Aker Arctic Technology Inc Newsletter

September 2018

# Arctic Passion News

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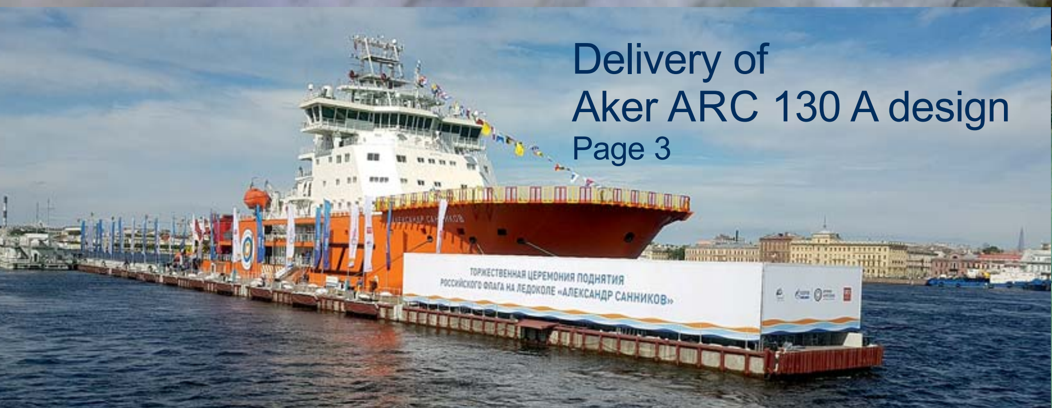

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## Announcements

**Jianhua Mei** has been appointed as Regional Manager for China from August 2018. He will be located in Aker Arctic Technology's new Shanghai office at the FinChi Innovation Center in Zhangjiang Hi-tech park in Pudong. Jianhua Mei will work with sales and marketing, customer support and with developing the market in China. For the past thirteen years he has worked in sales and marketing at Shanghai Jiangnan Changxing Heavy Industry Co. (a merger of Jiangnan Shipyard, SWS and Hudong Shipbuilding). Jianhua Mei graduated as a Naval Architect and Marine Engineer from Huazhong University of Science and Technology, China, in 2005. In addition, he completed a Master's degree in Industry Engineering at the same university in 2015.

**Jillian Adams** has been appointed Project Engineer in the Machinery & Structures department. She did her Bachelor of Applied Science at the University of Waterloo in Ontario, Canada and has now pursued a Nordic Master in Maritime Engineering, which included one year at Chalmers University of Technology in Sweden and one year at Aalto University in Finland. She finished her Master's thesis, Application of an Extended Inverse Method for the Determination of Ice-Induced Loads on Ships, at Aker Arctic in August. Read about her research findings on page 13.

# Dear Reader,

The development of icebreaking technology and the design of icebreaking vessels are the key fields for Aker Arctic and what we have been working with for decades. In today's world new digital technology is coming strongly to all industries. In the marine business the emphasis right now is on the development of automated systems and even autonomous vessels. The first area of application may not be in ice-infested environments, but the development is strong in Finland where we cannot neglect winter and ice in the Baltic Sea. We have also taken our first steps in this development: a successful experiment was conducted with a small autonomous ferry in our ice test basin last June. This experiment proved how well-developed our existing systems are and gives us the possibility to support other developers in the controlled but challenging test conditions that can be created in the basin.

At the same time development of icebreaking vessels continues on other levels. Today's trend is to utilise liquefied natural gas (LNG) which brings the benefits of clean fuel. Infrastructure has and is being built to make it possible to use LNG fuel even in remote arctic areas. Certain technical issues need to be solved but overall LNG proves to be a practical fuel for most ships.

As we all know, many nations are suffering from a lack of modern icebreakers and are making plans for renewal. Canada has taken a quick step to remedy their position and have purchased three existing icebreakers from Sweden. These ships will require some refurbishment, but the model gives the Canadians a rapid solution to renewing their national icebreaker need.

I hope you find the articles in this issue of Arctic Passion News interesting and provide you with the latest information on technological development in polar shipping.

*Sincerely,*
*Reko-Antti Suojanen*

# Aleksandr Sannikov enters service in the Gulf of Ob


*Aleksandr Sannikov, constructed at Vyborg Shipyard, was delivered in Saint Petersburg at the end of June.*

The first of two powerful icebreakers designed for the Arctic Gate oil terminal and constructed at Vyborg Shipyard, *Aleksandr Sannikov*, was delivered at the end of June in Saint Petersburg and has now begun work in the Gulf of Ob.

The icebreaker will be stationed at the Arctic Gate oil terminal and used to support year-round transportation of oil from the Novoportovskoye field onboard icebreaking shuttle tankers. The loading tower is located 3.5 kilometres offshore in the central Gulf of Ob, an area characterized by shallow water and harsh winters during which the ice can grow up to two metres thick and remain in place for nine months. With intense tanker traffic the partially refrozen ice rubble around the terminal can become several metres thick, reaching almost to the bottom of the sea.

**State-of-the-art solutions**

*Aleksandr Sannikov* is based on the Aker ARC 130 A design developed by Aker Arctic. Compared to the Finnish icebreaker *Polaris* that was used as the parent design, the new icebreaker has been given additional ice strengthening and higher propulsion power to match the more challenging operational conditions of the Arctic. The vessel is also thoroughly winterized to operate in ambient temperatures as low as -50°C during the winter months.

"*Aleksandr Sannikov* is designed to operate efficiently in all environmental conditions encountered in the Gulf of Ob," says Project Engineer Tuomas Romu.

The diesel-electric propulsion system consists of three azimuthing propulsion units, two in the stern and one in the bow, giving the vessel excellent manoeuvrability during icebreaking operations. In open water the transverse bow thruster provides DP2 level dynamic positioning capability.

"Both features are important when operating year-round in close proximity to other vessels and the loading terminal," Romu adds.

**Important secondary duties**

In addition to icebreaking and ice management, *Aleksandr Sannikov* is equipped for a wide range of important secondary duties while on standby at the offshore terminal. Her powerful external fire-fighting system meets the most demanding class notation from the Russian Maritime Register of Shipping (RS). She also carries multiple workboats and oil spill response equipment and has dedicated storage tanks for recovered oil. The open aft deck served by a 26-ton crane can be used to transport containers and other cargo. The forward helideck is dimensioned for large Russian helicopters such as the Mi-8.

*Aleksandr Sannikov*'s sister ship, *Andrey Vilkitsky*, is currently under construction at Vyborg Shipyard and will be delivered later this year.

"These two vessels are the most powerful diesel-electric icebreakers ever constructed in Russia," Romu says. "In terms of icebreaking efficiency and overall operational capability, there are no similar icebreaking vessels in service anywhere in the world."

Full-scale tests are planned for next winter. ■

**Technical specifications:**

| | | |
|---|---|---|
| Length: | 121 m | Propulsion: Diesel-electric; two 7.5 MW ABB Azipod units in the stern and one 6.5 MW Azipod unit in the bow |
| Beam: | 26 m | |
| Design draught: | 8 m | Ice class: RS Icebreaker8 |

*In terms of icebreaking capability, the Aker ARC 130 A design is comparable to the well-known nuclear-powered icebreakers Taymyr and Vaygach, but requires about 40% less propulsion power.*

Photograph: PJSC Gazprom Neft

*The 42,000 DWT shallow-draught Shturman Albanov-class tankers built by Samsung Heavy Industries loading oil at the Arctic Gate terminal utilise the Double Acting concept and hull form developed by Aker Arctic.*

# Port icebreaker Ob has been launched

## The highly advanced port icebreaker *Ob*, designed for keeping the arctic harbour in Sabetta open and to assist LNG tankers in berthing and loading at the terminal, was launched at Vyborg Shipyard on the 21st of June.

Photograph: Alexander Polunin/Sudostroenie.info

During the cold winter months a thick layer of consolidated ice rubble forms in harbours when the ice is constantly broken by the visiting ships. As the broken ice pieces mix with cold water and freeze again, the brash ice can grow to be several metres thick. *Ob* is based on the Aker ARC 124 design developed to operate efficiently in thick brash ice which is the most challenging condition in Sabetta harbour.

"Manoeuvrability has been taken to a new level with four azimuthing propulsion units, two in the bow and two in the stern," says Project Manager Mika Hovilainen.

"The icebreaker will be very capable in the harbour basin in Sabetta where it will assist the large LNG tankers in berthing. Additionally, the propulsion units will be efficient in flushing the ice away when cleaning the quayside from ice."

The ship will also be equipped with ABB's new Onboard DC Grid, an electrical system which offers the advantage that the main diesel generators can run at variable speed rather than fixed speed. An additional feature is Wärtsilä's 31 series main engine with online engine monitoring, improved fuel economy and a modular design. The installed propulsion power will be 12 MW. ■



# LNG-fuelled 40 megawatt line icebreaker for Rosatomflot

**Rosatomflot and Aker Arctic signed a contract to design a powerful line icebreaker for escorting commercial vessels sailing year-round in western areas of the Northern Sea Route: mainly the Kara Sea, the Gulf of Ob and the Yenisey river. The icebreakers will use liquefied natural gas (LNG) as fuel.**

The new line icebreakers will replace the current ageing nuclear-powered shallow draft icebreakers and respond to increased traffic in the area together with the new nuclear-powered icebreakers currently under construction in Russia. The vessels will operate with LNG fuel, which is readily available in the operational area from the Sabetta terminal with a fuel capacity sufficient for 30 days operation in the prevailing ice conditions.

### One month autonomy

The project began in 2017 with a feasibility study to investigate if sufficient autonomy time can be achieved with LNG fuel. In addition, two alternative propulsion systems were compared on the design board and in the ice model basin. As a result an autonomy time of 30 days with LNG fuel was found to be feasible with the customer preferring conventional shaftline propulsion for the line icebreaker.

The new icebreakers will replace existing icebreakers operating in the area which are approaching the end of their service life and need to be renewed. The cargo traffic in the area is also increasing which means the need for icebreaker assistance is growing.

### A huge leap forward

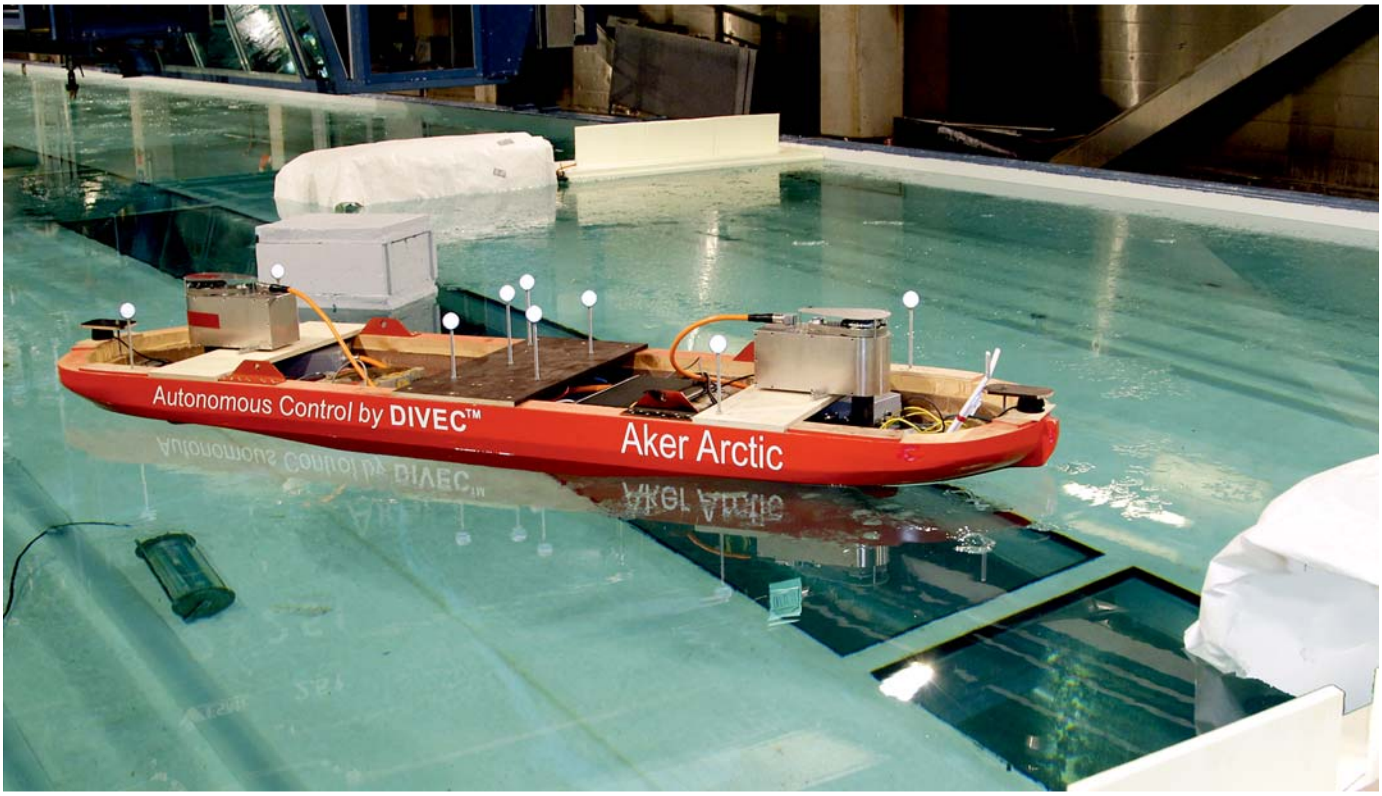
Compared to previous LNG-fuelled icebreakers the new 40-megawatt line icebreaker is a huge leap forward. “The new vessel design will have the same capabilities that could previously only be achieved with nuclear-powered icebreakers,” says Project Manager Mika Hovilainen. “Additionally, the new icebreaker will have sufficient autonomy time for operation in the harshest ice conditions in the area, which was a special challenge with LNG fuel.”

The new 40-megawatt icebreakers will be even more powerful than the well-known nuclear-powered icebreakers *Taymyr* and *Vaygach* built in Finland in the late 1980s. As LNG is available locally from Sabetta there is no need to travel long distances for bunkering. The icebreaking performance of the new design is 2.5 metres of multi-year level ice, comparable to the older *Arktika*-class nuclear icebreakers. The new vessels will be about 160 metres long and 30 metres wide.

”Compared to previous LNG-fuelled icebreakers the new 40-megawatt line icebreaker is a huge leap forward.”

# First autonomous model test in ice tank

An autonomous ship model was successfully tested in Aker Arctic's ice model test laboratory in June. In the demonstration test the ship model was able to detect obstacles in the ice tank utilising onboard sensors, manoeuvre around them without operator input, and dock itself automatically to a target pier.




*The ice model test laboratory has been prepared so that it is easily adaptable to customers' needs.*

The wireless model used in the test was equipped with battery-powered propulsion units, data transfer to the "shore facility", and an autonomous navigation system that routed the vessel around obstacles detected by the onboard sensors.

**Plug-and-play**

The various components were connected using Distributed Intelligent Vessel Components (DIVEC™), a specially developed network framework that provides a modern protocol for connecting devices and transferring necessary data between them.

"The DIVEC™ software architecture allows reliable communication between different software components," says Development Engineer Jukka-Pekka Sallinen.

"Expanding the network is easy due to the automatic node discovery, and its centralised configuration management enables the development of plug-and-play devices. It is therefore easy to connect third-party software to the model unit such as propulsion control, sensors, dynamic positioning (DP) systems or autonomous control systems, according to the purpose of the testing."

**Successful test**

The test was carried out with a double-ended ferry model, 3.4 metres long and 0.8 metres wide. It was equipped with azimuth thrusters and two lidar sensors (laser radars), one in each end of the model. The vessel was programmed to perform the task of leaving one pier, travel to its destination pier, dock, then undock and return to origin and dock. Along the route were different obstacles.

The vessel was equipped with a reactive route planner; the lidars detected obstacles and the route planner constantly rerouted the vessel to avoid the obstacles in the environment. The planned route and rerouting could be followed on a computer screen. The environment was scanned with a fast refresh rate in order for the model to reliably detect changing obstacles.

"The test was successful and gave an example of how testing can be carried out," Sallinen says. "At the time of the test the International Marine Design Conference (IMDC) was taking place nearby, and most of the spectators were participating in the conference. The comments we received after the test were extremely positive."

**Ready for customer projects**

“Our aim has been to prepare the ice model test laboratory in such way that we can offer an easily customised testing facility to companies developing autonomous shipping,” Sallinen continues.

“We have made major improvements to the testing facility and equipment, such as installation of a wireless system, development of new propulsion units and propulsion control units for thrust allocation. The use of battery power and wireless networks allow us to offer customers completely cable free models.”

All systems are connected through DIVEC™ and it is therefore easy to add new third-party software components depending on the customer's needs.

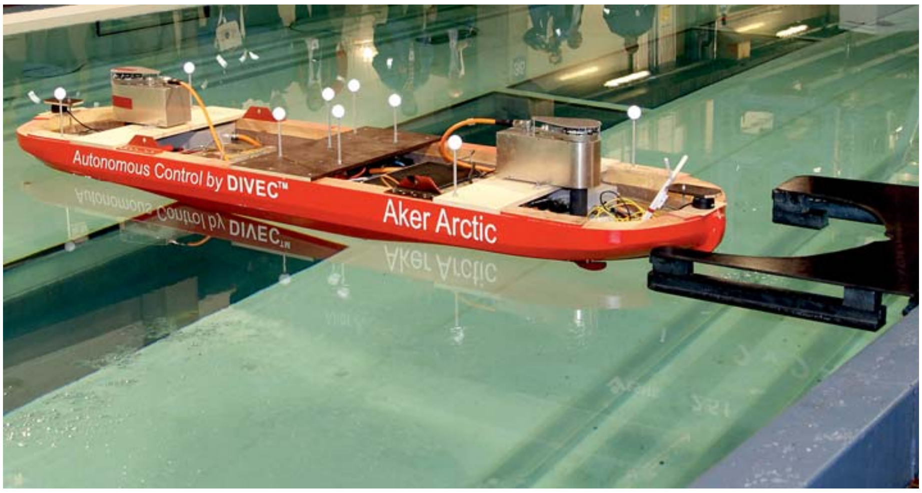
“For example, in the real world vessels use motion reference units, gyrocompasses and satellite navigation systems to establish their location and heading, which is a prerequisite for autonomous operations,” Development Engineer Olli Kokko explains. “However, in the model basin we use a motion capture camera system, which simulates a satellite navigation system and gyrocompass for this purpose. The camera system is from a third-party supplier and integrated to the system with the help of DIVEC™.”

Furthermore, Aker Arctic has a co-operation agreement with Aalto University in Otaniemi for the joint use of both ice tanks for model testing and research purposes.

“When the Aalto ice tank is ready in the near future we can also test autonomous vessels in their 40 by 40 metres square tank which offers an additional benefit especially when testing manoeuvring and other operative model tests,” Sallinen says.

“We are now ready to welcome customers for testing their autonomous vessel systems and help out with their different development stages.”

The video of the model test can be seen at https://youtu.be/7iTMdHjGoso. ■




*In the demonstration test the ship model was able to detect obstacles in the ice tank utilising onboard sensors, manoeuvre around them without operator input and moor itself automatically to a target pier.*


*All systems are connected through DIVEC™ and it is therefore easy to add new third-party software components such as propulsion control, sensors, DP systems or autonomous control systems, according to the purpose of the testing.*

*The test was carried out with a double-ended ferry model, 3.4 metres long and 0.8 metres wide. It was equipped with azimuth thrusters and two lidar sensors (laser radars), one in each end of the model.*

## Meet Jukka-Pekka Sallinen

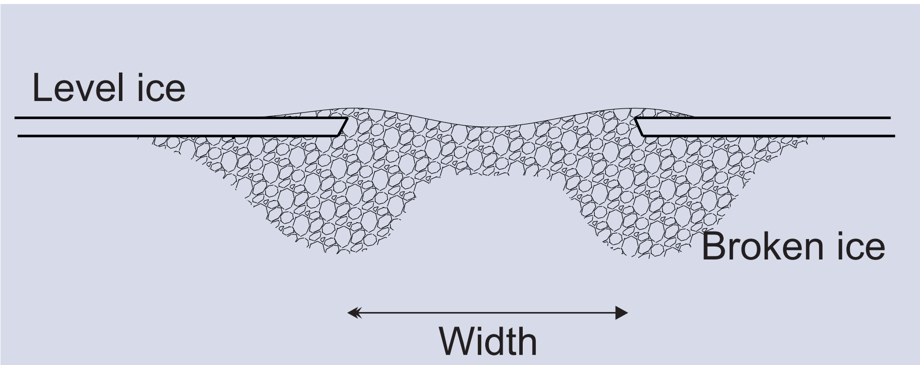
Jukka-Pekka works with various development projects, especially IT related projects, such as the Aker Arctic Ice Simulator, autonomous vessels and the Ice Load Monitoring System. He graduated from Aalto University in 2013 and started to work full time at Aker Arctic with ice model testing. In 2016 he continued the Ice Simulator development and moved to the Electronics and IT-department after it was established.

Jukka-Pekka enjoys longboarding and playing the bass in a band in his spare-time. He also likes working on his two motorcycles and playing with his dog.

# Full-scale tests in brash ice channel

*The researchers alternated with walking to the middle of the channel to take measurements while the other two stayed on the consolidated layer taking notes with a rope tied to the sledge, ready to pull it back if something happened.*

Last March three Aker Arctic engineers travelled to Kemi in Bay of Bothnia, rented a snowmobile and went out on the sea ice in search of a brash ice channel for full-scale measurements.




*A brash ice channel is filled with ice blocks which pile up towards the edges and is thinner in the middle. Source: Sandkvist, J., 1978. Problems in Keeping Year-Round Navigation in the Luleå Harbour, IAHR-78.*

Aker Arctic is leading a research project with the aim to ensure that brash ice model tests in all model testing facilities correspond with reality. A series of model tests were carried out in the ice laboratory last year, but due to the variations in the test results, full-scale channel tests were required.

**Extensive measurements**

Research Engineers Riikka Matala, Toni Skogström and Development Engineer Jukka-Pekka Sallinen dressed warmly with floating safety clothes and headed out to balance on the ice blocks in one of the brash ice channels outside Kemi to take measurements.

"We acquired a sledge which could carry the drilling equipment and also serve as a rescue boat in case one of us would fall into the freezing water," Matala says.

A brash ice channel is filled with ice blocks which pile up towards the edges and is thinner in the middle. It is kept unconsolidated during winter time by icebreakers and daily vessel traffic, but the surface ice blocks may at times freeze to form a thick, consolidated layer. The floating ice layer is thick enough to walk on, even when unfrozen, as during the test.

"We alternated so that one of us would walk to the middle of the channel to take measurements, while the other two stayed to take notes on the consolidated channel edge with a rope tied to the sledge, ready to pull it back if something happened," Skogström explains.

In total eight profiles were measured from different points of the channel along a distance of 2.5 kilometres, which is an extensive series of measurements. The average thickness of the middle channel was measured to be one metre, which was also the requirement for the test. The thickness on the sides of the channel was measured to be about two to three metres.

**Successful tests**

The vessel used for the full-scale test was cargo vessel *Eeva VG*, owned by Meriaura Ltd. She is a 103-metres-long and 13.6 metres wide dual-fuelled dry cargo carrier based on the VG EcoCoaster design, jointly developed by Meriaura Group, Foreship and Aker Arctic Technology a few years ago. Matala praises the help and assistance received from Meriaura and the ship crew.

"According to the Finnish-Swedish ice class rules, a 1A class vessel has to be able to navigate at a speed of at least 5 knots in a brash ice channel with one metre thickness," Matala continues.

▶

"We will now perform model tests in the ice basin with the same vessel model to see how well the tests correspond with reality."

## The model tests will be performed in three different ice-channels, which all fulfil the current requirements in the rules.

"The aim of the project is to test three different ways of modelling brash ice and to compare the behaviour to full scale, using the same vessel. The most reliable modelling method will then be adopted for future use. The ultimate goal is that model tests would correspond to real life in the best manner in order to give ship designers reliable guidelines for building safe vessels that correctly fulfil the ice class requirements," Matala emphasises.

The project is funded by the Finnish-Swedish Winter Navigation Research Board.

Read more about the results in next issue of Arctic Passion News. ■

*Depending on the intensity of traffic and the temperature the surface ice blocks may freeze together to form a thick, consolidated layer. This was not the case during the test, but the floating ice layer was still thick enough to walk on.*

*A sledge was acquired which could carry the drilling equipment and also serve as a rescue boat in case someone would fall into the freezing water.*

*A snowmobile was used to travel to the brash ice channel chosen for the test.*

Photograph: Meriaura Ltd.

*The vessel used for the full-scale test was cargo vessel Eeva VG, owned by Meriaura Ltd. She is a 103-metres-long and 13.6 metres wide dual-fuelled dry cargo carrier based on the VG EcoCoaster design, jointly developed by Meriaura Group, Foreship and Aker Arctic Technology. Ice model tests were performed in Aker Arctic's ice laboratory in Helsinki.*

*Research Engineers Riikka Matala, Toni Skogström and Development Engineer Jukka-Pekka Sallinen braved the Finnish winter, dressed warmly with floating safety clothes and headed out to balance on the ice blocks in one of the brash ice channels outside Kemi for the full-scale test.*

## Meet Riikka Matala

Riikka graduated from Aalto University in 2012 specialising in both energy engineering and naval architecture. She had worked at Aker Arctic previously during holidays and part-time in particular projects but moved into working full time with model testing after her graduation. She runs tests in both the ice model testing facility and full-scale tests, as well as participates in research projects.

In her free-time Riikka enjoys spending time with her family, gardening and playing the saxophone in a big band.

# Aker Arctic assists Equinor with station keeping trials

## Equinor and Viking Supply Ships executed a series of station keeping trials in ice in the Bay of Bothnia during March 2017 with a primary focus on measuring managed and unmanaged ice loads on a moored stationary vessel.

Viking Supply Ships provided two vessels for these trials: *Magne Viking* and *Tor Viking*. *Magne Viking* acted as the stationary vessel and *Tor Viking* as the support vessel, performing ice management as well as other duties.

Essential to the success of the trials was ensuring that station keeping operations occurred in the presence of realistically managed ice, while ensuring the overall safety of the operations. The ice risk management was the responsibility of the Lead Ice Advisor Erik Almkvist, along with the vessels' masters. Planning of the ice management operations was a group effort, with Aker Arctic assisting with ensuring that the ice management was conducted in a realistic manner, while meeting the demands of the station keeping trials. For this, Aker Arctic utilized its ice management prediction software (AIMS) to simulate the operation both prior to and during the trials.

**Verification of the prediction tool**

Although the primary objective of the trials was to measure loads on the station keeping vessel, the trials provided an excellent opportunity to learn and collect data about ice management operations. A secondary objective was therefore to verify the performance of AIMS. This was achieved whilst performing ice management for the station keeping trials as well as during dedicated tests designed specifically to verify a variety of components within AIMS.

Mike Neville, a Naval Architect from Aker Arctic Canada's office, accompanied Equinor representative Francesco Scibilia onboard the *Tor Viking* during the trials to assist with the planning, execution and documentation of the ice management operations. Daily duties consisted of developing a plan for the ice management operations, documenting the operations, collecting ice

*Francesco Scibilia (left) and Mike Neville (right) during Station Keeping Trials. Photo Courtesy of Viking Supply Ships*

management data, and comparing AIMS results to the observations. Having Neville onboard during the trials ensured that the ice management operation was documented in such a way that it could support the calibration of the ice management software AIMS after the trials were complete.

**Dynamic approach**

Due to uncertainty in what conditions would be encountered during the trials upfront planning was very challenging. Preparations included ensuring adequate planning tools were available and performing simulations for a range of possible conditions that could be encountered. However, a dynamic approach was utilized for planning the trials, allowing the project team to adapt to the daily conditions. For each station keeping test performed in managed ice a target floe size was specified. An ice management strategy would then be developed that would achieve the desired floe size while maximizing the value for the model calibration. Neville then simulated an ice management strategy using AIMS to define the required parameters required for the vessel's crew to generate the correct floe size distribution before the operation took place.

Several ice management techniques were utilized during the trials. The techniques were based on the effectiveness of managing the ice as well as the feedback from Viking Supply Ship's crew on the ease or difficulty in performing the desired maneuvers. As much as possible techniques were selected that simulated how a real ice management operation would be conducted. However, care had to be taken not to over-manage the ice, as it was desirable to perform the station keeping trials close to the limits of the *Magne Viking*.

## Overall the AIMS model turned out to be a useful tool for the station keeping trials.

The ability to run AIMS in the field provided a quick reference check of the validity of the model and allowed the ice management tactics to be adjusted to achieve the desired level of ice management efficiency. Some initial data analysis has been conducted which indicates that AIMS can reliably predict the floe size produced by ice management operations.

More information about the station keeping trials can be found in the proceedings of the 37th International Conference on Ocean Offshore & Arctic Engineering (OMAE 2018). ■

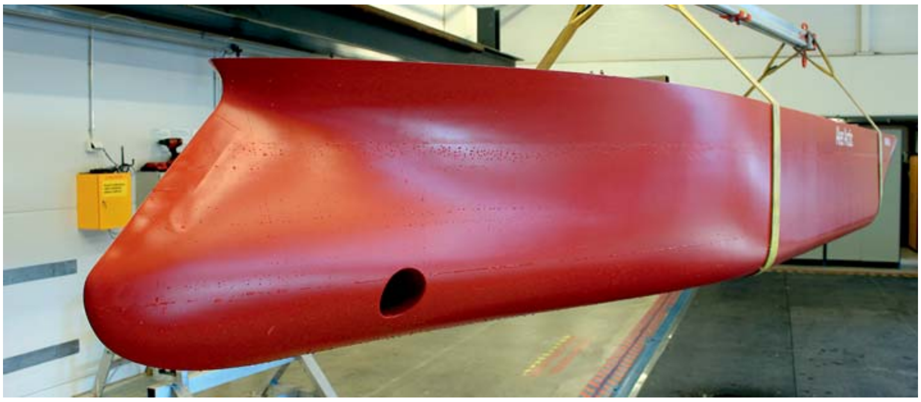
*Tor Viking (foreground) performing physical ice management updrift of the stationary vessel Magne Viking (background). Photograph: Mike Neville*

# Testing EEDI bow forms

**The IMO Energy Efficiency Design Index (EEDI), introduced in 2013, will change the hull forms of new vessels and lower the engine power and service speed in order to fulfil the new open water efficiency requirements. Aker Arctic has recently performed tests to evaluate how well the new EEDI-compliant vessels manage in ice conditions as part of the BowForm project.**


Photograph: Neste Oil

*Naval Architect Mikko Elo was onboard cargo vessel Suula to observe the real ice conditions in Bay of Bothnia in winter 2017.*



*Suula is a conventional product tanker with a bulbous bow designed for ice operations.*

The winter navigation system in the Baltic Sea requires all merchant ships, even those usually escorted by icebreakers, to have some ice performance and accordingly the Finnish-Swedish Ice Class Rules include a requirement for minimum installed power. On the other hand, the Energy Efficiency Design Index (EEDI) imposes a power ceiling for ships, resulting in somewhat contradictory regulations. To proceed in ice ships require higher installed power than is in use when sailing in open water. In EEDI calculations this handicap is compensated for with a correction factor in order for ice classed ships to be on the same level as average open water ships. There is a fear, however, that the EEDI requirements will have an impact on the winter navigation system and an increase in icebreaker services would be needed to maintain an efficient and fluent navigation system. If this is the case then the entire aim of lowering carbon dioxide emissions is lost. Consequently, the Winter Navigation Research Board funded a research project named BowForm, with the aim to see how well the new EEDI-ships manage in ice conditions in practice compared to ships of conventional design.

## Testing programme

In the Finnish-Swedish Ice Class Rules the installed power requirements for each ice class are based on the ship's ability to maintain a speed of 5 knots in a brash ice channel of certain thickness.

"In real life, nature is never perfect and ice channels are not always available," Project Manager Ilkka Saisto explains. "Due to that reason, our aim was to investigate also conditions where there is no defined channel, or situations where no icebreaker is available."

Aker Arctic Naval Architect Mikko Elo was first onboard tanker *Suula* in March 2017 to gather information about the real ice conditions. *Suula* is a conventional product tanker with a bulbous bow designed for ice conditions.

"We started the trip from Porvoo, via Oulu onwards to Vaasa," Elo says. "We had open water until the Bay of Bothnia, where the ice thickness was only about 30 cm. No ice ridges were encountered but a strong wind from southwest resulted in pressure in the ice field, which slowed us down at times. Outside the Oulu fairway there was additionally a narrow patch of thick brash ice at the edge of the fast ice cover which turned out to be the most challenging ice conditions during the trip."

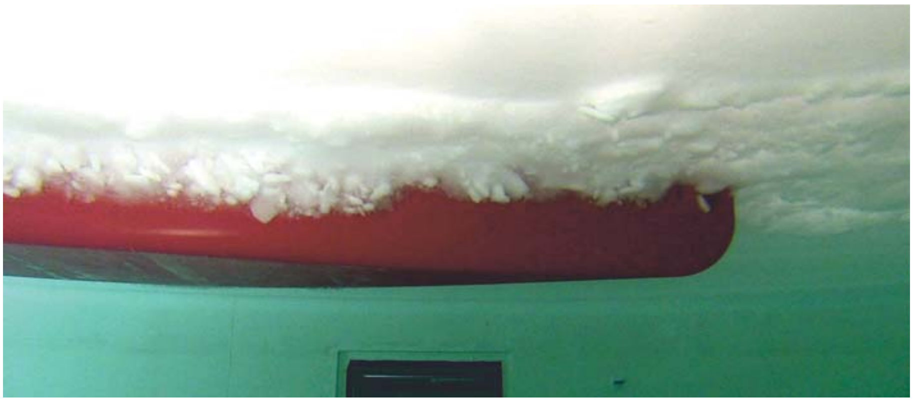
Based on these observations a testing programme was established.

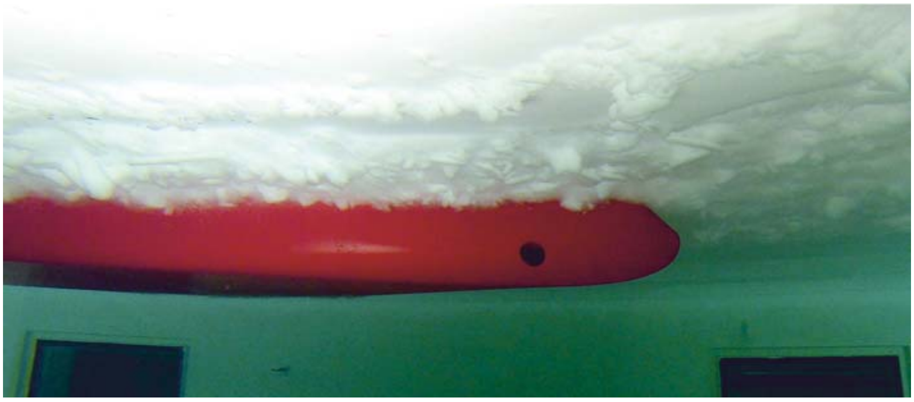
For the tests a two-part model with a changeable bow was used.

"The advantage is that it is basically the same ship with different bows so the results are easy to compare," Saisto says.

Two different bow forms, an "EEDI bow" designed to fulfil the requirements of low water resistance and the Suula bulbous bow, were tested in two different ice conditions. ▶


*"EEDI bows" are typically more vertical and straighter than conventional bows. They are optimised for open water and summer use and are more energy efficient in these conditions. However, they are not designed for use in ice. Vessels with EEDI bows are also difficult for icebreakers to assist due to the narrow shape of the bow. Vessels with EEDI bows can be ice strengthened and classified according to the ice class rules.*





*Two sets of tests with both models were performed.*

"Both vessels performed well in the test channels prepared according to ice class rules," says Senior Designer Tom Mattsson. "However, tests in level ice with the 'EEDI bow' did not go well at all, whereas the *Suula* bulbous bow could manage. The results from the tests indicate that there are possibilities to manage in broken ice but not in level ice."

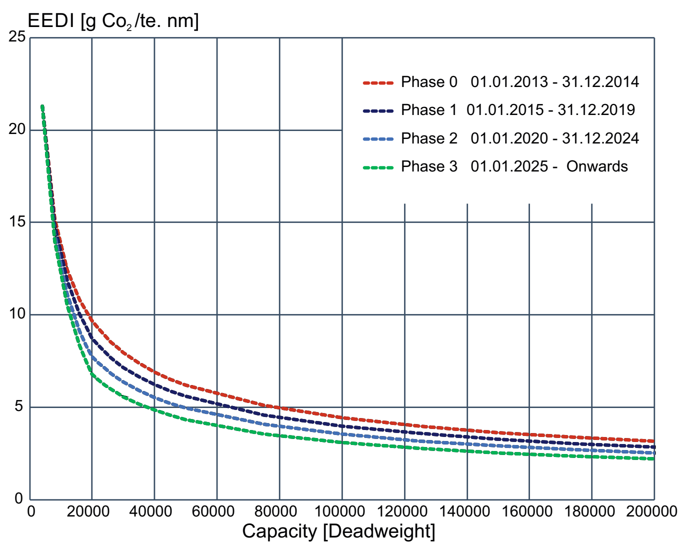
The full results will be available later this year.

**Other projects**
The Winter Navigation Research Board has also funded other research projects related to EEDI and ice navigation. Mattsson has recently finalised the PREEDICT project in which he has, together with the Finnish Transport Safety Agency (Trafi), developed a proposal for new correction factors for installed power to be able to compare ice going ships with open water ships.

"As a continuation of these projects we are now working with Tevo Lokomo Oy to research how ice class affects the propulsion performance," Mattsson adds. "The results will be ready by the end of this year."

All the Winter Navigation Research Board's reports can be found on the following website https://www.trafi.fi/tietopalvelut/julkaisut/talvimerenkulun_tutkimusraportit

*The purpose of the IMO Energy Efficiency Design index (EEDI) is to promote energy efficient ships and thereby reduce $CO_2$ emissions by 30% between 2013 (phase 0) and 2025. The coefficients vary for different ship categories. This example is for tankers.*



# Ice induced loads on the Oblique icebreaker Baltika

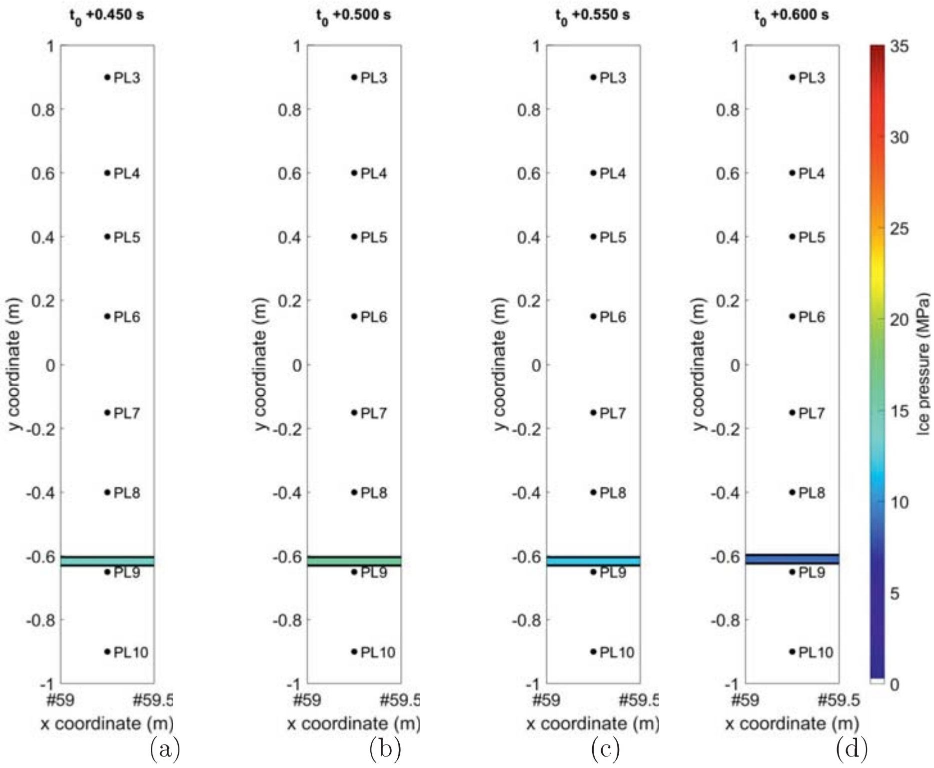
**The oblique icebreaker *Baltika*, currently operating in the Gulf of Ob, is the first oblique icebreaker ever made. An ice load monitoring system was installed on the inclined side used in icebreaking operations during construction in order to gather information about the ice loads and learn more about the asymmetrical hull shape. The data has now been analysed with new scientific discoveries as a result.**

*Baltika* has been operating in the Gulf of Ob for four years and has continuously been gathering data concerning the ice loads it experiences. There are 22 strain gauges used to measure the ice load. All of the sensors are located on the inclined side of the vessel and centred around the waterline. Maritime Engineering graduate Jillian Adams has analysed the first two years of data (May 2015 – May 2017) as the topic of her Master's thesis for Aalto University, with Naval Architect, Structural Designer Ville Valtonen from Aker Arctic acting as her advisor.

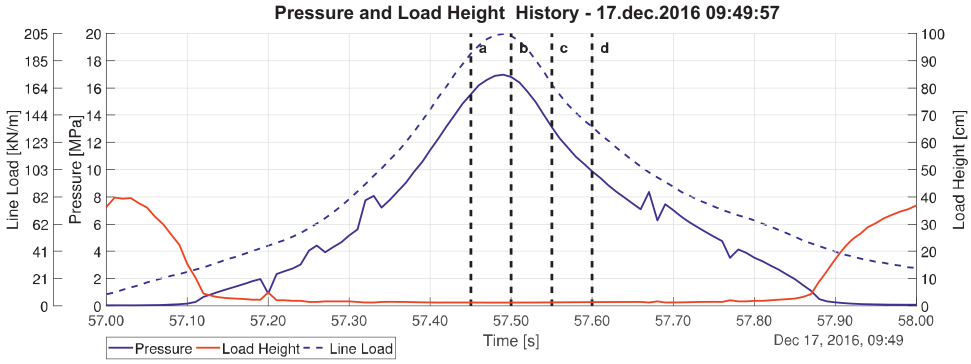
**Inverse method**

Adams further developed an inverse method, originally implemented by Teemu Ikonen for his Master's thesis at Aker Arctic in 2013 to analyse the full-scale strain measurements taken on board *Baltika*. Two discretisation patterns were used to estimate the pressure and load patch height induced by impact events between the ship and the surrounding sea ice.

Analysis revealed low magnitude yielding incidents due to higher ice loads than the vessel was designed for. *Baltika* was originally designed for Baltic Sea ice but was taken, shortly after her delivery, for ice trials in the Arctic. There she surpassed the required performance targets even though the ice conditions are much harsher than the ones she was designed to operate in. She has now successfully served as an ice management vessel at the Arctic Gate oil

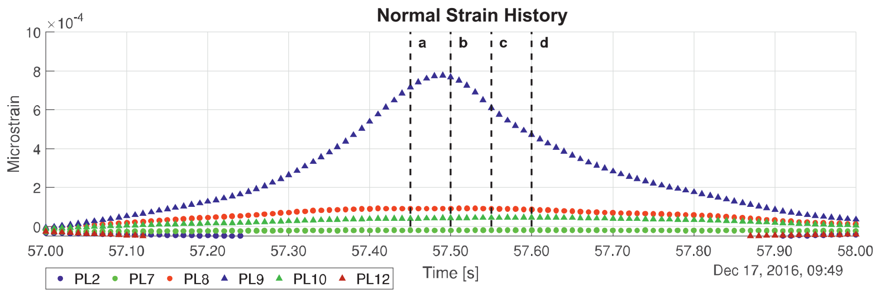



*The four figures show how the load patch and pressure load develops over time. The figures are captures from a video of the full impact event. In this case, the ice load is concentrated on one sensor for the full duration of the event.*
*a) High pressure due to crushing; just before the ice breaks*
*b) Peak pressure of approximately 17 MPa as the ice breaks*
*c/d) As the load disengages from the ship and the pressure decreases*




*The development of the line load, the pressure and the load height are shown for a full impact event. It shows a textbook impact event where the pressure (solid blue) grows gradually until a single peak occurs. The ice breaks at the point of maximum pressure. The pressure then decreases as the load disengages and loses contact with the hull.*

*The important part of the figure is the fact that the load height (red line) is very narrow. It is only 1-3 cm and it is constant throughout almost the entire impact event.*




*This details the strain history of the event. Here only one sensor measures significant strain (PL9 in blue). This is reflected by the load patch location shown in the top figure. The next closest sensors experience smaller magnitude strains.*

terminal assisting oil tanker operations together with nuclear-powered icebreaker *Vaygach* and the icebreaking supply vessel *Vladislav Strizhov*.

"The data shows that *Baltika* has been used in oblique angles of mainly 30 to 50 degrees for significant amounts of time," Adams says.

"*Baltika* can break ice in a 90 degrees angle, but the thick arctic ice sets some limitations," Valtonen adds. "It was however interesting that during the ice trials *Baltika* was compared to two other icebreakers with double the power and all three performed equally well."

**Research on ice loads**

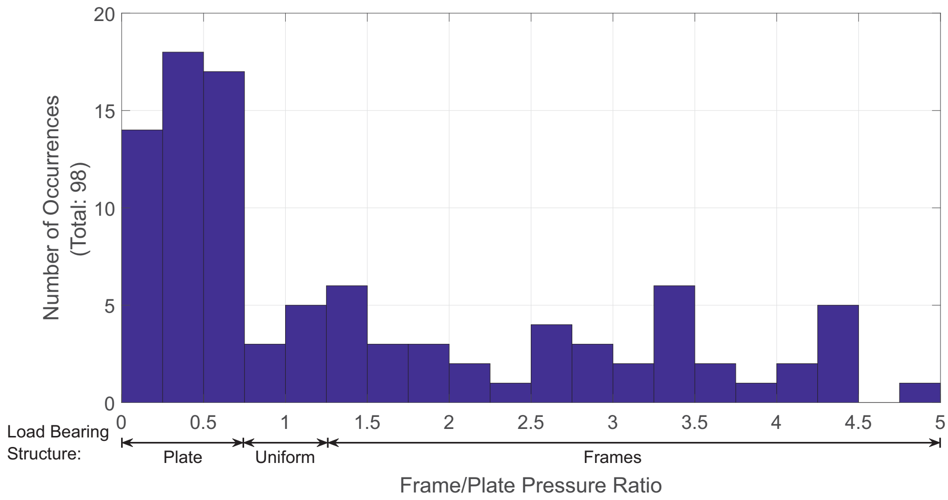
In her research Adams used finite element analysis to create an influence coefficient matrix that describes the strain response of the hull structures to an applied load. The inverse method was applied to the strain measurements from 250 impact events for the general analysis of maximum ice-induced loads and 98 events were selected to analyse the details of the full impact event.

The results of the study show that, for the analysed impact events, the peak pressure created by the ice is most often between 10 and 25 MPa. The load height at the time of maximum pressure is on the order of 1 to 3 cm, confirming that the ice-induced loads are line-like as suggested by earlier research. This implies that the main ice-induced pressure is concentrated on a smaller area than the load patches used in classification society rules.

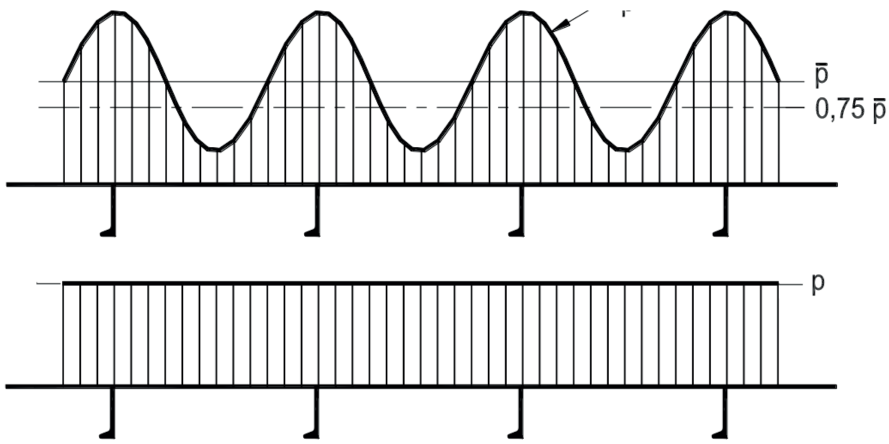
The detailed analysis revealed constant load patch heights over the duration of the individual impact events. Most high pressure impacts occurred in the area surrounding the design waterline. There were noticeably fewer large strains measured on the sensors immediately surrounding the large stringer located at the design waterline due the increased stiffness in that area. In most cases, the impact events are less than a second in duration and the full development of the pressure, from the crushing stage to the load disengagement, can be seen. A new discovery from this study is that the load height is markedly constant throughout the entire duration of the impact event, even though the location of the load varies throughout the loading event. The line load estimated using the inverse method follow the same trends as the loads estimated using more common methods based on shear strains.

**Ice load is independent from structure**

By dividing the frame spacing into three sections, Adams investigated the pressure distribution across the structural members. The results do not




*The figure presents the distribution of the ratios calculated for each of the impact events. The summary of the results indicates that there is no significant trend towards either a uniform distribution of the pressure or a consistent sinusoidal distribution. The results imply that pressure distribution is random and independent of the ship's structures.*




*The first figure is the pressure distribution assumed by the FSICRs. The pressure distribution on the structures is assumed to follow a sinusoidal pattern where the frames experience a higher pressure than the plates.*

*The second figure in contrast assumes a uniform distribution of pressure across the ship's structures.*

*The results from the analysis of the Baltika data imply that pressure distribution is more random and does not consistently follow either of these patterns.*

show a conclusive tendency for the frames to experience higher ice-induced pressures than the plates or for the distribution to be equal. For the impact events analysed, the distribution between events where the plates experience a higher pressure and where the frame experience a higher pressure is almost equal in the number of occurrences. The results indicate that the distribution of pressure across the structural members is more random and is independent of the supporting structures.

"This would mean that the ice load does not depend on the structure behind, which is currently the assumption in the Finnish-Swedish Ice Class Rules," Adams explains.

"This topic has been discussed for decades and, with the longest continuous full-scale data now analysed, the results can be considered quite reliable," Valtonen adds. "Based on this new scientific evidence, there seems to be room for development of the rules."

**Recommendations**

Based on the results and conclusions of the thesis, Adams makes the following recommendations with the intention of improving structural design.

1. Structural design investigation

   The results of the general analysis indicate that the ice impacts create concentrated high-magnitude loads on the hull structures. The nature of the loaded area differs significantly from the load patches and design pressures used in design and classification rules and standards.

It is unclear at this time how the line-like ice loads would affect the dimensions of the ship's structures if more concentrated loads were used as the design scenario. Therefore, an investigation of the effects of the concentrated loads is recommended to determine their influence on the structural design, with the aim of improving safety and efficiency of ice-going ships.

2. Further application of the inverse method
There exist many full-scale data sets from numerous ships operating in different ice-covered waters. The inverse method developed in the thesis proved to be capable of identifying ice-induced pressures and load patches. Applying the method to additional data sets with different instrumentation layouts would be beneficial to determine the methods accuracy and allow for comparison of the results.

**Measurements continue**
Measurements will continue on *Baltika* for at least another set of two years, maybe even more.

“Our mission at Aker Arctic is to design icebreakers, but also to advance the field of icebreakers by conducting scientific work,” Valtonen says. “Ice is such a complicated material and behaves in unexpected ways close to the melting point that the only way to get reliable information about ice loads is either instrumentation or studying damages on ships. In the past years, research has advanced remarkably because we have more sophisticated tools to analyse data accurately compared to twenty years ago.” ■

# Arctic Passion Seminar gathered experts from all over the world


## This year, the 13th Arctic Passion Seminar focused on discussing new Arctic projects and the development of new polar vessels and technologies, including a model test demonstration of the world's first LNG-fuelled icebreaker, *Polaris.*

The opening speech was given by Mr. Petri Peltonen, Under-Secretary of State from the Ministry of Economic Affairs and Employment, Finland, who summarized the core policies in the country's upcoming EU presidency with four letters: A for the Arctic, B for bioeconomy, C for cleantech, and D for digitalization.

Aker Arctic's Managing Director Reko-Antti Suojanen gave an overview of the Arctic market, recent achievements and new tools for design and testing at Aker Arctic. Examples of recent achievements are the beginning of the first Arctic LNG project for Yamal LNG, the construction of the ice class PC 3 Chinese icebreaking research vessel, and the design of a LNG-fuelled, ice class PC2 polar icebreaking cruise vessel for PONANT.

Dan McGreer, from Vard Marine Inc., presented the Chilean Antarctic Vessel's design project, in which Aker Arctic supported Vard with the design of the hull form, model tests and some specific ice class design solutions.

Mikhail Grigoryev, from GECON, continued with forecasts on how freight traffic on the Northern Sea Route will grow according to two different scenarios. He also gave his view on how many new arctic cargo vessels need to be constructed in the future.

The French Polar Logistics Vessel, *L'Astrolabe*, successfully finished her first year delivering supplies to Antarctica and patrolling in the Indian Ocean. Jean-Luc Prime, from Piriou Shipyard, described the first winter's positive experiences and showed impressive pictures from loading and unloading cargo by the quayside, on ice floes and with helicopter.

Finnish and Swedish exports depend on efficient winter navigation on the Baltic Sea. With the introduction of EEDI (Energy Efficiency Design Index), which aims to lower $CO_2$ emissions a need arises to ensure that ships will continue to sail with feasible schedules. Arto Uuskallio, from Aker Arctic, gave an overview of the potential risks and what Aker Arctic is doing to prevent them from becoming reality.

In addition to seminar presentations, one of the highlights was the demonstration of an ice model test. This year, the icebreaking capability of the Finnish icebreaker *Polaris*, the world's first LNG-powered icebreaker, was demonstrated. The vessel is based on the Aker ARC 130 concept design and full-scale ice trials were carried out in 2017.

After lunch, Torkild Skjong, from Vard Group AS, presented Vard's different vessel construction projects along with the new luxury icebreaking expedition cruise vessel for Ponant, which Aker Arctic has designed in close cooperation with Stirling Design International.

Mikhail Belkin, from FSUE Atomflot, then talked about their icebreaking support for Arctic projects, their current fleet and the new generation icebreakers which will be the basis for year-round navigation along the Northern Sea Route.

Novatek is planning to further expand its LNG production on the Gydan peninsula. Maxim Minin, from PAO NOVATEK, gave insight into the project.

Search and rescue operations in the Arctic have been under development. Commander Tomi Kivenjuuri, from the Ministry of the Interior, Finland, explained what the Arctic Coast Guard Forum (ACGF) does as a cooperation of the eight Arctic member states.

Tuomas Korpela, from ICEYE, continued with presenting a new service for on-line ice data, based on SAR satellite images.

Alexey Fadeev, from Gazpromneft-Sakhalin LLC, described their offshore projects on the Russian shelf. Lastly Ilkka Rantanen, from STARKICE Ltd., presented experiences of intelligent de-icing on an 1A Super ice class bulk carrier in the Baltic.

We would like to thank all guest speakers and participants of this year's successful and interesting Arctic Passion Seminar! The seminar presentations have been uploaded to our website **www.akerarctic.fi.** ■

# The vessel that changed arctic shipping


**In 2006 the first independently operating double acting arctic cargo vessel was delivered. The ship, *Norilskiy Nickel*, proved that operations in the Arctic without icebreaker assistance is possible and changed the entire approach to arctic shipping.**

Twenty years earlier in the 1980s, Finnish shipbuilders constructed a total of nineteen SA-15 series multipurpose cargo vessels used by Murmansk Shipping Company, Far East Shipping Company and Sakhalin Shipping Company. With assistance from the powerful icebreakers, *Taymyr* and *Vaygach*, the mining company Norilsk Nickel could transport their products from Dudinka to Murmansk all-year round.

However, in the 1990s the Soviet Union collapsed, Russian industry was privatised and tariffs grew constantly. This increased the already high logistic costs for the mining company. Simultaneously, the azimuthing podded propulsion unit was developed in Finland, which lead to the revolutionary Azipod product and the Double Acting Ship (DAS™) concept Kvaerner Masa-Yards (KMY) developed for ice navigation.

## Innovative ideas

KMY and Norilsk Nickel initiated discussions on how to improve efficiency of arctic logistics and lower costs of the operations.

“We believed strongly in the double acting ship concept and began to make simulations with alternative vessel concepts for Norilsk Nickel,” says Mikko Niini, previous KMY Sales Director and later Managing Director of Aker Arctic. “We wanted to show how much cheaper the transportation could become with independent vessels.”

After many years of discussions, a separate design contract was signed for a revolutionary ship in 2003 with the construction contract signed in 2004. That year Aker Arctic was established and inherited all the arctic technology, staff, know-how and facilities from Kvaerner Masa-Yards, which simultaneously turned into Aker Yards. “As it was an entirely new type of vessel, we agreed to a special clause in the contract. If the vessel would not fulfil design targets in ice trials, Norilsk Nickel could return the vessel,” Niini says. “We trusted in our expertise, our ice model tests and fully believed in the design.”

At the time of the discussions, the Helsinki Shipyard was building the first double acting icebreaker, *FESCO Sakhalin*, for FESCO and Exxon Neftegas. In addition the double acting tankers *Tempera* and *Mastera* were already transporting oil for Fortum (today Neste) in the Baltic Sea. This convinced Norilsk Nickel about Aker's ideas.

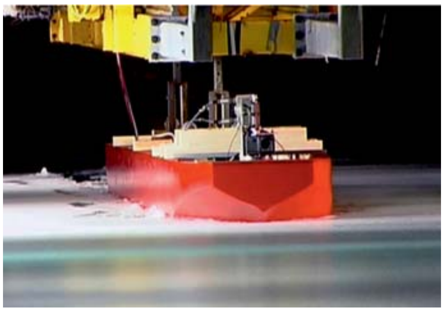
The revolutionary arctic cargo vessel was designed to break 1.5 metre ice independently without icebreaker assistance while carrying mining products in containers from Dudinka to Murmansk and Rotterdam year-round. The Yenisei channel and Kara Sea are especially challenging areas with thick level ice and brash ice channels. The vessel was at first conceived with a single 9 MW Azipod unit, but in the process of negotiations was increased to 13 MW.

## Successful trials

While the new vessel was being constructed at Helsinki Shipyard, Aker Arctic Technology became an independent unit from Aker Yards. The opening ceremony and first Arctic Passion Seminar were held in March 2006 while the Arctic Container Vessel, *Norilskiy Nickel,* was in full-scale trials in Kara Sea and Gulf of Yenisei. “Aker Arctic Test Manager Göran Wilkman was onboard the ship and managed to call us on that very day to report that the vessel had clearly surpassed all performance targets,” Niini reminisces.

One year later, Norilsk Nickel participated in the second Arctic Passion Seminar to present their experiences. “The vessel's construction price at that time was double of a similar capacity

*The conditions during the ice trials in 2006, with temperatures down to -40 degrees and strong wind, when all performance targets were confirmed.*

*Model tests while developing the concept.*

conventional vessel. However, Norilsk Nickel representatives told that their calculations showed that the ship would pay itself back in three years," Niini adds.

They were extremely happy with the vessel and ordered four additional cargo vessels with the same concept. These were built at Aker Yards in Germany as the Finnish Aker Yards in Helsinki and Turku were already fully booked. In 2011, tanker *Enisey* was also built for Norilsk Nickel, using the same design concept for the hull form and propulsion.

**A new standard**

"One person I would like to mention, who helped us many times during those years, is René Nyberg, Finland's ambassador to Russia, who worked in Moscow," Niini says. "The 1990s were turbulent times in Russia and people in charge changed all the time. Nyberg would help to arrange, for example, a sauna meeting when there was a stand-still in negotiations. He also assisted in organising a trip to Norilsk and Dudinka and discussions with the company owners, Interros's Vladimir Potanin and at that time CEO Alexander Khloponin. Learning about real -45 °C conditions indeed deepened our understanding of the project requirements."

"Important was also the role of Nikolay Matushenko, former General Director of Murmansk Shipping Company and Chairman of ZAO Arctic Shipping Service, the operator of the Nemarc pilot Azipod vessels, *Uikku* and *Lunni*, in Arctic waters during 1993-2003, he being one of our counterparts in Norilsk Nickel at the time of negotiations," Niini adds.

Today the double acting technology has become the standard in arctic vessels and there are more and more powerful icebreakers, tankers and LNG carriers for various use in the Arctic, many of them designed by Aker Arctic.

"Icebreakers are nevertheless still a necessity in the Arctic as they help to keep channels open in the most difficult locations, secure safety of navigation and clean the ice around vessels when mooring, for instance," says Aker Arctic Managing Director Reko-Antti Suojanen. "As these special arctic tankers and container vessels can move independently in ice, they significantly reduce the need for the icebreaker support and provide significant cost savings for the overall transport scheme."

**Twelve years of service**

The Norilsk Nickel arctic cargo vessels have now been operating since 2006. Vyacheslav Konoplev, former Deputy Director, Head of Shipping Division and Director of Murmansk transport branch of Norilskiy Nickel from 2006 to 2015 says:

"Twelve years of year-round operation of the vessel in ice conditions fully confirmed the correctness of the company's chosen transportation scheme. During this period the transportation scheme proved its optimality, with the following main advantages:

- Year-round navigation of vessels without icebreaker support on sea routes through Barents and south-western part of Kara Sea, which significantly saves costs for icebreaker assistance. Safety of independent ice navigation is facilitated by an onboard information terminal, developed by AARI, which provides real-time ice forecast and routing.
- High technical characteristics of *Norilskiy Nickel*-type vessels and their good ice performance made it possible to operate the fleet and ports of the company practically on a liner schedule, ensuring regular planned delivery of necessary cargoes to the Norilsk industrial area and export of Norilsk products to customer.
- The technical capabilities of the vessels, as well as the measures taken by the company to speed up their processing in ports, have resulted in a significant reduction in the delivery time of products to customers.
- Voyages of *Monchegorsk* in 2010 and of *Zapolarnyy* in 2011 from Murmansk/Dudinka to south-east Asia have confirmed that ships of *Norilskiy Nickel*-type can operate along the entire Northern Sea Route without icebreaker assistance until January. In other words, the possibility of extending the period of independent navigation in the Arctic by transportation vessels with Arc7 ice class up to 6 months has been proven."

Some modifications to the design have been made along the years, for instance the installation of cargo cranes, changing port diesel generators to operate on heavy fuel grades instead of diesel fuel, increase of container capacity and installation of equipment for ballast water treatment on vessels, to mention a few.

"The delivery of the fifth and last vessel in the series, *Nadezhda*, on February 28, 2009 completed the first investment project in Russia that had no analogues in the world shipbuilding practice; the construction of ships capable of transporting cargo along the Northern Sea Route without icebreaker support," Konoplev highlights.

*Arctic shipping had changed.* ■

# Arctic condensate tanker nearing delivery


*Boris Sokolov right before launching.*

*The arctic condensate tanker was launched on 15th June in Guangzhou, China.*

## Construction of the arctic condensate tanker for the Yamal LNG project is almost ready and the vessel is scheduled for delivery this fall.

Aker Arctic developed the Aker ARC 212 Arctic Condensate Tanker design for transport of gas condensate from the natural gas fields in Yamal peninsula to the markets in Europe and Asia. Guangzhou Shipyard International (GSI) in China is constructing the ship and launched it in mid-June. Aker Arctic has continued to support the shipyard during the entire construction phase and will also be responsible for full-scale ice trials after the delivery.

“The vessel has been designed and built to the Russian Arc7 ice class,” says project manager Riku Kiili. “It will be able to sail independently year-round in the Russian Arctic where temperatures may drop down to -50°C.”

The 214 m long and 34 m wide vessel can transport almost 60,000 m³ gas condensate or other oil products in five cargo segregates. It has a moderate ice bow and is designed based on the Double Acting Ship (DAS™) principle, sailing bow ahead in open water or light ice conditions and stern first in heavy ice. Its propulsion is based on diesel-electric machinery with two azimuth propulsion units. The hull form is of a new type with a round-shaped twin gondola aft hull, which will work well in the harsh conditions the vessel will be sailing while also improving performance in open water.

“The construction of the vessel is going well and we are busy finalising the project,” says Engineer Manager Cao Lu, GSI.

Sea trials are planned for September with delivery of the vessel in October.

# New features in the Ice Load Monitoring System


Aker Arctic has further developed the Ice Load Monitoring System (ILMS) installed on board the oblique icebreaker *Baltika*. In the new version, sensors are installed on several locations around a vessel's hull and results are immediately displayed on a monitor for a clear overview of the ice load, peak values and the predicted ice load in simplified form. The aim of the original ILMS installed on *Baltika* was to measure loads and gather data on the new asymmetric hull form, whereas the newer version is intended to support the captain in making decisions on how to proceed in an ice field and at what speed, in order to improve the safety of ice operations. “We are currently researching new types of sensors to be used around the ship hull,” says Electrical, IT and Automation Team Leader Antero Jäppinen.

# Botnica in Canada

Estonian multipurpose icebreaker *Botnica* was spotted in St. John's, Canada in July, when she arrived from Estonia on her way to the Canadian Arctic to support the iron ore shipments out of Milne Inlet for Baffinland. The vessel was built in 1998 at Finnyards in Rauma, Finland and sold to Estonia in 2012.

**News in brief**

## Construction of the first icebreaking cruise vessel to begin

Rendering: Courtesy of PONANT

In December 2017, Aker Arctic, Stirling Design International and the luxury expedition cruise company PONANT announced the world's first ever luxury icebreaking cruise vessel, which will take passengers to previously never explored polar destinations. Passenger safety and preserving the environment have been crucial in the development of this new and innovative vessel concept.

"The basic design work for the hull structures is underway at the moment and scheduled to be finished in November," says Project Manager Tommi Heikkilä. "An extensive model testing campaign, aimed at ensuring high level of passenger comfort during the cruises, was finalised in August."

Steel cutting for the vessel at the hull building yard VARD Tulcea in Romania is planned to commence in November. The hull will then be towed to Norway for final outfitting, commissioning work, interiors and finishing at VARD Söviknes yard. The first cruise onboard *Le Commandant Charcot*, named after the French explorer, is intended to depart mid-2021.

## Solar panels power Aker Arctic's head office

Aker Arctic's head office and ice model test laboratory in Helsinki has been equipped with 240 solar panels.


The 65 kWP solar panel system installed on the flat roof produces renewable electricity for the building and reduces the need to buy electricity from the national grid. An added benefit is that the solar panels absorb the heat in summer and therefore less cooling of the offices is needed. While the electricity production is lower during the dark winter months, less energy is needed for cooling the ice laboratory.

"After five months in use, the solar panels have produced a comparable amount of electricity for 1.4 million hours of computer work or seven million hours on the phone," says Head of Research and Testing Services Topi Leiviskä.

As of August 2018, the carbon offset is 18,054 kg.

## Viking Supply Ships sells three icebreakers to Canada

Viking Supply Ships AS, a wholly owned subsidiary of Viking Supply Ships AB (VSS) has sold its three icebreakers, *Tor Viking, Balder Viking* and *Vidar Viking* to Her Majesty the Queen in Right of Canada.

Photograph: Viking Supply Ships AS


Chantier Davie, Lévis, Quebec, is to convert the three icebreakers for the Canadian Coast Guard.

In its fleet listings, Viking Supply Ships describes each of the ships as "Combined AHTS & Ice-breaker with DNV Ice-10 notation. Capable of operations in harsh environment offshore regions and Arctic/Sub-Arctic regions."

Public Services and Procurement Canada says the contract with Davie will ensure that shipping lanes in the St. Lawrence River remain open in the winter.

The first vessel is expected to begin operations for the upcoming icebreaking season, beginning in December 2018. The second and third vessels will be converted, refit and available to support Coast Guard programs by the summer of 2019 and the winter of 2019-2020, respectively.

www.vikingsupply.com, www.marinelog.com

# Wind in the sails

**Aker Arctic's employees are naturally passionate about boats and enjoy spending time on the sea. Quite a few spend their holidays on a sailing boat. This past August, those with a boat available nearby invited the rest of the staff to join them for a day out in the beautiful Finnish archipelago outside Helsinki.**

*A fleet of four sailing boats and one motorboat headed to Kaunissaari (Beautiful Island) for a recreational day with colleagues.*

*The early autumn day emerged with lovely sunshine and a tiny breeze.*


After some days with heavy rain, the sailing day emerged with lovely sunshine and a tiny breeze. Groups were formed and boarded the five boats under the command of skippers Reko-Antti Suojanen, Ilkka Saisto, Lasse Lönnberg, Teemu Heinonen and Björn Schönberg.

Our destination was Kaunissaari, a recreational island with free access to visitors located about 22 kilometres east of Helsinki. The two-square-kilometre island has a protected pier for mooring of private boats and can also be reached with a commuter vessel from Vuosaari.

There are small huts and rowing boats for rent, covered cooking facilities and a restaurant. The nature, which reflects the island's name “Beautiful Island”, varies from rocky beaches, sand and bushes to a variety of birds, small animals and fish.

At Kaunissaari, it was time for a picnic lunch consisting of a traditional sausage barbeque and coffee brewed on an open fire. After lunch the group boarded the boats again and returned to head office for sauna and dinner. A lovely day with colleagues!

*A Finnish picnic tradition is sausage barbeque and coffee brewed on open fire.*

## *Meet us here!*

We will participate in the following events:

**IRSO Meeting,** Barcelona, Spain
1 – 4 October 2018

**Offshore Marintec Russia**
St. Petersburg
2 – 5 October 2018

**AECO's Annual Cruise Conference**,
Norway, 17 – 18 October 2018

**Arctic Shipping Forum North America**
St John's, Canada
17 – 19 October 2018

**ATC**, Houston, USA
5 – 7 November 2018

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