canada, while advancing high Arctic science, and providing a faster response to maritime emergencies.

Part of the design team

When the Canadian government awarded the design contract to STX Canada Marine in 2012, Aker Arctic was part of the design team developing the Polar Icebreaker for the Canadian Coast Guard and providing support on icebreaking-related issues.

"As the original vessel design was developed nearly a decade ago, technology has since taken leaps forward, particularly in propulsion systems and hull construction," says Mika Hovilainen, managing director at Aker Arctic Technology.

In 2021, Aker Arctic's experts teamed up with Seaspan Vancouver Shipyards and another Finnish design company, Elomatic, for a thorough design check and update of the Polar Icebreaker design.

Design check of concept

The overall aim is to build a modern and effective icebreaker which responds to future requirements and fulfils its complex mission profile.

The project thus began with a review of the vessel concept, aiming to investigate possible improvements in the design and to ensure that the vessel incorporates the latest technology.

"Essential parts of this investigation were identifying possibilities to reduce technical risks and evaluating improvement opportunities," Hovilainen explains.

An additional target was optimising the design for construction.

Efficient propulsion system

In the next phase, contract design options (CDO), three different propulsion options were evaluated.

"In a joint workshop with the Canadian Coast Guard, a hybrid propulsion configuration, incorporating two azimuthing propulsion units for optimal manoeuvrability and a centre shaft-line for efficiency during long transits in heavy ice, was proposed," Hovilainen continues.

An extensive set of model tests in ice and open water were completed to verify seakeeping, manoeuvrability, and the enhanced performance, all with fulfilling results.

Steel hull improved with nonlinear analysis

Nonlinear analysis provides a more insightful method to calculate a vessel's primary structures, including a better understanding of the safety margins present in the design. When the exact point of failure is known, contrary to traditional linear analysis, unnecessary steel structures can be reduced and other vulnerable structures strengthened, to improve the overall structural design of the vessel.

The steel hull of the new Canadian polar icebreaker has been optimised with the help of Aker Arctic's nonlinear analysis tools. The result is a lighter ship with many benefits; for instance, lower steel weight, reduced construction costs, and an efficient steel structure. (Read more in Passion News 2023)

"Some special materials have also been substituted to streamline construction work, such as extra high tensile steel," adds project manager Jukka-Pekka Sallinen at Aker Arctic.

Optimising the design

During the past year, the conceptual design material has been updated jointly with Vard Marine, Elomatic, Canal, Barrier Marine Services, Knud E. Hansen, and Seaspan Vancouver Shipyards.

"The final construction engineering design phase is now ongoing with functional design soon to be followed by production design," Sallinen says.

In addition to providing continuing support to Seaspan's design team, Aker Arctic's experts are responsible for the Polar Icebreaker's hull form, ice strengthening of the hull structures, performance, stability, and winterization.

Supervising role

Aker Arctic has also supported the shipyard's Technical Authority team supervising the ship design to ensure that all fundamental aspects of the design, such as owner's requirements, cross-discipline integration, and safety, are taken into account.

"The design documents are verified to ensure that aspects related to operation in low ambient temperatures and ice-covered waters are incorporated properly, as this is our core expertise," underlines Jillian Adams, team leader for structural design at Aker Arctic.

Prototype block to test processes

Before full-rate construction on the Polar Icebreaker begins, Seaspan has been developing a prototype block to pilot the new systems, processes, people, and tools that are required to work with the heavy structures necessary to manufacture a Polar Icebreaker. Some of this steel will be up to 60 millimetres thick, to enable the ship to safely navigate through the multi-year ice it will encounter in the Arctic.

In December 2023, Seaspan reported that work on the prototype block will be completed in the beginning of 2024. The lessons learned from building the block will be used to help improve the quality and efficiency of the process for designing and manufacturing the vessel when full production begins in late 2024 or early 2025. ■

Technical details

Length	158.2 metres
Beam	28.0 metres
Design Draught	10.5 metres
Displacement	about 26000 tonnes
Complement	100
Propulsion	Diesel-electric twin-azimuth/single-shaft hybrid propulsion; 34 MW in total
Installed power	About 48 MW
Icebreaking	3 knots in 2.5 m level ice with 30 cm snow
Ice Class	Polar Class 2 (PC 2) Icebreaker (+)

First corvette for Squadron 2020

Ship project manager Björn Enroth, Finnish Defence Forces Logistics Command, is supervising the construction project of the new multirole corvettes. Photos Finnish Defence Forces.

Construction of the first Pohjanmaa-class multi-role corvette for the Finnish Navy's Squadron 2020-project began at Rauma Marine Construction in October 2023. Aker Arctic is scheduled to deliver the propellers and shaftlines for this ship in late spring 2024.

The steel cutting ceremony marked the commencement of construction at Rauma Marine Construction, where a total of four ice-going Pohjanmaa-class multi-role corvettes will be built. The next significant milestone is projected to be in spring 2024 with the keel laying of the first ship.

Ship project manager Björn Enroth, from the Finnish Defence Forces Logistics Command, is overseeing the construction alongside a dedicated team. Their goal is to ensure that the ships meet all specified requirements.

Active service in 2027

Enroth anticipates the first ship will be completed by spring 2026, followed by the Swedish company Saab's installation and activation of the vessel's combat system. Successful combat and sea trials will signify the initial operational capability, paving the way for active service starting in 2027.

The project aims to achieve full operational capability by 2029, with the delivery of all four corvettes to the Finnish Navy.

A ship in its own class

The Navy's new ships will play a crucial role in Finnish naval defence, designed for repelling sea-based attacks and securing critical assets at sea and in the archipelago.

The challenging conditions in the Baltic Sea demand a unique ship class. Finland is the only country in the world where all harbours can freeze during winter. The presence of islands, shallow waters and reefs further complicates navigation.

"An ice-going ship of this size and capability is unprecedented," states Enroth. "These ships are designed to operate year-round, under all conditions."

Stringent demands on propulsion

The ships' unique requirements, including ice-going capabilities, high open-water speed, and preparedness for antisubmarine warfare, present challenges for the propulsion system. Low underwater noise is vital, necessitating meticulous design.

The Defence Forces have therefore entrusted Aker Arctic with designing and supplying controllable pitch propellers and shaftlines for all four corvettes, recognizing their proven expertise.

"Aker Arctic has met all our expectations. We value their work and look forward to continued cooperation," remarks Enroth. "Their customer-centred and solution-oriented approach has been instrumental in our collaboration."

The development of the propulsion line began in the early 2010s, with Aker Arctic participating from the beginning to ensure the new multi-role corvettes will meet the Finnish Navy's stringent operational performance criteria.

Currently, Kongsberg in Sweden is producing and testing the propulsion components for the first ship, with delivery scheduled for late spring 2024. ■

Offshore wind farms need robust foundations

Tahkoluoto offshore wind farm. Photo Petteri Mäkelä / Hyötytuuli Oy.

Aker Arctic's core expertise is to produce and develop services and products that enable sustainable and safe operations in ice-covered waters. Apart from icebreakers and other ice-strengthened vessels, this includes offshore wind park foundations which face similar challenges as vessels in icy waters.

Over the past year, Aker Arctic has been delving deeper into offshore wind farm developments, in particular investigating the challenges farms face in ice conditions and how to solve them in the most efficient way.

As a result, a clear strategy has been developed regarding how best to serve customers, ways to extend services, and increase expertise in this special field.

"Our offshore wind strategy is to develop and design cost-efficient, sustainable and robust foundations for offshore wind parks which can withstand ice in addition to open water conditions," outlines Julian Wehnert who is responsible for developing offshore wind services at Aker Arctic.

The design process encompasses the entire lifecycle of the foundations, including production, transportation, and installation, along with the operation and decommissioning of the wind park once it reaches the end of its expected lifetime in 25–30 years.

Green transition is an opportunity

Companies can battle climate change not only through their own actions but also by developing new business opportunities and participating in the green transition.

To steer the development in the correct direction, the European Union has set tight emission targets and Finland aims to become carbon-neutral by 2035. Consequently, there are many offshore wind parks being planned now, part of them in waters with significant ice challenges.

Cost-efficiency in ice

Risk evaluations prior to investments require detailed information about costs. While construction prices for offshore wind parks in open water areas are already quite well known, ice induced costs are more demanding to establish.

An offshore wind park is a power plant generating electricity into the national grid to be used by industry, companies, and households. Construction and service costs of the park will thus have a direct effect on the levelized cost of energy.

"Our target is to help investors minimize the added price tag of ice conditions so that the electricity price of a certain project is close to those wind parks situated in open water areas," Wehnert highlights. "With our expertise in ice, we can add clear monetary value to our clients."

Sustainable foundations

Lifecycle cost analysis is factored in all Aker Arctic's projects, including considering the requirement to minimize each project's carbon footprint.

"In practice, we want to count all the emissions from the production of construction materials and transportation," Wehnert clarifies. "In the future, we will also be able to include installation and decommissioning in our figures."

Aker Arctic's goal is to utilise domestic and local resources as much as possible in all designs, thus avoiding costs and emissions from long transportation processes.

Growing the team

Currently, Wehnert is working closely with the Aker Arctic consultancy team in offshore wind park projects. However, the target is to grow the team to include specialists that focus on offshore wind farm foundations.

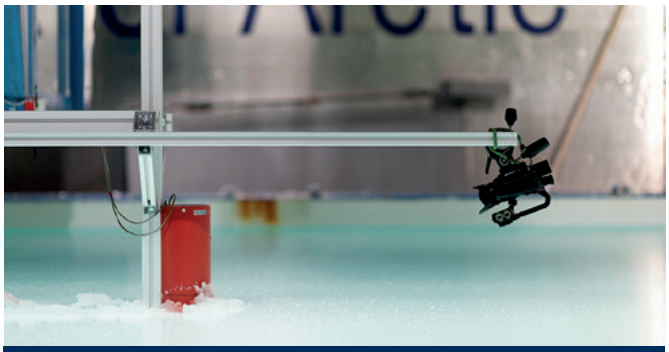
"In ship design projects, a large team collaborates to develop designs. The same applies to offshore wind farm foundations where our service concept includes comparing different solutions, planning how to attach the foundations, designing the actual substructure tailored for suitable turbines, in addition to cost evaluation and lifecycle cost analysis," Wehnert says.

He adds that Aker Arctic's future target is to participate in all major design phases of a project: feasibility studies where plans are outlined; concept evaluation where promising concepts are compared; pre-FEED design (front-end engineering) and FEED.

Recent projects

In one of Aker Arctic's recent projects, ice loads on various floating foundation options were investigated, as well as the combined load impact from other environmental factors such as wind speed and waves.

"We also conduct our own research to learn more about different phenomena, such as the recent evaluation of ice loads on windmill monopile foundations performed in our own ice basin," Wehnert notes.



Model tests are the only reliable way of investigating and comparing different foundations before investment decisions are made.

Model tests are the only reliable way of investigating and comparing different foundations before investment decisions are made.

"Our expertise in ice applies to all constructions used in ice-covered waters. By expanding our know-how and sharing it with customers, we want to contribute to the global effort to combat climate change and the progress of sustainable energy production. In the end, we only have one planet," he adds. ■

Meet Julian

Julian Wehnert joined Aker Arctic in February 2023 and has developed the company's offshore wind services since then. He is responsible for the strategy, expanding the services and increasing expertise in this particular area.

Before joining Aker Arctic, Julian worked in the sustainable energy market for ten years, developing wind farm projects in Finland. He takes a keen interest in the green transition, as it is part of his core values.

He was born in Helsinki but grew up in Germany. After his studies in economics in Berlin, he moved to Finland in 2014 joining a German-Finnish company developing renewable energy projects.

Wanting to deepen his engineering capabilities, he took part in further studies of sustainable energy systems & markets at Aalto University. In his master's thesis, he investigated lifecycle costs of hydrogen, receiving his master's degree in engineering in spring 2023.

Julian enjoys living in Finland, although at times he also misses Germany. He praises the digitalisation which makes everyday life easy and believes the green transition is one step ahead in Finland.

Service vessel for wind farms in ice areas

A pioneering service operation vessel, tailored for wind parks and optimised for both ice and open water conditions, is set to launch soon.

To avoid downtime in electricity production from offshore wind farms, suitable vessels for service and repair work are an essential part of the investment. Each day a turbine is out of order may cause losses of up to 20,000 euros.

Given the plans for new offshore farms in the Baltic Sea, the ability to access these farms also during winter becomes crucial. Aker Arctic is therefore developing a service vessel, which is optimised for both ice and open water conditions.

Current designs depend on the weather

In open water areas where turbines are already in operation, two main types of vessels are employed: Service Operation Vessels (SOV) and Crew Transport Vessels (CTV), each serving distinct purposes. For constructing and installing wind farms, many other types of vessels are also needed.

SOVs are larger vessels, particularly equipped with a motion compensated gangway, allowing workers to walk safely between the turbine and the vessel with tools and spare parts, to conduct repairs and service work. CTVs are fast and light vessels used for quick visits with small amounts of people, weather permitting.

However, neither of these vessel types traditionally possess ice strengthening or icebreaking capabilities. A small vessel also encounters more weather restrictions as waves and wind conditions result in uncomfortable vessel behaviour hindering the vessel's possibilities of reaching the farm safely.

Hence, access to turbines during bad weather is not possible and access during the ice season is only possible if a suitable tugboat is available for occasional emergency visits. In harsh ice conditions a tugboat may not be enough.

Reliability to reach turbines

The background work for a Baltic Sea SOV has been completed and initial outline design drawings are developed.

"The next step is to develop a concept design of the vessel, which will take approximately three months," says chief designer Lars Lönnberg.

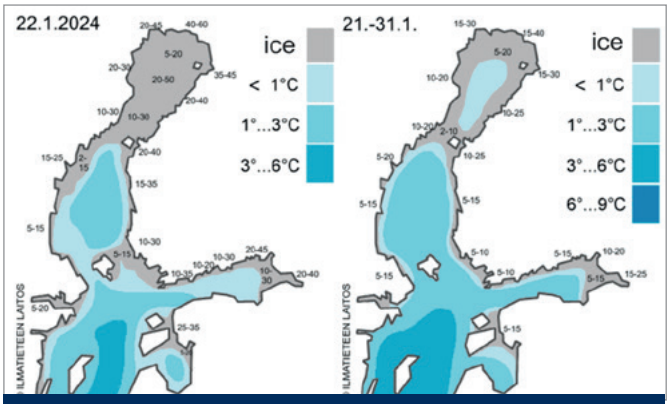
A Baltic Sea SOV differs from an icebreaker in several ways; the size can be smaller and the speed in heavier ice conditions slower, as it is not assisting any other vessels.

According to Lönnberg, the ability to break 1-metre level ice at a speed of 2 knots is deemed sufficient for Baltic Sea conditions, even in the northern parts. More important than speed in level ice is the reliability to reach turbines in all prevailing conditions.

Seakeeping improves safety

While icebreaking power is essential, the importance of seakeeping capabilities to reduce downtime is equally significant. Apart from the winter months, the vessel will operate most of the time in open water, and a safe transit in challenging weather conditions is necessary. Calm vessel movements, even in high waves, are vital in ensuring passenger comfort.

The inclusion of a motion compensated covered gangway is a fundamental part of the crew safety. Especially when there are waves, it is the only secure way to reach the turbines from the vessel. An additional significant challenge is maintaining the vessel's position in dynamic ice fields.



Ice condition map of the Baltic Sea, www.ilmatieteenlaitos.fi

Tailored concept

The SOV concept design will be further tailored for every area, as requirements are quite different depending on where in the Baltic Sea a wind farm is situated.

"Optimizing the service vessel design is key to enhancing a wind farm's output reliability and ensuring comprehensive safety for all stakeholders. It includes keeping the vessel's capital and operation costs small, i.e. to avoid over-design. This is important for the service crew, investors as well as individual electricity clients," Lönnberg highlights.

Sustainable ship design for a sustaina

In response to climate change, current megatrends, stakeholder expectations, as well as evolving international regulations, Aker Arctic has developed a sustainability guidance plan towards a more responsible future while helping customers to achieve their sustainability goals.

The sustainability plan is aligned with the three main topics outlined in EU corporate sustainability reporting directives, namely E=Environment, S=Social, G=Governance (ESG).

The areas considered most relevant in Aker Arctic's daily work have been identified. In these we believe we can add most value for our customers, our stakeholders, our people, and our planet.

Good governance is the basis for everyday work

Aker Arctic's projects have increasingly shifted towards renewable energy production, for instance wind power, and supporting markets for renewable fuels, including hydrogen, methanol and ammonia.

We will continue to focus on projects in these areas, while working with responsible customers, shipyards and stakeholders. This is in line with our renewed strategy that now incorporates ESG.

Aker Arctic's mission is to produce and develop services and products that enable sustainable and safe operations in ice-covered waters. We are therefore fully committed to International Maritime Organisation (IMO) greenhouse gas reduction targets.

Throughout the company's history, Aker Arctic experts have actively taken part in and facilitated discussions in the industry. Examples include: participating in IMO workshops, presenting R&D at global shipping events, arranging the yearly Arctic Passion Seminar in Helsinki, as well as publishing articles on new projects, development trends and research findings in Arctic Passion News – the printed and online company magazine.

In our selection of partners, codes of conduct and safety have always guided us, but now ESG has been added to the requirements.

Preserving the environment for future generations

As an engineering office, Aker Arctic's own emissions are quite small. However, Scope 1 & 2 greenhouse gas (GHG) emissions have already been monitored for five years, and the aim is to continue reducing them through various actions. Scope 3 emissions will be defined during 2024.

Scope 1 emissions are direct GHG emissions from sources owned or controlled by the company. Scope 2 emissions refer to indirect GHG emissions associated with the purchase of electricity, heat, or cooling. Scope 3 emissions encompass all other indirect emissions in the value chain.

About six years ago, solar panels were installed on the office roof, providing renewable electricity during the sunny months of the year. Nevertheless, Finland has many dark months, during which

ble planet

outside providers are needed. The target is to switch to 100 % renewable energy year-round in the near future.

Enabling customers to reach their goals

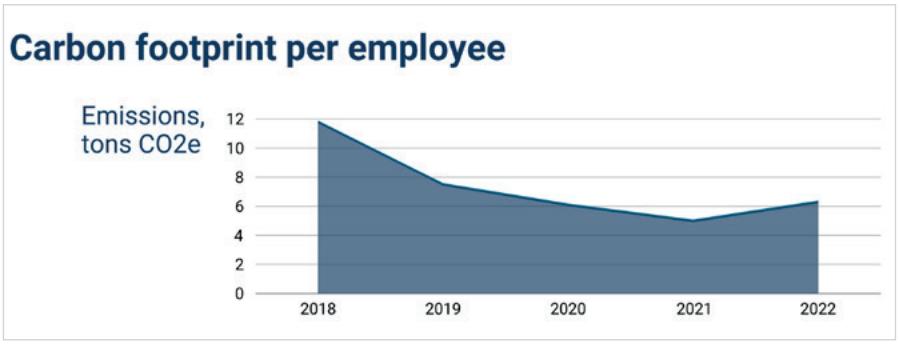
Increasing the carbon handprint and climate impact in the value chain are where the prime positive environmental influences can be achieved. In every new vessel project, the design should be more sustainable than its predecessors.

This means considering what fuel options can be implemented to reduce climate impact. Additionally, lower emissions can be achieved both in construction and operations by utilising the latest technologies and implementing new approaches.

For example, in the recently designed Swedish icebreaker, the requirement was to design a vessel with 70 % lower emissions than the previous one, and this was achieved.

For the recently designed Swedish icebreaker, the requirement was to design a vessel with 70% lower emissions than the previous one, and this was achieved.

Lifecycle assessments (LCA) are further recommended in every new project, where GHG emissions in the design are calculated to support customers in their decisions. The aim is to help customers find ship solutions that reach their requirements, consume less energy, and use carbon-neutral energy alternatives.



Solar panels installed on the office roof have provided renewable electricity for about six years. Photo Catarina Stewen

"In every new vessel project, the design should be more sustainable than its predecessors."

Passionate ice people are the key to success

Aker Arctic employees are all tremendously enthusiastic about ice, icebreaking, Arctic areas and improvements in technology. This is the place where our passionate team finds daily meaning in their work. We are continuously developing our expertise to achieve even more successful operations in ice. Aker Arctic's high employee satisfaction score, long-term employment and low sickness leave records testify to this.

In addition to competitive salaries and a salary equality policy, employee benefits are on a high level; occupational healthcare and regular joint recreational activities being among them.

As a responsible and flexible employer, cycling and public transport to work is encouraged. Remote working opportunities are offered, and free charging points for employees using electric cars are provided.

All ESG actions are part of creating a green organizational identity, where every Aker Arctic employee actively cares about ESG and contributes to a more sustainable future.

We will continue to monitor key sustainability indicators such as carbon footprint, energy efficiency and social impact metrics and publish results annually to ensure transparency and to track our progress towards a more sustainable future.

World icebreakers overview

For those who share our passion, we present a snapshot of the world icebreaking fleet as of 1st January 2024.

There is a multitude of ice-strengthened vessels designed for various purposes in the world. Some possess exceptional ice-going capabilities while others are suited only for light ice conditions. Only a select few can truly be classified as icebreakers.

Icebreakers pave the way

An icebreaker is a vessel designed for icebreaking duties. Its core features include a reinforced hull shaped to break the ice, a robust and powerful propulsion system, and appropriate winterization against low ambient temperatures. All characteristics are meticulously selected based on the intended area of operation and planned tasks. These typically include escort or ice management functions.

Major classification societies such as American Bureau of Shipping, Bureau Veritas, Det Norske Veritas, Lloyd's Register, Russian Maritime Register of Shipping and – most recently – China Classification Society have established rigorous standards and guidelines for icebreakers to ensure safe navigation in ice-covered waters.

Hard to draw the line

The diversity of icebreaking ships makes compiling an exhaustive list of icebreakers challenging. It is difficult to draw a clear line between ships that should be included and ships that should be left out.

In addition to purpose-built icebreakers, many research ships, offshore vessels, and even one luxury cruise ship have been officially classified as icebreakers. However, their ability to operate independently in difficult ice conditions is merely a means to carry out other tasks. Although smaller ice-strengthened tugboats are often used for icebreaking operations in harbours, they are not considered as icebreakers. Oil tankers, LNG carriers, and other cargo ships are also excluded even if they are fully capable of independent year-round operation in the most challenging Arctic ice conditions.

Market intelligence

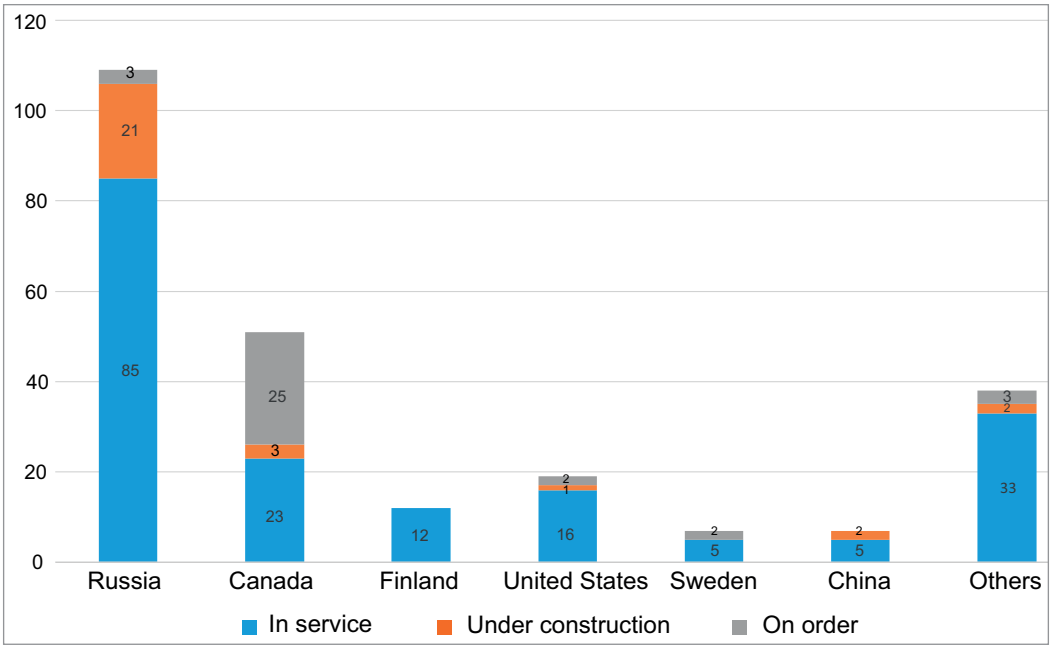
At Aker Arctic, we keep a close track on all world icebreakers, including ship type, size, ice class, primary mission, icebreaking capability, and other technical characteristics in addition to expected lifespan.

"This is a cornerstone of our expertise, rooted in our keen interest in monitoring market evolution in our field," notes Senior Naval Architect Tuomas Romu, who has compiled the overview of the world's icebreaking fleet presented here.

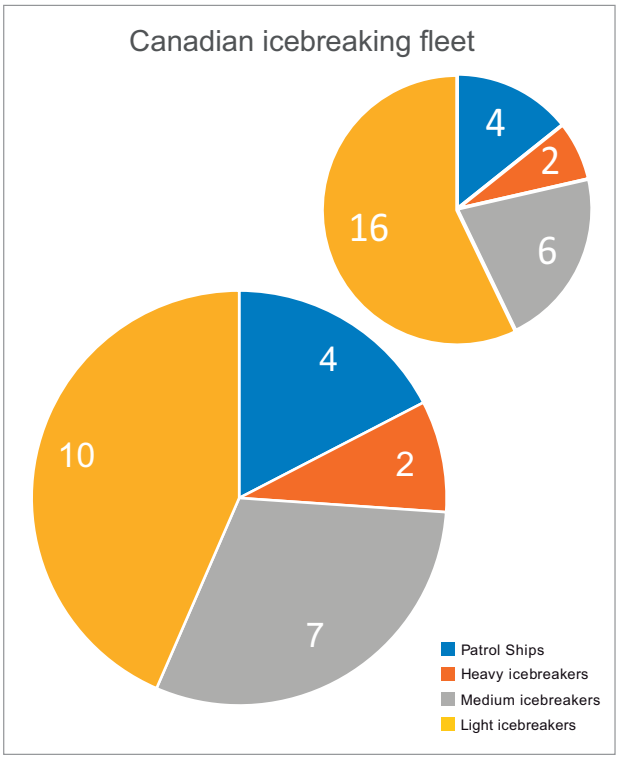
"However, different countries' fleet sizes should not be directly compared due to the diversity in the sizes, capabilities and characteristics of individual ships on the list," Romu adds.

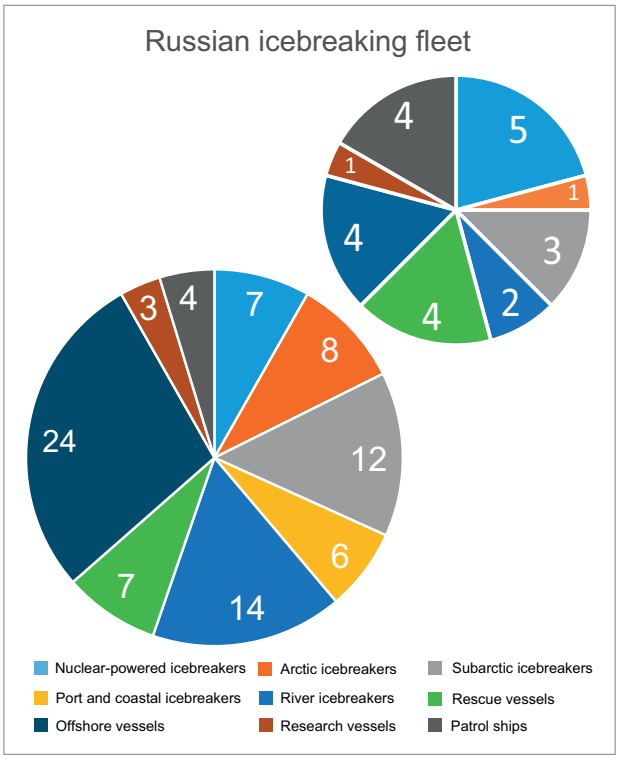
As of 1 January 2024, the complete list of icebreaking ships includes 243 ships: 179 in service worldwide, 29 under construction, and 35 in the shipyards' orderbooks or included in various procurement programs. While the global fleet is gradually increasing in numbers, many of the new icebreakers are built as replacement to older ships.

World icebreaking fleet 1 January 2024.



Examples of two different classification systems: Canada and Russia. The larger chart shows vessels in use, the smaller chart planned vessels.





Although an icebreaker is a very specific ship type, a review of the global icebreaking fleet must consider not only the diversity of the vessels themselves but also the different ways icebreaking ships are perceived and classified worldwide.

For example, United States and Canada each use their own way of classifying icebreakers as "heavy", "medium" or "light". On the other hand, Russia's vast icebreaking fleet can be split into a number of categories based on type, purpose and key technical characteristics.

Finland leads the world

Following World War II, Finnish companies made rapid advancements in icebreaking technology, pushing the state of the art in icebreaking design, construction, power supply, and propulsion systems. Today, Finland is a global leader in icebreaker design and construction, with most of the world's icebreakers originating from Finnish expertise. Naturally, every single icebreaker in service in Finland has been designed and constructed locally.

The strong Finnish maritime cluster is composed of engineering offices, shipyards, equipment manufacturers, universities, model testing facilities, and other related entities. The cluster collectively foster research, new ideas and innovations, continually inventing ways to improve operations in ice.

The task of how to break ice more efficiently and sustainably has intrigued naval architects and ship engineers for generations, constantly pushing the boundaries of the icebreaker design using new hull forms, alternative fuels, different propulsion systems, and new engine types.

Full-scale references

The Finnish maritime industry also maintains the most extensive full-scale reference database, ensuring that every new vessel meets its performance requirements set before construction.

"Anyone considering acquiring an icebreaker looks to Finland first. With over 80 years of experience, we consistently pioneer new market innovations," says Romu. "Moreover, our vessels have received global acclaim for their performance and quality."

Environmental stewardship

The global icebreaker market represents a diverse and dynamic sector, essential for supporting operations in challenging ice conditions worldwide. Finnish leadership in this field, marked by decades of innovation and excellence, sets a high standard for icebreaker design and construction. With increasing demand for efficient icebreaking vessels and sustainable maritime solutions, the Finnish maritime cluster remains at the forefront of technological innovation and environmental stewardship.

We at Aker Arctic are dedicated to monitoring developments, sharing our insights and fostering collaborations to further enhance our own capabilities. We believe this is vital for pushing the state of the art of icebreaking in order to ensure safety and optimal efficiency for maritime operations in icy waters in a constantly evolving world.

Reducing emission cost on Baltic

Balancing environmental benefits with economic feasibility poses challenges for shipments to and from Finland, particularly in the Bay of Bothnia where winter traffic faces severe ice conditions. Addressing this challenge is crucial to avoid escalating costs for future exports and imports.

Shipments in the Baltic Sea are primarily regulated by both national and international regulations. However, progressively tightening emission targets introduce additional limitations.

The International Maritime Organisation (IMO) has set a target to reduce shipping emissions by 40 % by 2030 (from 2008 levels). EU aims to cut greenhouse gas emissions by 55 % by 2030 (from 1990 levels) and to become climate-neutral by 2050, while Finland's goal is to reach overall carbon-neutrality by 2035.

In response to global environmental concerns and the green transition, there is also a growing demand from exporters and investors for low-carbon maritime transportation.

Three main solutions

There are three main solutions to achieve lower emissions in shipping: utilising alternative fuels, improving the energy-efficiency of vessels, and enhancing logistics.

The development and adoption of low-carbon and/or fossil-free fuels is advancing steadily, offering an efficient way to reduce emissions. Unfortunately, they currently come with a higher price than traditional fossil fuels.

"Forecasting the price level in ten years, when emission reduction targets are fully in effect and demand peaks, is challenging," notes Senior Naval Architect Tommi Hietamäki from Aker Arctic, who is focusing on solving these cost-related issues.

"Therefore, other measures to compensate, at least partly, for the higher fuel costs are essential," he emphasises.

Energy-efficient vessels

Improving the energy efficiency of merchant vessels is a key solution. Vessels can be developed to utilize less energy, i.e. less fuel consumed through better hydrodynamics, improved ice performance, utilization of energy-efficient machinery, and even auxiliary propulsion systems such as wind propulsion.

The maritime logistic system in Finland can also be enhanced. This involves utilising larger cargo vessels, reducing the speed of vessels, changes in harbour operations, and reconsideration of transportation routes.

Challenges in ice

The Finnish-Swedish winter navigation rules require all vessels arriving and departing Finnish harbours to have certain level of performance in ice when assistance restrictions are in force. This is enforced through minimum power requirements or verification through ice model tests. However, the tightening emission regulations have resulted in many new cargo vessels having lower sailing speed and lower installed power. This reduces CO_2 emissions per ton-mile of transported cargo which is a positive development.

"However, these vessels struggle in ice conditions, a trend that current developments are exacerbating," Hietamäki says.

Consequently, the need for new modern icebreakers capable of assisting these new types of cargo vessels efficiently is growing.

Updates to winter navigation rules

Hietamäki believes that cargo vessels with smaller engines should be allowed into Finnish-Swedish ports if they have sufficient ice strengthening. Strengthening merchant vessels' hulls and propulsion systems, in addition to considering specific ice going properties in hull form development, can make them suitable for ice conditions without compromising their open water capabilities.

"We have recently developed a new bow geometry which enables a large ship to follow a smaller icebreaker by widening the channel by itself without losing any of the open water features," Hietamäki explains.

Additionally, modern icebreakers, such as *Polaris* and the future Swedish icebreakers, are extremely efficient in assisting cargo vessels with their agility, speed and flushing capabilities.

"Therefore, doubling or tripling current vessel sizes would not be a problem even in Bay of Bothnia winter conditions. We estimate that doubling the ship size can reduce fuel usage per transported ton of cargo with 25 %," Hietamäki highlights. "This would, however, require changes in the winter navigation rules."

Study to evaluate costs

Aker Arctic is experienced in conducting logistics studies where economic feasibility and emissions are calculated. In this way, both the price and the CO_2 emission per transported ton-mile of cargo are quantified.

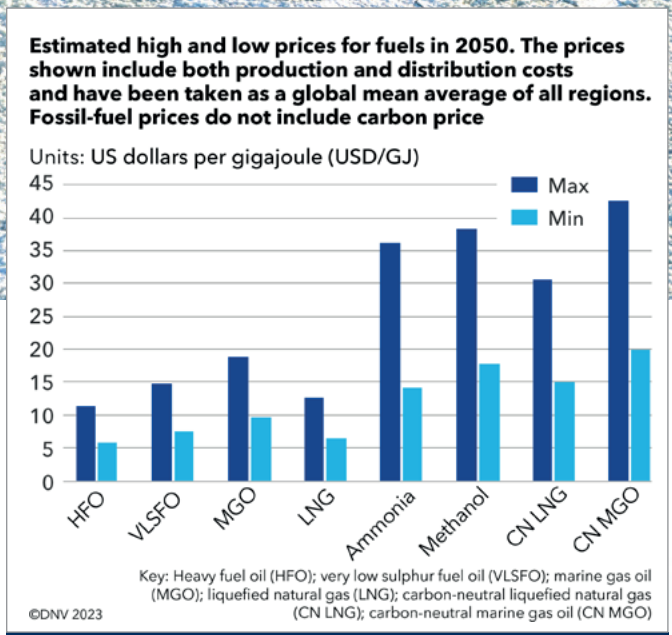
In numerous projects, we have conducted initial transportation studies to identify the most efficient system alternatives. These have included evaluating the most effective and

Sea shipments

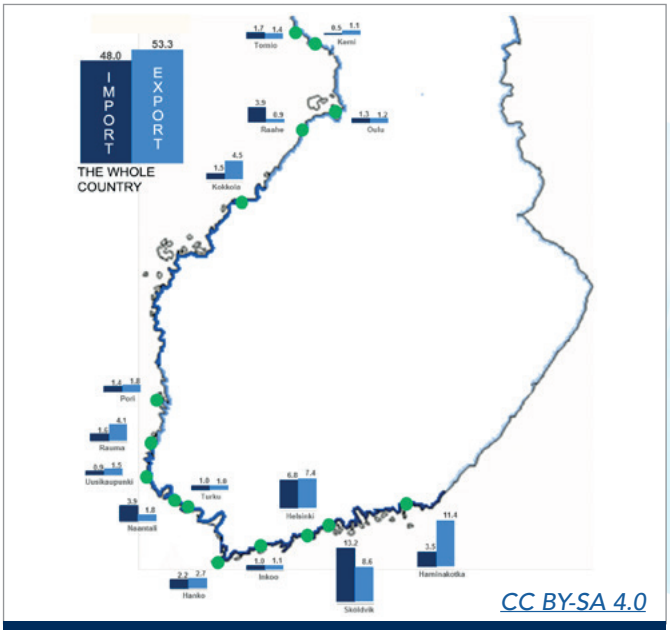
Photo courtesy of Arctia

cost-efficient options for cargo vessels, transportation schedules, supporting icebreakers, and possible other vessels. Lifecycle analysis (LCA) and lifecycle cost (LCC) calculations are part of these evaluations.

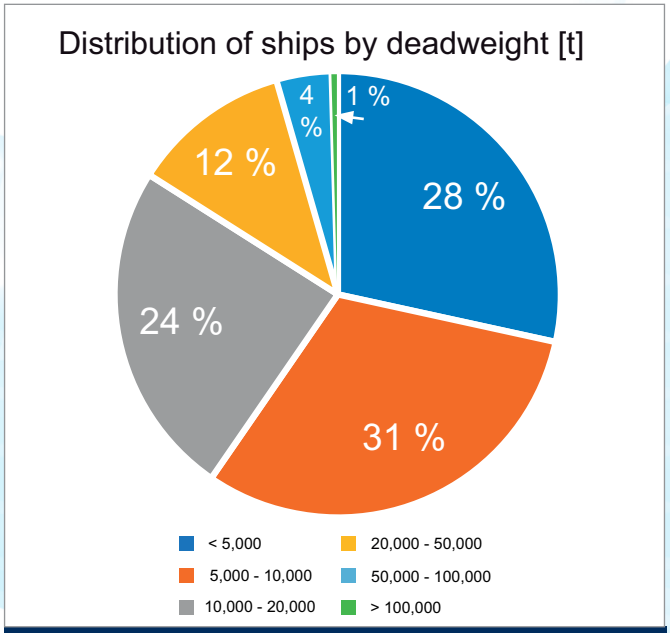
"A logistics study could be done for the entire Baltic Sea transportation system, or for smaller sub-entities," Hietamäki says. "However, time is running, as changes are not happening overnight. The Finnish Transport and Communication Agency (Traficom) is already considering solutions because stability in regulations is a prerequisite for acquiring new vessels." ■



Estimate of fuel prices in 2050. Compared to current price level, fuel prices will likely double. Source: DNV, Energy Transition Outlook 2023, Maritime Forecast to 2050.

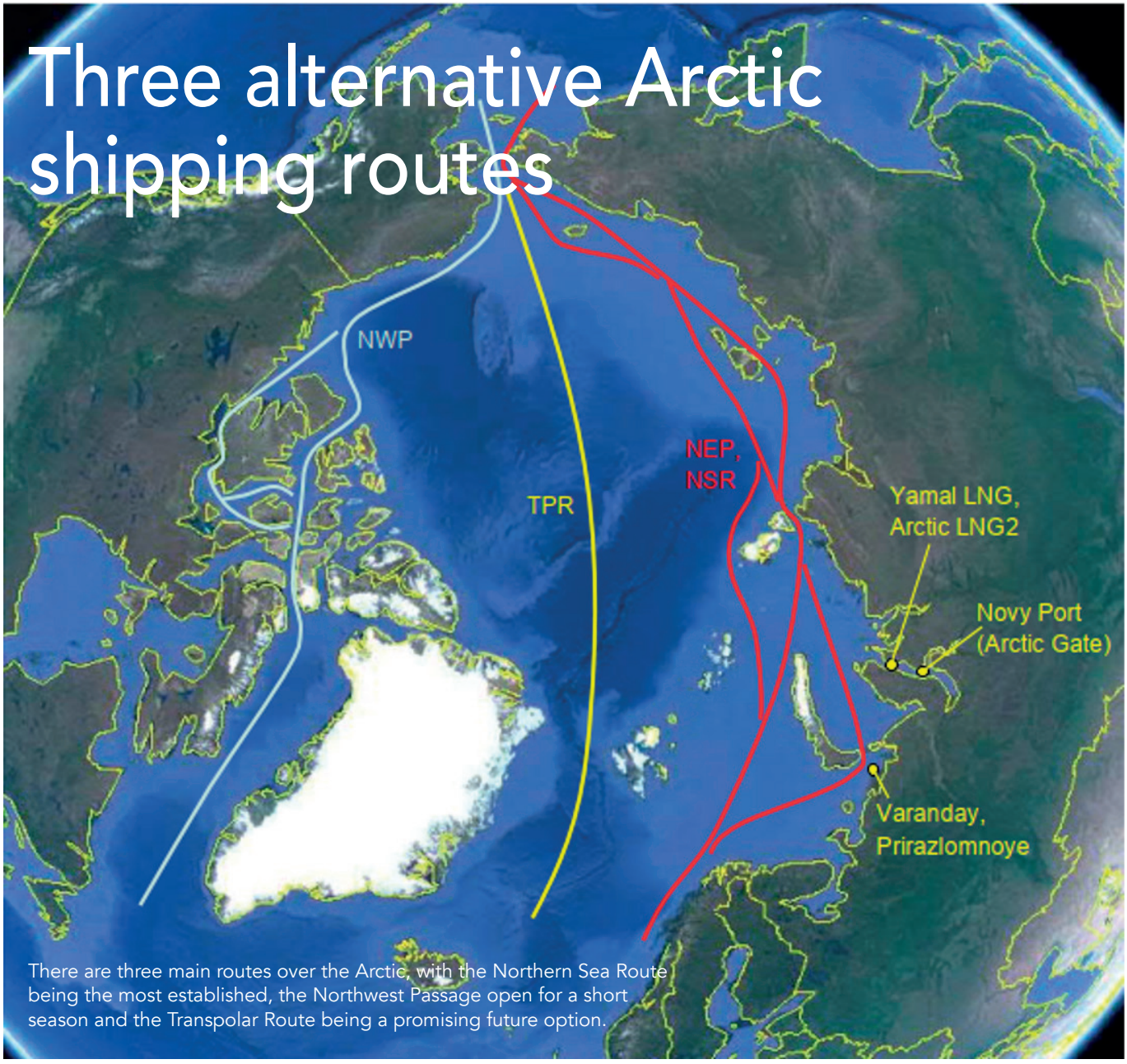


Finnish exports and imports at various harbours 2019. Source Ministry of Transport and Communications report 2022.



Distribution of merchant vessels by deadweight in Bay of Bothnia. Data from IHS Maritime Portal.

Three alternative Arctic shipping routes



There are three main routes over the Arctic, with the Northern Sea Route being the most established, the Northwest Passage open for a short season and the Transpolar Route being a promising future option.

Aker Arctic has reviewed the past season, compared alternative Arctic itineraries and evaluated future options for Arctic shipping.

"First of all, it is essential to distinguish between transit shipping and destination shipping," underlines Alexey Shtrek, development engineer at Aker Arctic Technology.

"Transit shipping utilises a certain route to transport cargo between non-Arctic ports. It is therefore shorter and saves time when compared to, for instance, passing the Suez Canal or Panama Canal. Destination shipping is cargo shipments of oil, liquefied natural gas (LNG), ore or coal from Arctic production sites to the market."

Sharp decline on the NSR

The Northern Sea Route (NSR) following the Russian Arctic coast is the most known and established Arctic route, with high levels of destination shipments year-round, utilizing specially designed Arctic vessels and supporting icebreakers to safeguard transports.

It has the longest seasonal window for lower ice-class vessels. With Polar Code Category C vessels, the NSR can be used 2–3 months (August to October). With Category B vessels, the NSR can be utilised 4–5 months (end of July to beginning of December).

"However, Arctic international transit shipping is sensitive to disturbances, and with the current political situation, a sharp drop was seen the past two years. A similar decline happened in 2014, when Russia changed the rules and regulations for the NSR transit," Shtrek explains.

No real international transit

Despite the official Rosatom statements on the resumption of NSR transit in 2023 to the volume of 2.1

million tons, there were no real international transit voyages. The main part of the cargo (1.5 million tons) was crude oil exports from the Russian Baltic ports and Murmansk, a few voyages of large bulk carriers from Murmansk, and one LNG cargo from Gazprom's Portovaya terminal.

Three subsidized round-trip voyages with general and container cargo ships between western and eastern Russian ports were also made, two of them by nuclear containership *Sevmorput*. In addition, the Chinese company known as NewNew Shipping sent a few containerships to Russian ports; on the last voyage, timber was exported from Arkhangelsk.

"Thus, despite the fact that the NSR remains the most favourable Arctic transit route by ice conditions, geopolitical risks prevent its use by international shipping companies," Shtrek highlights.

For Russia, the NSR has become even more strategically important, but Russian shipowners do not have a sufficient number of suitable ice class vessels to further extend the traditional transit navigation period.

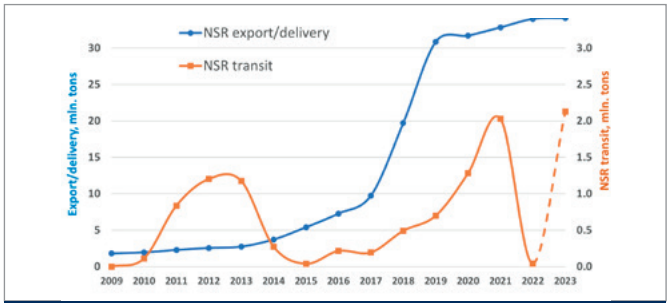
Constraints on the NWP

The Northwest Passage (NWP), along the Canadian Arctic coastline and archipelago, is an alternative route to NSR transit traffic. However, it has more severe ice conditions with multi-year ice and narrow straits, restricting the time it can be utilised. The availability of icebreaker assistance is also limited.

There are strict environmental constraints and an approval process in place to use the route. Destination shipping is mostly seasonal, except for a couple of mining projects in the Canadian sub-Arctic.

"The transit distance on the NWP is almost equal to the NSR. Furthermore, it is an established route, which, for instance, Wagenborg uses regularly," Shtrek says.

"The seasonal window, however, is very short. With Category C vessels, the route can only be used in September, for about a month. With a Category B vessel, the NWP can be sailed for approximately two months (August–October)."



While most international organisations have stopped reporting on shipping cargo on the NSR, Aker Arctic has continued to follow shipment volumes. In 2023, there were no real international transit shipments on the NSR.

The future option

The Transpolar Route (TPR) is a high-latitude route envisaged straight across the Arctic Ocean. It covers the shortest distance and uses only international waters outside national jurisdictions.

Due to high seasonal variability of ice conditions throughout the entire Arctic basin, the TPR does not exist as one fixed shipping lane but could follow a number of optional navigational routes.

Yet, the area is currently the most unexplored, uncertain, least known, with severe ice conditions of multi-year drifting ice. The known data is also old and should be updated to provide more detailed conclusions.

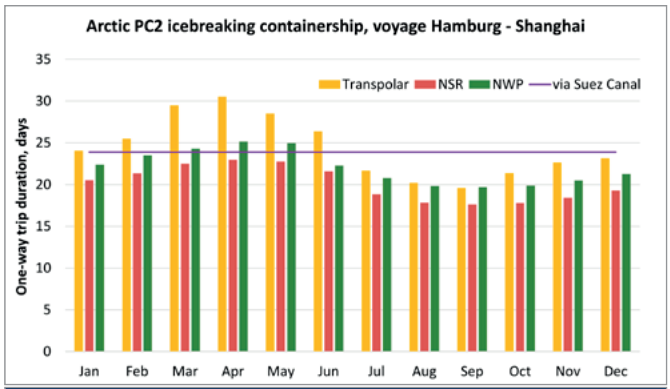
"In the future, maybe in ten years, if climate conditions allow this route to become feasible, it will have potential. Utilising route optimisation with satellite imagery to find open water paths, could open the TPR for seasonal transit shipments," Shtrek says.

"With icebreaker assistance and proper tactical navigation, a Category B vessel could already utilize high-latitude routes outside official NSR water areas during one to two months," he adds. "The Aker Arctic designed polar expedition cruise ship *Le Commandant Charcot*, a Polar Class 2 (PC2) vessel, has made regular tourist voyages to the North Pole since 2021, without any assistance."

Advice on ice trends

Aker Arctic continues to follow the situation on different cargo shipping routes. We have also evaluated how our designs are feasible to use in changing situations and on new routes.

"We are available to advise our customers on ice trends, what ice class, level and kind of power is needed for particular routes. Don't hesitate to contact us with any questions," Shtrek reminds.



A theoretical comparison of the duration to transit on the various routes according to season, with an 8000 TEU Arctic containership. Read more about our design in Arctic Passion News issue 21.

NWP Transits

Although Northwest Passage transits are still somewhat exceptional, there was nonetheless an over 40 % increase in 2023, compared to previous year.

In 2023, there were 24 complete transits by 22 large commercial vessels: 17 westbound (eight cruise ships and nine cargo ships) and seven eastbound (three cruise ships and four cargo ships). Two of the transits were return voyages within the same season.

Six of the ships were first-timers on the Northwest Passage; 12 ships had completed the voyage once before and four ships more than once. PONANT's cruise ships *Le Boreal* and *L'Austral* each completed their fifth Northwest Passage transit.

While this year saw some new operators on the route, most ships belonged to companies with prior experience from sailing the Northwest Passage. One of the regulars, Royal Wagenborg, increased its total number of full transits to 31.

Unlike on the Northern Sea Route where the media has tracked a number of non-ice-strengthened oil tankers this year, all of the transits on the Northwest Passage were by ice-strengthened vessels: three ice-class 1C cruise ships, eleven ice class 1A cargo ships, six Polar Class (PC) 6 cruise ships, one PC 5 cruise ship, and one PC 2 icebreaking cruise ship.

The Northwest Passage was ice-free for much of the season and only the first few ships were escorted by Canadian Coast Guard icebreakers. Choosing an ice-strengthened ship for such Arctic voyages is still a prudent precaution.

Scott Polar Research Institute maintains an exhaustive list of Northwest Passage transits. ■

Doctoral thesis on brash ice channels approved

Riikka Matala, Aker Arctic's senior research engineer, has been investigating brash ice channels since 2018 through both full-scale and model-scale tests. She successfully defended her doctoral thesis, **Verification of vessel resistance in old brash ice channels through model scale tests**, in a public examination at Aalto University School of Engineering in December 2023.

The winter navigation system in the Baltic Sea is vital for ensuring year-round supply security. The system revolves around an icebreaker fleet escorting ice classed merchant ships, whereby the ice classification imposed on such merchant ships are intended to ensure a safe and efficient winter navigation system in the Baltic Sea. The ice class imposes requirements on, among other aspects, the ship's performance in brash ice channels that form in shipping lanes after frequent traffic. Such performance can be verified by model scale tests.

Changes in the fleet

The winter navigation system has functioned well with the current ice performance determination procedures. However, recent environmental standards have resulted in substantial changes to the merchant fleet, with new hull shapes to meet the regulations. Thus, the thesis analyses the processes and forces contributing to a ship's resistance in an old brash ice channel to assess whether current model test practices can simulate all significant factors accurately for all bow shapes.

Based on her research, Matala proposed a new approach for performing model-scale tests in an unconsolidated old brash ice channel. The new scaling approach improves the simulation of the interaction between the ice fragments to better mirror the resistance component caused by moving ice fragments sideways.

"The merchant vessels currently being replaced by new ships were constructed 30 years ago, when the fuel price was not as important as it is today," Matala explains. "In addition, new EEDI-standards limit engine power. This development will limit the ice performance of the merchant fleet, which may impact the whole system's functionality."

Reasonable transportation costs

Accurate determination and understanding of the ice performance of ships in different ice classes are vital to monitor, control, and ultimately improve the winter navigation system.

Simulation method explored for brash ice tests

The brash ice channel was filled with 4 m^3 of ice cubes.

To further secure the reliability of ice-model-test-based performance predictions in the future, Aker Arctic works continuously to add understanding to the correlation between full-scale observations and model tests in different conditions. In 2023, we evaluated how a computer-simulated, brash-ice channel test could add value to our processes.

Aker Arctic's state-of the-art ice-model testing procedures provide highly advanced and accurate methods for evaluating a vessel's ice performance prior to construction. The currently applied model ice and model scale testing methods were originally developed for predicting maximum ice conditions for a vessel in level ice.

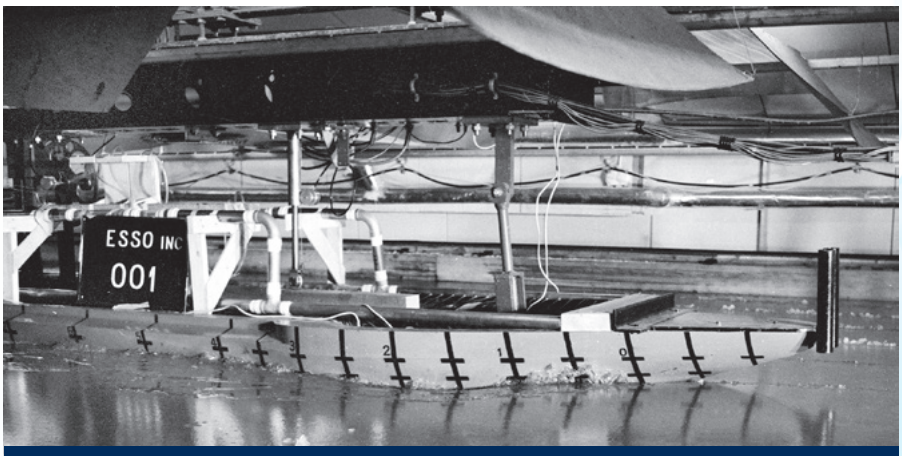
Brash ice channels differ from level ice

Brash ice increases the resistance of a ship, and thus affects the power requirement and fuel consumption of the ship on a voyage. Understanding the interaction between the ship's hull and brash ice in the channel is crucial when attempting to reduce the resistance caused by ice and managing the shipping operation.

Aker Arctic's earlier research on a ship's resistance in an old brash ice channel (Matala and Suominen, 2022) indicated that currently applied methods might be providing conservative predictions of channel resistance for certain types of modern hull shapes. This can result in unnecessary high demands on the ship's minimum engine power or in suboptimal hull shape development.

Simulation results compared to model tests

To tackle the problems of current model testing methods of predicting brash ice resistance, research trainee Juhan Voutilainen studied how a model test in a brash ice channel could be replicated using numerical simulation. As part of his master's thesis, he applied coupled computational fluid dynamics (CFD) and discrete element method



The first ice model tests were performed more than 50 years ago in Finland. Accurate performance predictions are now of the utmost importance for efficient winter navigation, both on economic and environmental grounds.

According to Matala, optimizing the whole system benefits all stakeholders. Keeping transportation costs reasonable is important both for the industry and for the citizens. Moreover, by using less fuel, both money and the environment are saved.

Reflecting on her contribution, Matala says: "I am honoured to have contributed to a solution that not only ensures the reliability of Aker Arctic's predictions in this new scenario but also serves the needs of the authorities to secure the safe and sustainable winter navigation system." ■

(DEM) approaches in order to model ship-to-ice interaction.

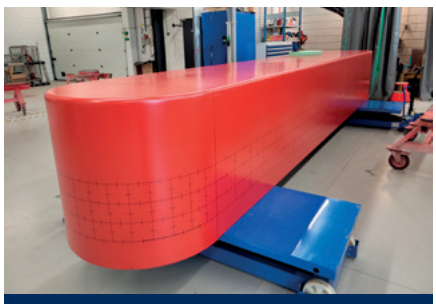
When modelling the interaction between a hull and brash ice correctly, it is necessary to understand the physics behind the phenomenon.

"The forces experienced by the hull can be split into hydrodynamical and contact forces," Voutilainen explains. "It was therefore relevant to be able to model both fluid flow and the movement of the particles."

The results of the achieved simulations, conducted with a commercial Simcenter Star-CCM+ 2206.0001 software with an existing CFD-DEM solver, were compared to experimental results. The experiments were performed with cylinder-shaped solid fresh-water ice blocks of unscaled strength to avoid an overestimation of the resistance occurring in brash ice model tests using model ice with scaled-down strength.

"Important aspects of the study were the comparison and selection of DEM-models, the selection of ice parameters, and finding reasonable simplifications to keep the computational cost under control," Voutilainen says.

The simulations were conducted at several speeds with a simple ship-like geometry without propulsion to keep the focus on the interaction between ship and brash ice, and to make the comparison with experimental results easier.



The model used was 6 metres long, which corresponds to a 120-metre-long real vessel, of an extremely simplified form, without propulsion.

Potential tool to support model tests

Voutilainen believes the studied CFD-DEM method proved itself as a potential tool for modelling a ship in a brash ice channel.

"Especially for simple cases, with Froude numbers exceeding 0.13, the potential is obvious, and the method could be used alongside traditional model tests. With some additional work, the simulation model could also be expanded to lower velocities," he clarifies.

Parameters confirmed

Aker Arctic's senior research engineer Riikka Matala has investigated brash ice channels over many years, both in full-scale tests and model tests, using the corresponding ship model in the basin. (See previous articles in Arctic Passion News issue 16/2018 and issue 19/2019.)

She is excited about the results of Voutilainen's research.

"Maybe the most important lesson for us was the confirmation that we had correctly understood the parameters which dominate the test results in a brash ice channel, when the brash ice consists of solid ice cubes," Matala highlights.

The crucial ice parameters were concluded to be brash ice porosity, shape and size of individual ice pieces, and both static and kinetic friction of ice-ice and ice-model contacts.

"It turned out that one significant improvement we achieved in this work, compared to our earlier attempts with simulations, related to the physical friction measurements we achieved for the ice type used in the tests," Matala says.

Both static and kinetic friction coefficients were measured for ice-ice contact and in ice-model contact. The measurement results from the friction measurements were directly utilized in the simulation.

Accurate predictions require research

"In addition to our customer projects, we constantly conduct research work to ensure that our methods are of highest standards and accurately predict real-life situations which vessels face after delivery," Matala says.

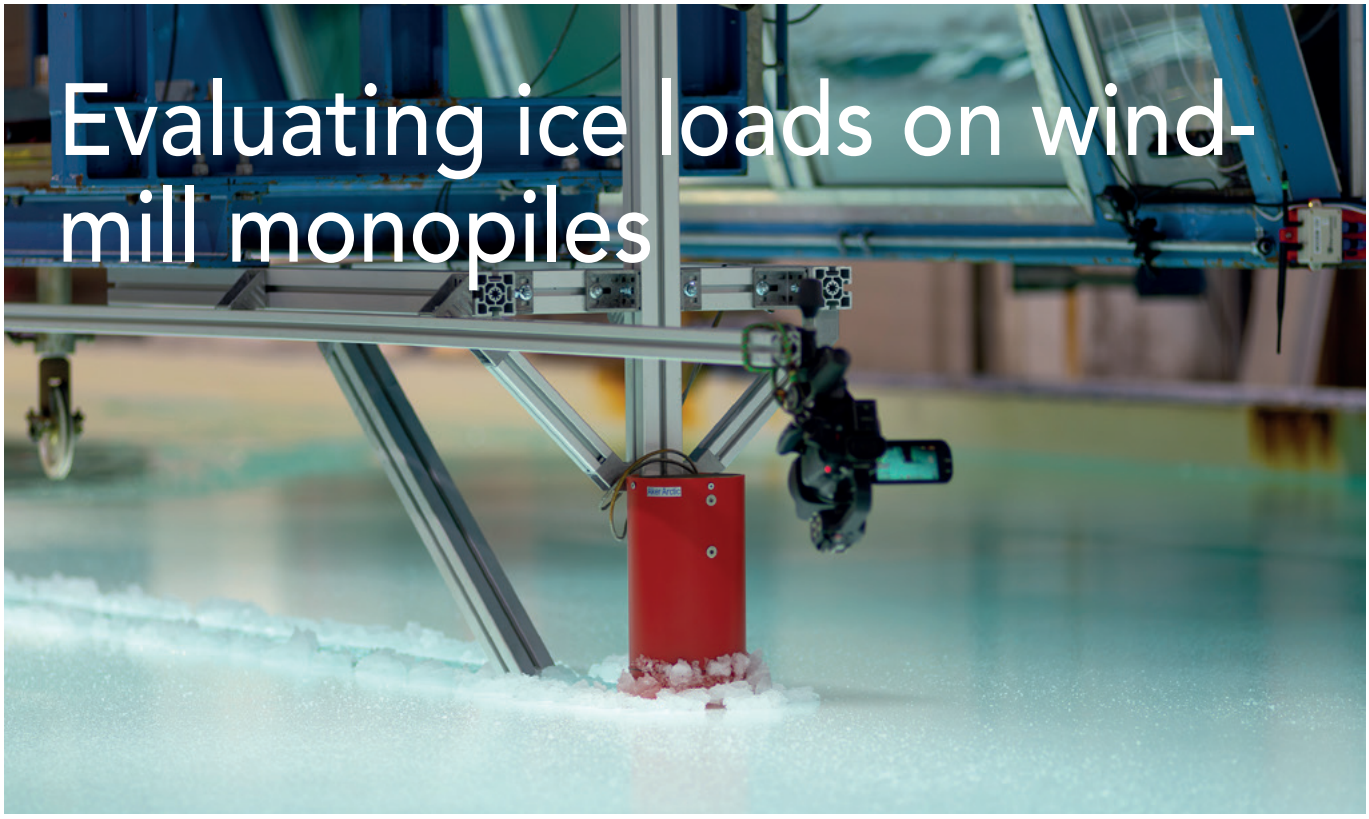
According to Matala, it would be interesting to repeat the same model test and simulation correlation study on a different bow shape, and later to add hulls with propulsion, to learn more about the possibilities of simulation.

"All research related to ships transiting old brash ice channels is especially interesting, as it is the determining operational condition for granting ice class according to the Finnish-Swedish ice class rules," she adds.

Chief Inspector Ville Häyrynen from the Finnish Transport and Communications Agency comments:

"The core aim of the Finnish-Swedish ice class rules is to allow ships safe and efficient winter operation in Finnish and Swedish ports. These rules are the result of gathering real-world, research and model test data over a relatively long period of time. Further understanding of a ship's resistance in an old brash ice channel could allow for more accurate requirements for the engine power of a ship in the rules. This in turn would make winter navigation more economical in the future, as the rule required minimum engine power would more closely match the actual operational requirements." ■

Evaluating ice loads on windmill monopiles



As part of Aker Arctic's own research and development work, a series of ice model tests were conducted in November 2023 to investigate the ice loads affecting windmill monopiles.

Offshore windmills require robust foundations to withstand the harsh marine environment, including ice and waves. Similar to the planning of icebreakers or other ice-strengthened vessels, the testing of offshore structures with scaled models is a cost-efficient method to verify design adequacy before construction begins, ensuring suitability for the intended operational area.

Crushing strength is crucial

Aker Arctic's previous structural ice model tests have focused on researching cone-shaped structures where bending strength was determined to be the best ice scaling option. However, when testing vertical structures, such as monopiles, it is deemed crucial to scale the model ice in relation to its crushing strength.

"Model ice differs from natural ice in its homogeneity," explains Topi Leiviskä, Team Leader, Model Tests and Facility at Aker Arctic. "Additionally, model ice can be scaled for either crushing forces or bending forces, but not for both simultaneously."

Research engineer Toni Skogström adds, "We adhere to a systematic scaling and testing approach. While similar tests have been performed before, we aimed to delve deeper into vertical structures to identify the most appropriate model ice parameters."

Full-scale data has been gathered from the offshore lighthouse Kemi I, located in the Gulf of Bothnia, in 1984–1986

Four pillar sizes investigated

The research team examined four different pillar sizes across four distinct ice thicknesses with scale ratios ranging from 1:89 to 1:16. This approach allowed the team to extrapolate data trends for a full-scale monopile with a 6.67-metre diameter in 80 cm thick ice.

"In real-life conditions, a windmill monopile will be wider than this size, but we opted for a diameter that yields the most data for our research," Leiviskä says. "It is the scaling ratio, rather than the absolute size, that is of greater interest in this case."

Straightforward testing procedure

Every model test requires a singular ice sheet which entails preparation and freezing time. As a result, each of the monopiles was tested in separate testing slots.

In November 2023, the various pillar shapes prepared for the tests were instrumented and mounted on a mobile platform. The aim was to capture comprehensive data on ice loads. This was achieved by moving the setup across the ice basin at different speeds in level ice conditions while measuring the global forces at the water line.

Skogström clarifies the unique failure patterns of natural ice compared to model ice, highlighting

why speed is important and how it affects the distribution of pressure.

"Natural ice breaks in multiple ways contrary to model ice. In nature, the highest pressure is focused on the centreline. The faster the speed, the more centred the pressure becomes. However, in low speed, the crushing pressure is spread wider."

He predicts that while the tests were straightforward, analysing the data will be a complex and insightful process.

Conforming with calculations

The current monopile design calculations widely used adhere to ISO standards, yet lack full-scale empirical data for validation.

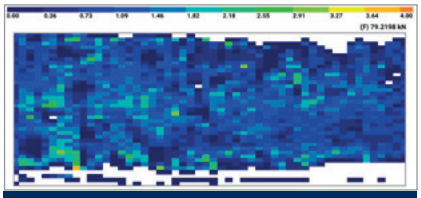
However, full-scale data has been gathered from the offshore lighthouse Kemi I, located in the Gulf of Bothnia, in 1984–1986. This area is ideal for tests in extreme conditions including fast ice, moving ice sheets, pack ice fields and ice ridges.

"Our goal with the monopile tests is to investigate how well the standards align with our findings," says Leiviskä. "Through our research, we aim to enhance the reliability and safety of windmill structures in icy conditions, potentially leading to more durable and cost-effective designs. This could significantly contribute to the advancement of sustainable energy solutions in harsh marine environments."

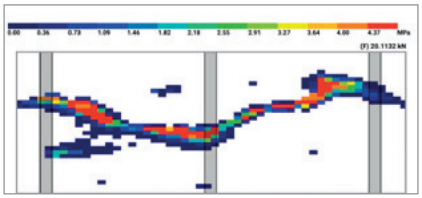
The research team anticipates publishing the results following a detailed analysis and review. ■

Our research aims to enhance the reliability and safety of windmill structures in icy conditions.

Natural ice breaks in multiple ways contrary to model ice:



Pressure distribution at a continuous creep speed when ice failure is ductile.



Pressure distribution at a continuous faster speed when ice failure is brittle.

Source: Määttänen, M., Marjamaa, P., Saarinen, S. & Laakso, M. 2011. Ice crushing tests with variable structural flexibility. Cold Regions Science and Technology. Vol. 67. S. 120–128.

NEWS IN BRIEF

100 years of Finnish icebreakers

March 2024 marks the 100-year anniversary for the first icebreaker designed and built in Finland.

Voima was a Finnish and later Soviet steam-powered icebreaker. Laid down in Tallinn in 1916 and fitted with boilers in Danzig (today Gdansk) in 1918, the unfinished hull was towed to Helsinki in 1920 and rebuilt by Sandvikens Skeppsdocka och Mekaniska Verkstads Ab in 1923–1924. After two decades of successful service in Finland, *Voima* was handed over to the Soviet Union as part of the war reparations in 1945.

Source Wikimedia commons.

Voima was the first state-owned icebreaker acquired by an independent Finland. She can also be considered as the first state-owned icebreaker designed by Finnish naval architects and delivered by a Finnish shipyard. ■

Davie and Helsinki Shipyard celebrated new beginning

In November 2023, the Canadian shipbuilding company Davie announced that it had completed the acquisition of Helsinki Shipyard. The owners, employees, stakeholders, and even one icebreaker later gathered at the shipyard to celebrate the new beginning, which is significant both nationally and internationally. The new shipbuilding company formed was named DNY Finland Oy.

The historic transaction combines the skills, experience, and capabilities of two leaders in Arctic shipbuilding and other high-value products. While the Canadian and Finnish shipyard will be separate legal and operating entities, the business headquarters will remain in Québec. The transaction will create opportunities for employees, encourage collaboration, facilitate the transfer of know-how, provide access to resources, and stimulate export potential. ■

Aker Arctic team visited Tampere

In December 2023, the Aker Arctic team visited the city of Tampere, located about 180 km north of Helsinki. In Finland, we usually celebrate something called "Little Christmas" with our colleagues before the beginning of the festive season dedicated to family traditions.

The highlight of our trip was learning about the steel foundry process at Tevo Lokomo, a company manufacturing demanding steel and bronze solutions for the shipbuilding, offshore, mining, steel, and energy industry. We then visited Finnish textile manufacturer Finlayson's 100-year-old steam engine at the Werstas-museum, explored the beauty of the city filled with Christmas decorations, and enjoyed a tasty dinner in the company of dear colleagues. ■

ANNOUNCEMENTS

Victor Grönroos has joined Aker Arctic as a project manager in the ship equipment and special projects business unit.

Victor graduated with a master's degree in Naval Architecture from Aalto University in 2013. Before joining Aker Arctic, he worked at Helsinki Shipyard for ten years. During his years at the shipyard, he held different positions in project and middle management in the structural design and project departments.

Joakim Majander has joined Aker Arctic as a senior development engineer, working with electronics, measurement systems and software development.

Joakim graduated from the Technical Physics Department at Helsinki University of Technology (today Aalto University) in 1995. Joakim has worked at VTT, Fortum and ÅF-Consult as a CFD engineer and product manager before starting his own company developing inclining sensors for boats and ships in 2014.

Roman Repin has joined Aker Arctic as a consulting engineer in the consultancy and technology development team.

Roman graduated from the Ship Structural Mechanics Department of St. Petersburg State Marine Technical University in 2013, with a master's degree in Applied Mechanics. He began his career at Krylov State Research Centre in St. Petersburg, Russia. After relocating to Finland in 2016, Roman worked as a researcher at Aalto University until he joined WSP Finland's wind engineering team. Currently, besides his work at Aker Arctic, Roman is pursuing part-time doctoral studies at Aalto University.

Henrik Strand has joined Aker Arctic as a measurement engineer in the ice model tests and facility team.

Henrik graduated as BASc. Electrical Engineer from Arcada University of Applied Sciences in 2013. Before joining Aker Arctic, he worked at a consulting engineering company for 10 years as an electrical engineer specializing in HVAC (heating, ventilation and air conditioning) systems and archipelago projects.

Julian Wehnert has held the position of head of offshore wind services at Aker Arctic since February 2023.

He has ten years of hands-on experience in the wind power industry, developing projects from their early stages until construction, as well as managing stakeholders. In his current position, Julian is responsible for developing offshore wind service consulting at Aker Arctic. Besides his work, he finished his master's degree in engineering at Aalto University in 2023, investigating the lifecycle costs of green hydrogen. ■