Arctic Passion News

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Icebreaker Polaris begins work

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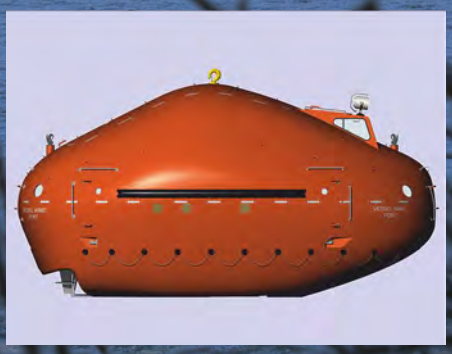

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Announcements

Alexey Shtrek has joined Aker Arctic as development manager. Alexey graduated from the St. Petersburg State Marine Technical University in 2000 with a Master's Degree, and previously worked in the Laboratory of Icebreaking Technology of Central Marine Research and Design Institute. He has participated in the feasibility studies of new icebreakers and Arctic cargo vessels, research and development, expert consulting works on their designs, as well as taken part in experimental voyages and full-scale trials of ice-going ships. Many of these have been done together with the Aker Arctic team.

Jesse Lehtonen has been appointed project engineer, and will be working with machinery system design. Jesse graduated as a Naval Architect from the Aalto University School of Engineering in January 2017. In his Master's thesis he studied simulations of propulsion system dynamics under propeller-ice interaction.

Heikki Sipilä retired from Aker Arctic in October 2016 after a long career in the ship development and ship engineering industry. He worked mostly in Turku, Finland first with Wärtsilä, then Masa Yards and lastly at STX Lifecycle Services before joining Aker Arctic. We wish Heikki a happy retirement!

Dear Reader,

The year 2017 is quite significant for Finland when it comes to Arctic matters, as Finland is taking the chairmanship in the Arctic Council, and the same year celebrating the nation's centenary of independence. This results in a number of special events that also affect our businesses in the Arctic region. Although Aker Arctic is focusing on technical matters and development of the solutions to be used in both Arctic and other icebreaking vessels, administrative actions are of much interest to us.

Regulatory issues are developing. This is the first year of polar code implementation, and we also see significant development in the environmental codes, EEDI, BWM and IMO regulations, which show the way for the future. The main focus and importance is in open water shipping because it dominates the volume of the ships, and thus has the greatest influence on global emissions. The Arctic region on the other hand is suffering most from climate change. We have in recent years seen alarming signs of how changes in the Arctic are quick and big. IMO level regulations are to be applied also in ice-classed vessels. They create a special difficulty, as low-energy solutions are often controversial to the practical ice vessel operations. This challenge drives us even further to develop ships with easier icebreaking technologies as well as vessels' system solutions, which are clean and efficient.

A great example of this is the Polaris icebreaker, which in addition to using LNG fuel has been designed to have systems that save fuel and energy. Despite these solutions, Polaris has the best icebreaking capabilities in its duty as a Baltic heavy icebreaker.

This year will show how the major and pioneering Arctic project, Sabetta terminal, the first ever real Arctic LNG project, is coming onstream. This project is a great showcase of how the new vessels and technological solutions will be used in the extreme Arctic conditions. It is also paving the way for future projects, and hopefully showing that Arctic projects can be carried out in a timely manner while also being safe and sustainable. The new activities also require more supporting services, such as ice forecasting, operative management, training etc. Aker Arctic is active in developing those either independently or in co-operation with other organisations.

In this issue of Arctic Passion News you can read the latest information on the vessel projects that we have had the privilege of being part of. I find it extremely interesting to be making history in icebreaking and Arctic shipping together with our clients and partners.

Best Regards,
Reko-Antti Suojanen
Managing Director

Front cover:
Brand new LNG Baltic icebreaker Polaris (left) side by side with icebreaker Urho (right), at Katajanokka in Helsinki in January 2017, a few days before Polaris departed for icebreaking duty in the Bay of Bothnia.

Finland to chair the Arctic Council 2017-2019

Minister of Foreign Affairs of Finland Timo Soini (third from the right) at the Glacier-meeting in Alaska in 2015.

Finland will take over the two-year chairmanship of the Arctic Council from the U.S. at the beginning of May 2017. The focus will be on implementing the Paris Agreement on climate change and the UN sustainable development goals as part of Arctic cooperation. A more detailed programme will be published in April 2017.

The Arctic Council was established twenty years ago as a high level intergovernmental forum to enhance cooperation, coordination and interaction on common Arctic issues. The member states are Finland, Sweden, Norway, Denmark, Iceland, Russian Federation, the United States of America and Canada. The region's indigenous peoples such as the Sami also participate in the cooperation. The Council is a forum for promoting environmental protection, sustainable development, and the wellbeing of the inhabitants of the Arctic areas.

The Council has during its existence played a leading role in delivering world-class scientific assessments, addressing the impacts of globalisation and climate change, and facilitating cooperative responses to these challenges. The Arctic Council has also provided a forum for the negotiation of two important legally binding agreements among the eight Arctic states, both of which came into force in 2013. These are the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic, and the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic.

The Arctic Council's foreign ministerial meeting is organised every second year. The next ministerial meeting will be held in May 2017 in Fairbanks and the following towards the end of the Finnish chairmanship in spring 2019.

Finnish goals

The Arctic Team at the Ministry for Foreign Affairs will coordinate Finland's Chairmanship. The programme has been prepared in cooperation between actors representing the entire state administration and different interest groups. The Finnish Chairmanship will focus on environmental protection, meteorological cooperation, as well as improving communication and education as part of Arctic cooperation. According to René Söderman, Senior Adviser at the Ministry for Foreign Affairs, the Arctic Team will publish a more detailed programme in April 2017.

In issues related to the economy, close collaboration with the Arctic Economic Council will be sought. The Arctic Council's Chairmanship provides an opportunity for Finland to strengthen its Arctic image and raise awareness of Finnish expertise in operating in cold conditions.

Finland has a great deal to offer to Arctic cooperation in terms of Arctic-related expertise. Finland has several biological research stations in Lapland, where Arctic ecology is being studied. The Arctic Centre, a separate institute affiliated to the University of Lapland in Rovaniemi, carries out interdisciplinary research on the effects of global changes on Arctic nature and Arctic societies. The University of Oulu is a centre for Arctic medical sciences. Arctic-related issues can be found also in the teaching and research programs of many other institutions of higher education in Finland.

Finnish industry has expertise and modern technology in such fields as Arctic transportation and navigation in ice-covered waters, Arctic construction, Arctic environmental technology as well as the development of Arctic infrastructure.

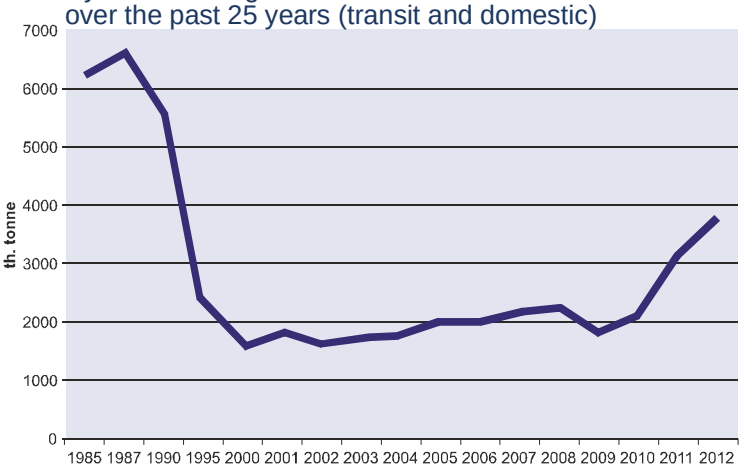
Mr Timo Soini, Minister of Foreign Affairs of Finland, expressed in his speech at the Arctic Circle Conference in October 2016 why Arctic cooperation is important.

“In the 21st century, the Arctic has the potential to become a hub between Europe, America and Asia. Natural resources and the opening of new sea routes in the Arctic may bring many benefits, but also challenges. In view of these unprecedented changes we need to safeguard sustainable development of the Arctic region.”

Icebreaking needs and plans on the Northern Sea Route

Growth of shipping on the Northern Sea Route has been connected with the commercial exploration of the Arctic regions. Icebreaker fleet and duly ice-strengthened transport vessels successfully transport natural resources and deliver equipment, and commodities to and from the areas of difficult access.
Although the NSR offers opportunities as a shorter transit route for shipping, the main growth forecasts in transportation are currently related to the exploration of new fields and exportation of raw materials from the Arctic shelf.

Dynamic of cargo volume on the NSR over the past 25 years (transit and domestic)



Source: http://www.arctic-lio.com/nsr_transits

The seaway of Northern Sea Route (NSR) is running through Kara, Laptev, East Siberian, and Chukchi seas. The NSR can be entered from west through the Straits Yugorskiy Shar and Karskiye Vorota, or by passing North of Ostrova Novaya Zemlya around Mys Zhelaniya, and from East through the Bering Strait.

The main factor influencing navigation through the NSR is the presence of ice. Annual and seasonal variability of ice conditions is typical for all areas of the NSR. Navigation season for transit passages starts approximately at the beginning of July and lasts through to the second half of November. On the western parts, it is possible to operate year-round with the assistance of icebreakers, or with independently icebreaking vessels.

Current projects along the NSR

Since the winter of 1978-79, one of the most advanced Arctic marine transport systems in the Arctic has been the year-round Dudinka – Murmansk shipping line. Cargo flow on this route remains at a more or less stable level of about 1 million tonnes annually.

Besides projects involving sea transportation of hydrocarbons from the Russian Arctic offshore, at present the export of oil from the oil fields of the Timan-Pechora region through the stationary sea ice-resistant shipping terminal Varandey has been going on several years. The sea ice-resistant stationary platform Prirazlomnaya began production and shipping in 2014.

Construction of the natural gas liquefaction plant in Sabetta and the export of oil from the Novoportovskoe field from the single-point mooring in Ob Bay in the Cape Kamenny area are under active construction at present.

The first shipment of LNG from Sabetta is planned for 2017, putting into operation the first train with annual production of 5.5 million tonnes of LNG. Already in 2019 the total productivity of three trains could reach 16.5 million tonnes a year. It is additionally planned to extract up to 1 million tonnes of gas condensate from Sabetta.

At the end of May 2016, the “Arctic Gate” single point terminal began operation near Cape Kamenny. It is intended that during the first years the volume of the annual transhipment of oil would reach 5.5 million tonnes and from 2019, reaching full output, the terminal would be capable of shipping about 8.5 million tonnes of crude oil annually.

NSR transit navigation

Since 2010, large-capacity ships of appropriate ice classes have carried out transit cargo transportation during summer-autumn navigation. These ships are sailing along the NSR under the escort of Russian nuclear icebreakers.

For the first time, the Aframax class tanker *SCF Baltica* made a transit voyage through the NSR from Murmansk to China in August 2010. The largest ship passing along the NSR in 2011 was the tanker *Vladimir Tikhonov* of the Suezmax class, with a deadweight of about 160 thousand tonnes. For the transit of such large ships, the deep-water high-latitude route to the north of the New Siberian Islands was used.

In November 2012, for the first time ever, the transportation of LNG on the NSR was carried out. The transportation was performed by LNG carrier *Ob River* with a capacity of 150, 000 m³ and was escorted by two nuclear icebreakers during the period of intensive ice formation.

However, the results of 2014-2016 seasons navigations have shown that the transit cargo flows though the NSR remain unstable, and can easily be redirected to other routes.

Vessels transited NSR in year 2016

Source: http://www.arctic-lio.com/nsr_transits

	Vessel name	Flag	Shipowner	Ice class	Type	Cargo	Qty (mt) / passangers	DWT (tons)	Max draught (m)	Port of departure	Port of destination	I/b assistance	WBNSR (Kara Gate)	WBNSR (Yugorskiy Shar)	WBNSR (Cape Zhelaniya)	EBNSR (Cape Dezhnev)	NSR passage time (days)
1	Kapitan Khlebnikov	Russia	PJSC "Far Eastern Shipping Company"	Icebreaker7	Icebreaker	Passangers	120	4 418	8,5	Anadyr	Murmansk	No			27.07.16 21:35	16.07.16 2:30	11,8
2	Brage Viking	Russia	LLC "Viking Supply"	Arc 5	Tug	n/a	0	4 352	7,4	Kholmsk	Aberdeen (Scotland)	Vaigach (Atomflot)			06.08.16 7:00	21.07.16 18:30	15,5
3	Yong Sheng	Hong Kong	Cosco Shipping Ltd	Arc 4	General cargo carrier	Ore in bulk,steel	13 514	19 150	8,3	Shanghai (China)	Glasgow (Scotland)	Vaigach (Atomflot)			06.08.16 13:26	28.07.16 7:00	9,3
4	Spasatel Karev	Russia	FBI "Marine Rescue Service of Rosmorrechflot"	Arc 5	Rescue	n/a	0	1 109		Saint-Petersbourg	Vladivostok	No		30.07.16 6:30		20.08.16 9:50	21,1
6	Gretke Oldendorf	Portugal	Oldendorff Carriers GmbH & Co KG	Ice 2	General cargo carrier	Coal	76 175	80 444	14,3	Vancouver (Canada)	Raahe (Finland)	Yamal (Atomflot)			28.08.2016 23:30	03.08.16 6:00	25,7
7	Winter Bay	St. Kitts & Nevis	Darliada Ltd	Ice 1	Refeer	Frozen meat	1 625	2 050	5,4	Tromse (Norway)	Osaka (Japan)	No			10.08.16 14:28	26.08.16 11:20	15,9
8	Tian Xi	Hong Kong	Cosco Shipping Ltd	Ice 1	General cargo	Paper pulp	30 042	36 000	10,5	Kotka	Qingdao	Yamal			16.08.16 12:40	29.08.16 14:15	13,1
9	Vidar Viking	Russia	LLC "Viking Supply"	Arc 7	Tug	n/a	0	2 600	6,75	Kholmsk	Landskrona	No			30.08.16 0:20	19.08.16 23:00	10,1
10	50 let Pobedy	Russia	FSUE "Atomflot"	Icebreaker9	Icebreaker	n/a	0	3 505	11,0	Murmansk	Anadyr	n/a	20.08.16 4:20			26.08.16 13:50	6,4
11	Hanseatic	Bahamas	Hapag-Lloyd Kreuzfahrten GmbH	Arc 5	Passanger	Passangers	126	1 177	4,9	Murmansk	Provideniya	No			24.08.16 4:00	06.09.16 21:30	13,7
12	Georg Oldendorf	Portugal	Oldendorff Carriers GmbH & Co KG	Ice 2	General cargo carrier	Coal	78 347	81 400	14,5	Vancouver (Canada)	Raahe (Finland)	No			08.09.16 19:00	30.08.16 13:45	9,2
13	Yaroslav Mudriy	Russia	Valkur Ltd	Arc 4	General cargo carrier	Oil products	8 470	10 463	8	Arhangelsk	Petropavlovsk-Kamchatskiy	No	02.09.16 18:00			12.09.16 11:41	9,7
14	BBC Lima	Germany	BBC Charteting Carriers	Arc 5	General cargo	General cargo	369	7 819	5,8	Shanghai	Bremerhaven	No			16.09.16 8:33	07.09.16 6:45	9,1
15	Winter Bay	St. Kitts & Nevis	Darliada Ltd	Ice 1	Refeer	Frozen fish	1 874	2 050	5,8	Petropavlovsk-Kamchatskiy	Saint-Petersbourg	No			11.10.16 11:45	03.10.16 1:25	8,4
16	Inzhener Trubin	Russia	Northern Shipping Company	Arc 5	General cargo carrier	Ballast	0	7 075	5,8	Arhangelsk	Quingdao (China)	50 let Pobedy (Atomflot)	31.10.16 16:50			12.11.16 8:55	11,7
17	Normann	Liberia	LLC "Femko	Arc 7	Supply vessel	n/a	0	2 600	7,6	Bergen	Kholmsk				02.11.16 12:00	17.11.16 17:45	15,2
18	HHL Valparaiso	Liberia	Hansa Heavy Lift	Arc 4	General cargo carrier	Port crandes; sand in big-bags; invertors	4 097	19 413	8,8	Saint-Petersbourg	Vostochniy	50 let Pobedy (Atomflot)			03.11.16 20:30	11.11.16 19:06	7,9
19	Pomor	Liberia	LLC "Femko management"	Arc 7	Supply vessel	n/a	0	2 600	6,1	Bergen (Norway)	Kholmsk				08.11.16 8:10	17.11.16 18:20	9,4
Total			Cargo				214 513	Average									14,3
			Passangers				246										

Role of NSR Administration

Politics of the Russian Federation regarding Arctic navigation is based on the principle that the NSR is a historically established national integral transport communication in the Arctic. In order to resolve pending problems of the organisation of navigation, and to ensure safety in the water area of the NSR, in 2012 President Putin signed the Federal Law "On amendments to certain legislative acts of the Russian Federation regarding the state regulation of commercial navigation in the water area of the NSR".

The Federal state Institution "The Northern Sea Route Administration" was established with the main targets to ensure safe navigation and protection of marine environment from the pollution in the water area of the Northern sea route. The main functions are the following:

- Obtaining and considering the submitted applications and issuing the permissions for navigation through the NSR;
- Issuing the certificates of the ice conventional pilotage on NSR;
- Researching weather, ice, navigational and other conditions on NSR;
- Coordination of installation of navigational aids and harmonization of regions to carry out hydrographical survey operations on NSR;
- Assistance in the organization of search and rescue operations in the water area of NSR;
- Assistance in eliminating the consequences of pollution from vessels of harmful substances, sewage or garbage;
- Rendering the information services in relation to the water area of the NSR, for example, about the organisation of navigation, requirements of safe navigation and others;
- Making recommendations about development of routes of navigation and using icebreaking fleet in the water area of the NSR, ice and navigational conditions there;
- Timely data retrieval from Russian hydro meteorological service about hydro meteorological forecast and ice analysis.

The intent is also towards a more justified fee policy. Fee rates for icebreaker escorts and ice pilotage of ships in the water of NSR are determined based on ship capacity, ice ▶

class, distance of escorting, and season of navigation. Payment is collected based on the amount of services rendered.

The new “Rules of the navigation in the water area of the Northern Sea Route” approved in 2013, state that icebreaker escort on the NSR is carried out only by icebreakers navigating under the flag of the Russian Federation. These rules also contain a list of documents, which ship owners have to attach to the application for the permission to navigate in the water area of the NSR, and criteria for admission of ships into the NSR in compliance with their ice class.

Icebreaker assistance

The NSR extends for about 3000 nautical miles. The length of the route with icebreaker assistance in each case depends on ice conditions, and on the choice of particular variants of passage of different stretches of the route.

According to a report by Arild Moe and Lawson Brigham published in the Geographical Review 2016, it is the responsibility of each captain to plan and carry out the voyage along NSR based on requirements and information received from the NSR Administration in Moscow. Practical planning must be negotiated with the icebreaker company.

Although there are many providers of icebreaking and ice pilotage services (the full list can be found at www.nsra.ru), for long hauls only Atomflot is relevant. Moe and Brigham further state in their report that they believe there will be a lack of strong icebreakers in the future if investments in new powerful icebreakers are not advancing.

“The eastern NSR-route across Laptev, East Siberian and Chukchi Seas to the Bering Strait is where the length of the ice navigation season remains uncertain. While it may be technically feasible with nuclear icebreakers to escort ships year-round along the eastern NSR, the safety and economical issues of doing so have not been fully addressed,” the report says.

In recent years, modern icebreaking vessels of Norilsk Nickel class operate year-round without icebreaker escort. The new LNG-carriers departing the port of Sabetta are also capable of winter voyages without icebreaker escort. However, users preferring independent navigation will still need icebreaker services for emergency situations. It is currently unclear how many new icebreakers would be needed to maintain service, not only for the extension of the NSR navigation season but also to provide marine access to the Russian Navy and resupply of remote coastal communities. According to the report, it is also unclear how IMO's Polar Code will be implemented in Russian waters.

Planned icebreakers

According to Rosatomflot, the following new building projects are now on-going: Three universal Atomic icebreakers (Project 22220) will be acquired for year-round navigation on NSR. These icebreakers will have a propulsion capacity of 60 MW. The first should be delivered in 2017, the second in 2019, and the third at a later date.

An Atomic-leader icebreaker (Project 10510) is currently at the planning stage. It is intended for year-round icebreaking pilotage of heavy tonnage vessels (deadweight above 100 000 t and breadth above 50 m) along the whole distance of the Northern Sea Route, with an economically effective speed (~10 knots) in 2 m thick ice.

Also proposed is a Multipurpose Atomic icebreaker (Project 10570) for ice pilotage in the shallow waters of the Arctic shelf.

Rosmorport is planning to start operation in the Arctic of a powerful diesel-electric icebreaker (25 MW) with a wide range of functional capabilities including escort of convoys along the Northern Sea Route and assistance of ships in shallow Arctic areas in 2018. The icebreaker Victor Chernomyrdin (project 22600) was laid down in 2012 and launched late December 2016 at Baltiysky Zavod shipyard in Saint Petersburg.

The various exploration projects have all ordered specific icebreakers to support their operations. Aker Arctic has participated in most of the projects designing icebreakers, support tugs, port icebreakers, tankers, module carriers, and has also assisted in port planning.

“The Northern Sea Route remains the most important part of the infrastructure of the economic system of the Far North of Russia,” says development manager Alexey Shtrek, Aker Arctic. “For the last decade, we have seen steady development of Arctic shipping projects connected with navigation in the NSR water area, although projected plans have not always advanced as fast as wished. Completely new types of icebreaking cargo vessels have been designed and built for this purpose. The potential of NSR transit shipping has been tried, and has proven its economical feasibility provided there is appropriate support and further development of infrastructure.”

“All this gives us hope of seeing the realisation of more Arctic production and transportation projects demanding more highly sophisticated icebreaking ships in the near future. A powerful Arctic icebreaker fleet will by all means remain key to ensuring safe navigation, and to facilitating traffic through the Northern Sea Route,” Shtrek adds.

Transportation projects with Aker Arctic involvement

Arctic container vessels
The container vessels designed for Norilsk Nickel in 2006 used the new revolutionary Double-Acting ship (DAS™) concept Aker Arctic developed. Today this technology is more or less the standard in Arctic vessels used in year-round traffic. These were among the first ships able to operate year-round in the Kara Sea without icebreaking support.

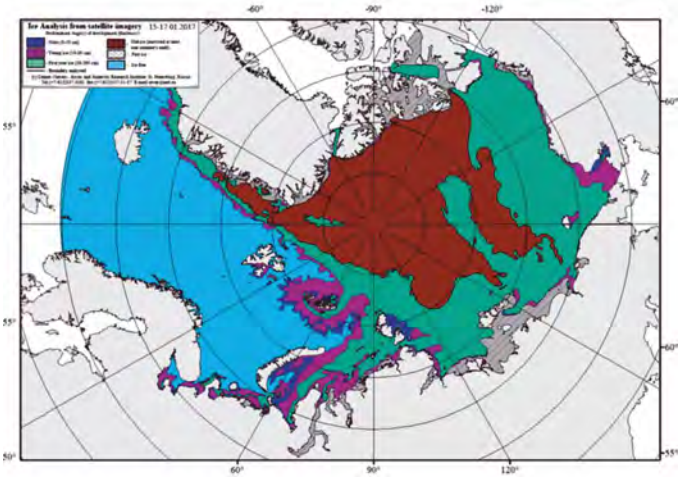
Photo: Sovcomflot OAO

Varandey
The seaport of Varandey is located on the shore of the Barents Sea near Varandey Bay. At present the oil export from the fields of the Timan-Pechora region through the stationary, sea-ice resistant shipping terminal Varandey has been taking place for several years. Aker Arctic designed the pioneering trio of Arctic tankers for transportation of crude oil without icebreaker escort.

Prirazlomnaya
The sea-ice resistant stationary platform Prirazlomnaya started production and shipping in 2014. Aker Arctic designed the vessels used in transporting the oil.


Courtesy of ZPMC Red Box Energy Services

Port of Sabetta
Sabetta seaport is located in the north-eastern part of the Yamal Peninsula, on the western coast of the Ob Bay. The port is under construction, as are the natural gas liquefaction plant and the Novoportovskoe oil field. The first shipment of LNG from Sabetta is planned for 2017. Aker Arctic began development work for the Yamal LNG project already in the 1990s. We have also been involved in the planning and design development of the LNG-carriers, Sabetta harbour, and design of the port icebreakers to ensure efficient year-round operations. In addition Aker Arctic designed the two PC3 class module carriers, which currently deliver construction modules for the LNG-plant from Europe and Asia, as well as an Arctic gas condensate tanker.


Source: http://www.nsra.ru

The NSR Administration publishes ice charts for different periods on their website to facilitate planning of vessel traffic and icebreaker assistance.

Arctic Gate
At the end of May 2016, a single point terminal started to operate near Cape Kamenny. It is intended that during the first years the volume of annual transhipment of oil would reach 5.5 million tonnes and from 2019 reaching the full output the terminal would be able to ship about 8.5 million tonnes of crude oil. Aker Arctic has been involved in developing the transport solutions for the oil shipments from Novy Port, as well as the powerful icebreakers to secure safe operations.

Sources:
Northern Sea Route Information Office website
http://www.arctic-lio.com
The Northern Sea Route Administration website
http://www.nsra.ru
Organization and management challenges of Russia's icebreaker fleet, article by Arild Moe and Lawson Brigham in Geographical Review 2016
Presentation by Rosatomflot 2016
Report by Alexey Shtrek, Aker Arctic Technology

Will EEDI become tighter?

The IMO Energy Efficiency Design Index (EEDI) came into force in January 2013. The purpose was to promote energy efficient ships and thereby reduce CO_2 emissions, but it now seems that not all the ships built based on EEDI are optimal when looking at the big picture.

The Energy Efficiency Design Index (EEDI) is a mandatory design method for new vessels above 400 GT. The intent is to reduce CO_2 emissions by regulating the installed propulsion power of new vessels with considerable conversions. At the moment, ships with icebreaking capability of more than one metre and ships with diesel-electric propulsion are excluded from EEDI requirements. However, there are currently no clear regulations on how the icebreaking capability of one metre can be verified.

Results from EEDI

Now that EEDI has been in force for three years, results are beginning to show. For container ships the solution to fulfil EEDI has been slow steaming with hull modifications, i.e. reducing speed and increasing of ship size. Thus, new container ships are getting bigger and slower than before. For other ship types, this solution is not always an option. For instance ice going vessels, which already move slow in ice, reducing speed is not possible or they might get stuck in ice. Cruise ships and ferries often have a daily schedule they need to keep, which means they cannot sail slower.

Based on the experience so far, it is easier for smaller vessels to meet the current EEDI requirements.

"If this phenomenon continues, it may increase the number of small ships at the expense of larger vessels, and bring an overall increase in the CO_2 emissions in comparison to a situation in which the same amount of cargo is transported with larger vessels," says sales and marketing manager Arto Uuskallio.

There is also political pressure to move on to phase two and three of EEDI regulation – and possibly to phase four, which would mean even tighter regulations for individual vessels, but not necessarily reduced overall emissions.

Optimal cargo flow

Given this situation, the Finnish Transport Agency and the Board of Winter Navigation have begun studies to gather information about the vessels built in phase one of EEDI, so as to evaluate how phase two and three of EEDI could be implemented. Scenarios will be built up regarding the cargo traffic in the Baltic Sea in order to evaluate the optimal amount and sizes of vessels needed for total cargo flow. As a result, emissions of both individual ships and total cargo traffic will be compared. Aker Arctic is participating in these studies.

Smaller vessels can easier fulfil EEDI rules. However, when the aim is to reduce CO_2 emissions, total cargo amounts to be transported have to be taken into account.

"EEDI regulations were based on vessel statistics," Uuskallio adds. "The challenge in gathering statistics regarding the Baltic Sea was, that there were not always enough vessels to get statistical relevance, and certain categories were based only on individual vessels. In some cases this might have been a special vessel with special solutions, and as such not a good representative of that vessel category."

Another challenge with EEDI is that it is somewhat contradictory to the goals of the Finnish-Swedish ice class rule with minimum power requirement, which needs further studies.

Additionally, the aim with the current studies is to clarify how to verify the EEDI compliance of high ice-class vessels. Open water vessels are currently verified through calculations, model tests and full-scale tests during the design and construction period. "A corresponding process would be appropriate for high ice class ice vessels too," says Uuskallio.

Polar Code in force

IMO Polar Code began in January 2017.
The compulsory requirements are needed for ships sailing in international polar waters.

For new ships, the Polar Code now applies. Existing ships need to comply with the Polar Code at their first intermediate survey or renewal survey after 1 January 2018.

One of the requirements in the Polar Code is the Polar Water Operations Manual (PWOM), which needs to be available in every vessel.

"The intention is to use it as a real operative manual which describes how things are done in cold and freezing conditions and how the vessel is operated in various situations," says Mr Uuskallio. "Insurance companies will surely verify this if something happens in the Polar areas. We at Aker Arctic offer the PWOM as a service to our customers, but it has to be compiled jointly with the ship-owner and the operator to meet the requirements for each vessel."

Crew training is essential

In order to support the crew, prior training in Polar water operations is necessary. At IMO, the ***Standards of Training, Certification and Watchkeeping*** committee (STCW) is currently in the process of finalising the instructions on how and who is allowed to offer crew training. In Finland, Aker Arctic's partner Aboa Mare provides this special training for the crews.

Polar Code training now available

Aker Arctic's cooperation partner Aboa Mare in Turku, Finland offers ice navigation training according to Polar Code requirements for vessel crews, which intend to sail in the Polar areas.

"Our new Ice Navigation Course is delivered according to STCW requirements and includes all the IMO guidelines for crew training," says training director Micael Vuorio, Aboa Mare.

The Polar Code certificate is required of officers sailing in Arctic and Antarctic waters. There are two levels of the Polar Code course, Basic and Advanced, and the course is offered in English. "Participants in our courses come from all over the world," Vuorio adds.

The IMO training requirements will come into force 1.7.2018 but Vuorio assures that their course includes everything needed to obtain the Polar Ship Certificate, as Aboa Mare has participated in developing the IMO training requirements.

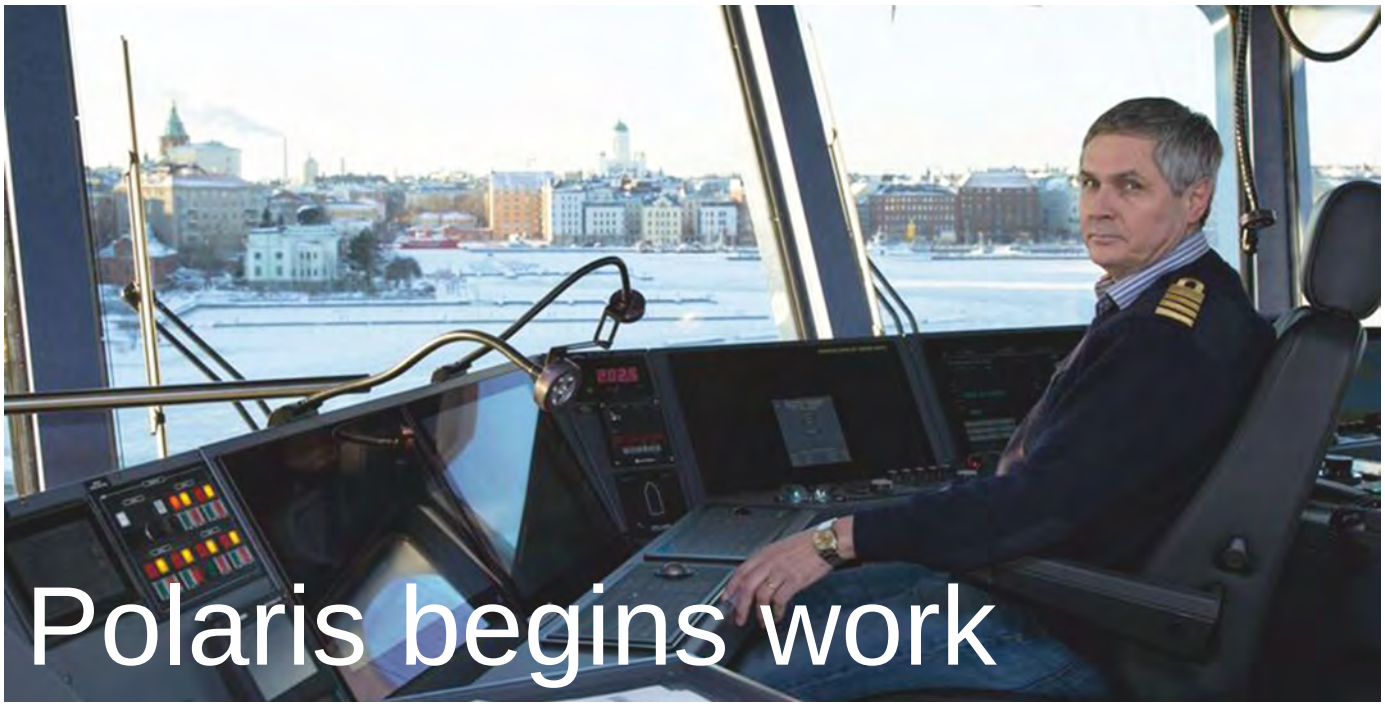
Aker Arctic and Aboa Mare have been working together since 2007 in ice navigation training, and today they are jointly developing the Aker Arctic Ice Simulator.

"The ice simulator is the best possible tool in learning ice navigation," Vuorio says. "For instance, the entire crew of the new Finnish icebreaker *Polaris* has been to our premises in Turku to practice handling the vessel using the ice simulator."

Aboa Mare has educated sea captains for over 200 years. They have ten different ship bridges to train on, and all of them include ice navigation as an option. "I believe our ice navigation know-how is among the best in the world."

Read more about courses at Aboa Mare from www.aboamare.fi.

The ice simulator is the best possible tool in learning ice navigation.



Polaris begins work

The brand new Finnish LNG icebreaker *Polaris* began her work in January this year. Praised for her powers and environmental solutions, Captain Pasi Järvelin and his crew are now testing her in the heavy ice conditions in Bay of Bothnia. The first weeks have been successful.

Pasi Järvelin at the bridge in Helsinki, before departing for icebreaking duties in the Bay of Bothnia.

Pasi Järvelin, the Captain of the new Finnish icebreaker *Polaris*, has worked forty years on the sea, all over the world. He has sailed around the world, spent several months in Antarctica, worked offshore, steered *Nordica* through the Northern Sea Route from Alaska to Europe and managed icebreakers for the past thirty years.

When the planning of *Polaris* began in 2013, Captain Järvelin joined the concept team in order to give his input on what is needed in a modern icebreaker. His responsibilities were icebreaking, cranes, interior design, the bridge, dynamic positioning (DP) and oil response.

"The advantage is that I know the ship inside out. I know exactly how she will behave in different situations and what she is capable of," Järvelin says.

Captain Järvelin was also involved full-time in writing the specification and supervising the construction work at Helsinki Shipyard together with his experienced colleagues Björn Fagerström, Jarmo Paajanen and Juha Hiltunen. "I went every day to the shipyard for two years, which taught me a lot about the vessel."

Quick movements

Polaris is a powerful icebreaker with a triple azimuth solution: two propulsion units in the stern and one in the bow. "From a users perspective, the biggest difference to traditional icebreakers is *Polaris'* agility. Her rate of turn is more than 200° in a minute. I believe the third Azipod in the bow will make *Polaris* the unchallenged dancer on the ice fields, as we say in Finnish."

"The vessel is very pleasant to steer, but the driver has to pay attention to sudden moves because she is extremely easy to turn around. In ice situations, the bow pod has to keep moving all the time."

Captain Järvelin mentions other special features such as quite a sharp bow and the steadiness when steering ahead. "The oil spill response system in case of oil accidents and the 'no compromise approach' regarding icebreaking are exceptional features in this modern icebreaker."

Polaris is also the first dual-fuelled icebreaker able to use both low-sulphur marine diesel and LNG as fuel. "Her scheduled life-time is fifty years and LNG is the future," Järvelin emphasises.

"Furthermore, we don't discharge any waste or grey water to the sea, not even shower water. Everything is transported to the shore every ten days when part of the crew is exchanged, the vessel refuelled and fresh groceries stocked."

Successful design

Polaris is based on the Aker ARC 130 concept developed by Aker Arctic in cooperation with ILS and the Finnish Transport Agency.

"Cooperation with Aker Arctic and ILS have been excellent during the entire project. Suggestions were always positively received and changes were made swiftly. I would especially like to highlight my appreciation for Mika Hovilainen and Esa Hakanen at Aker Arctic as well as Jyrki Lehtonen and Harri Eronen at ILS, all of whom had significant roles in the successful design," Järvelin says.

First weeks of icebreaking

Polaris is now in Bay of Bothnia for her first season of icebreaking. This area is the most difficult around Finland in winter due to the combination of freezing temperatures and strong winds. Icebreaking and escorting services are performed jointly with Sweden and there are currently five Finnish and Swedish icebreakers in the area to ensure safe travels at all times.

"The first two weeks have been very successful," Järvelin reports from Bay of Bothnia. "We have assisted thirty merchant vessels but only one needed towing, as the Azipods are extremely efficient. The left pod turns in the counter-clockwise direction and the right pod in clockwise direction, which means that the flushing effect keeps most of the ice away from the bulb of the assisted vessel. We have received plenty of positive feedback from customer ships for this feature."

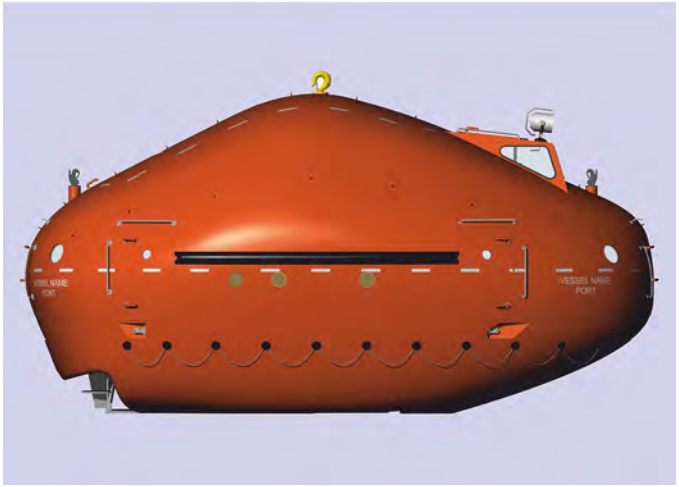
"Dislodging vessels stuck in ice has been performed with speed and elegance. Most of the time we have needed only two or three engines, but in a few cases in stormy weather where the merchant vessel was in hard ice pressure, we used all four engines for a quicker relief. Although winter is only beginning, it is already clear that the vessel specifications will be met," Järvelin says.

Model testing of Ice Strengthened Lifeboat

Over the past few years, Aker Arctic Canada, in partnership with Robert Allan Ltd., has been working on the design of an Ice Strengthened Lifeboat (ISL) to meet the demands of the offshore industry.

Model testing with ISL in 50cm thick pack ice conditions.

ISL model making forward progress in 15cm Level ice.



Ice strengthened lifeboat (ISL).

The design of ISL addresses the challenges with Escape, Evacuation, and Rescue (EER) in Arctic environments that have been outlined in the Polar Code and other research on lifeboats in cold climates. Heating and insulation, additional space, and endurance have all been addressed by the design. In addition, the ISL has the capability of tolerating dynamic pack ice conditions by using a hull form based on the 19th century Norwegian ship Fram, which prevents it from being crushed by in pressured ice conditions. The propulsion has been recessed into a tunnel, which allows the craft to be launched onto the ice without damaging the propulsion system.

The original design was conceived in 2002 by Robin Browne, and was developed by Robert Allan Ltd. as part of an oil industry joint industry project. Although the original project ended due to the downturn of the US economy in 2008, Aker Arctic Canada helped to revive the project in 2012, thanks to funding from Petroleum Research Newfoundland and Labrador (PRNL).

In 2016, with funding support from PRNL and Research Development Corporation (RDC) the design underwent a series of model testing and numerical analysis work led by Aker Arctic Canada. The purpose of the tests was to demonstrate the capabilities of the ISL in both open water and ice. Self-propulsion model tests were therefore conducted in calm water, waves up to “5” m, and in various pack ice conditions. Computational fluid dynamics (CFD) was used to extrapolate results into wave conditions up to 7.5 m.

“We are still in the process of analysing the data, but initial results are encouraging,” says Mike Neville, Aker Arctic's project manager for the project.

“The ISL's performance in open water exceeds that of traditional TEMPSC (totally enclosed motor propelled survival craft), while having the added ability of being able to transit in pack ice.”

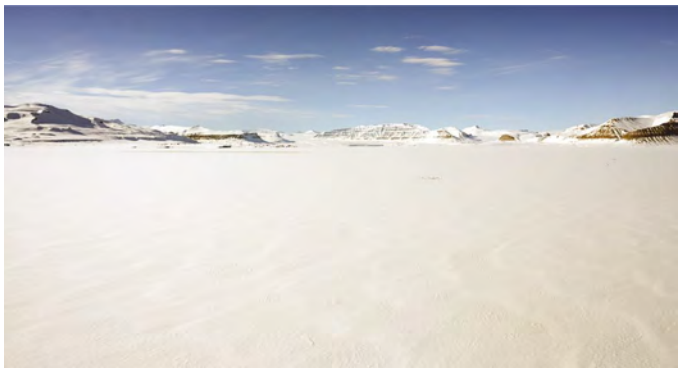
Although the original concept of the ISL was to be capable of being launched in all conditions, and keep the crew safe either on or in the ice until help could arrive, the tests have shown that the ISL also has the ability to transit in a variety of pack ice regimes and even in level ice.

Text by Evan Martin,
Aker Arctic Canada

Basics about ice, Part 1:

Ice properties and ice resistance

Icebreakers and ice-going vessels continuously encounter changing ice conditions during their operation. When developing such vessels, the designer must recognize which ice conditions are relevant and how they affect the vessel design. Typically, four main ice types are considered: level ice, drift ice, brash ice and ice ridges.



Level ice is an intact, continuous ice cover, which is typically encountered in coastal and sheltered waters where the ice cover is frozen to the coastline and islands. It is uncommon in open seas due to wind and waves. Although level ice is less encountered in nature, it is used as the basis when defining the icebreaking capability of an ice-going vessel, because vessel capabilities are then easier to test, calculate and compare.

Drift ice is a broken ice field consisting of ice floes of various sizes. This is the most common ice condition in open sea because wind and waves break the ice. Wind can also drive the drift ice into ice packs or ridges. Coverage is given in tenths i.e. 0/10 open water, 10/10 complete ice. If the ice coverage is less than 5/10, ice generally does not impede vessel passage.

Brash ice and ice channels form on shipping lanes and in harbour basins as a result of regular traffic and constant icebreaking activity. These ice blocks are roughly spherical with a diameter smaller than
2 m, and the thickness of the ice mass grows faster than that of the surrounding level ice. Ice blocks near the surface level may freeze back together, creating a thick consolidated layer. In channels the thickness of the ice mass increases towards channel edges, which can make breaking out from a channel very challenging. This is the typical operational environment for merchant ships in e.g. the Baltic Sea.

Ice ridges are accumulated ice blocks and rubble formed when wind and current push ice floes against each other. The total thickness can be tens of metres and the ice blocks can additionally freeze together to form a consolidated ridge. This is typically the most challenging ice obstacle encountered by ice-going vessels in all freezing seas, and in particular in coastal areas such as the Gulf of Bothnia and the Gulf of Finland in the Baltic Sea, and the Kara Sea in the Russian Arctic.

Ice conditions
In addition to the four different types of ice generally considered in the design process, there are two additional ice features worth noting, namely compressive ice fields and icebergs.

Wind can create compressive stresses in a **drift ice field**. When ice presses against the sides of the vessel, ice resistance increases considerably. If a vessel gets stuck in ice, it may result in ice damage if the hull structures cannot withstand the compression in the ice field. This also means that the channel behind the icebreaker closes and escorting merchant ships becomes more difficult.

Icebergs are large ice blocks calved from glaciers. Formed in high pressure over hundreds, even thousands of years, the ice is very clear and extremely hard. Ships should avoid coming in contact with icebergs, and ice management vessels should steer icebergs away from offshore structures. Small icebergs such as growlers and bergy bits are especially dangerous, as they are difficult to detect and colliding with them at high speed could sink a ship. Icebergs are typically not taken into account

in ice-going vessel design, as they are to be avoided. Not even the biggest and strongest icebreakers in the world can withstand collision with an iceberg, contrary to common beliefs.

Ice can also be either first-year or multi-year ice. In the Baltic Sea and most of the Arctic and Antarctic, the ice is first-year ice. This ice is more porous than multi-year ice. The maximum thickness depends on the geographical location, e.g. one metre in the Baltic Sea and up to two metres in the Arctic.

Ice that has survived more than one summer period is called multi-year ice. It has lower salinity and porosity, and is hard and often thick. Glacial ice is an extreme case of multi-year ice, which can be up to a thousand years old. Ships should avoid and circumnavigate multi-year ice whenever possible.

Ice failure process

Ice can be broken in two different ways: either by crushing or by bending. Ice loads and resistance become very high in crushing, and the power needed to crush the ice can be up to ten times higher than is needed for bending. The hull must also be much stronger. Therefore bending is the optimal way of breaking the ice, as it is much more efficient. Even very thick ice can be broken with reasonable propulsion power.

A traditional icebreaking bow bends the ice downwards, and sloping sides improve manoeuvring.

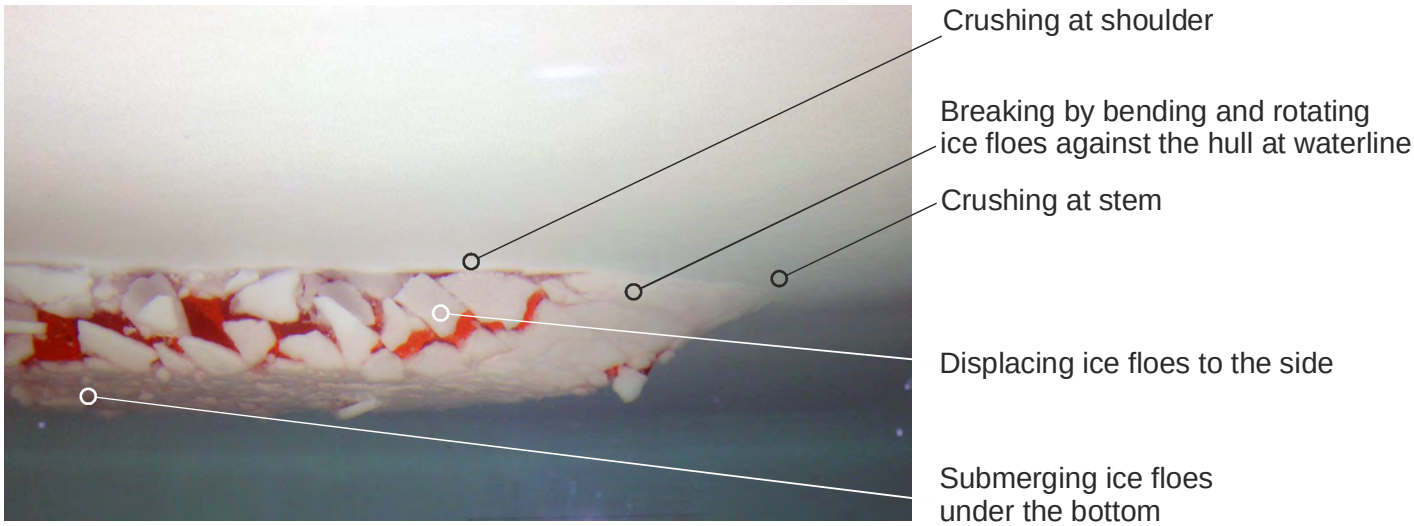
The modern method is to use the propeller flushing effect to reduce friction and dislodge ice blocks. It is possible to use bow propellers, as in traditional Baltic icebreakers. The active flushing is done with azimuth thrusters. Double-acting cargo ships can also move in the astern direction. If the vessel is kept in continuous motion, there is no danger of getting stuck in the ice.

Ice resistance

The ice resistance is the added resistance from the icebreaking process, which the vessel needs to overcome in addition to hydrodynamic resistance. The ice resistance as a whole is a result of different stages of the icebreaking process such as crushing, bending and submersion of the ice floes.

Icebreaking and ice-going capability are typically defined for level ice, because vessel capabilities are then easier to calculate, test and compare.

For special purpose vessels, icebreaking capability can also be defined e.g. for thick brash ice or other ice conditions. What is essential is that icebreaking is a complex process and numerical simulation of icebreaking is very difficult. Empirical methods and physical testing are much faster ways to get information and predict performance.



Icebreaking in level ice

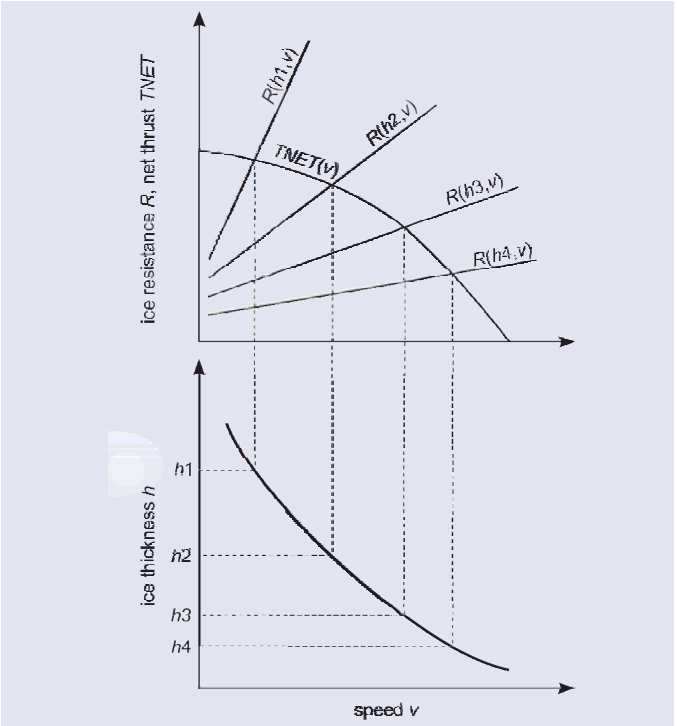
In level ice, the first way in which ice fails is by bending against the bow of the vessel. Crushing may also occur near the stem and shoulders, but one of the design goals is to minimise this. The broken ice floes rotate against the sides of the vessel, after which the ice is displaced to the sides and submerged under the bottom as the vessel moves forward. The second way ice fails is through friction between steel and ice as floes slide along the hull. In which ice-going vessels typically operate, the ice resistance increases linearly as a function of speed in the speed range.

Icebreaking in channels and ridges

If ice is already broken, the ice resistance is primarily a result of displacing the ice mass around and under the vessel, while part of the resistance comes from compressing the ice mass surrounding the hull. Even vessels with no independent icebreaking capability and limited propulsion power may be able to operate independently in ice channels.

Penetrating ice ridges

The traditional method to penetrate ice ridges is “ramming and backing”. The mass and momentum of the vessel is used to drive the hull through the ice feature. However, there is a danger of getting stuck in ice if the vessel cannot back away from the ridge. In order to break free, heeling and trimming systems or air bubbling can be used.



Basics about ice, Part 2: Special features of vessels operating in ice. Read more in next issue of Arctic Passion News.

Harmonising model tests for power requirements

Aker Arctic and Aalto University have started a joint project with the aim to develop the model test methods for defining vessels' power requirements according to the Finnish-Swedish Ice Class Rules.

Today there are no guidelines in the Finnish-Swedish Ice Class Rules on how to define brash ice channel properties in the ice model tests to define a vessel's power requirements.

The power requirements of the Finnish-Swedish Ice Class Rules (FSICR) can be defined by model tests. The tests are conducted in an ice channel where the thickness and width is defined by the guidelines. However, practice has shown that the model brash ice properties strongly affect the ice resistance of vessels, and these properties are not well defined.

"There are currently no guidelines for instance regarding the size of the ice blocks, level ice strength, cohesion nor porosity," head of the ice model testing laboratory Topi Leiviskä says.

Varied results

At the moment, ice model basins conduct tests for ice class certification with different methods. Some facilities conduct propulsion tests with a free running model, and others use towed propulsion tests; this variety of systems may lead to variation in results. The results may also differ depending on the ice and channel properties. It is therefore essential to harmonise the methods as much as possible.

Aker Arctic and Aalto University have started a joint project with the target of defining the needed channel properties and production methods. These will also be verified in two model test facilities at Aalto University and Aker Arctic. Both institutes have a long experience in ice model tests and good knowledge in testing and model ice preparation procedures. As part of the project, all main facilities, which are members of ITTC ice committee, have been asked to comment on their procedures and channel properties.

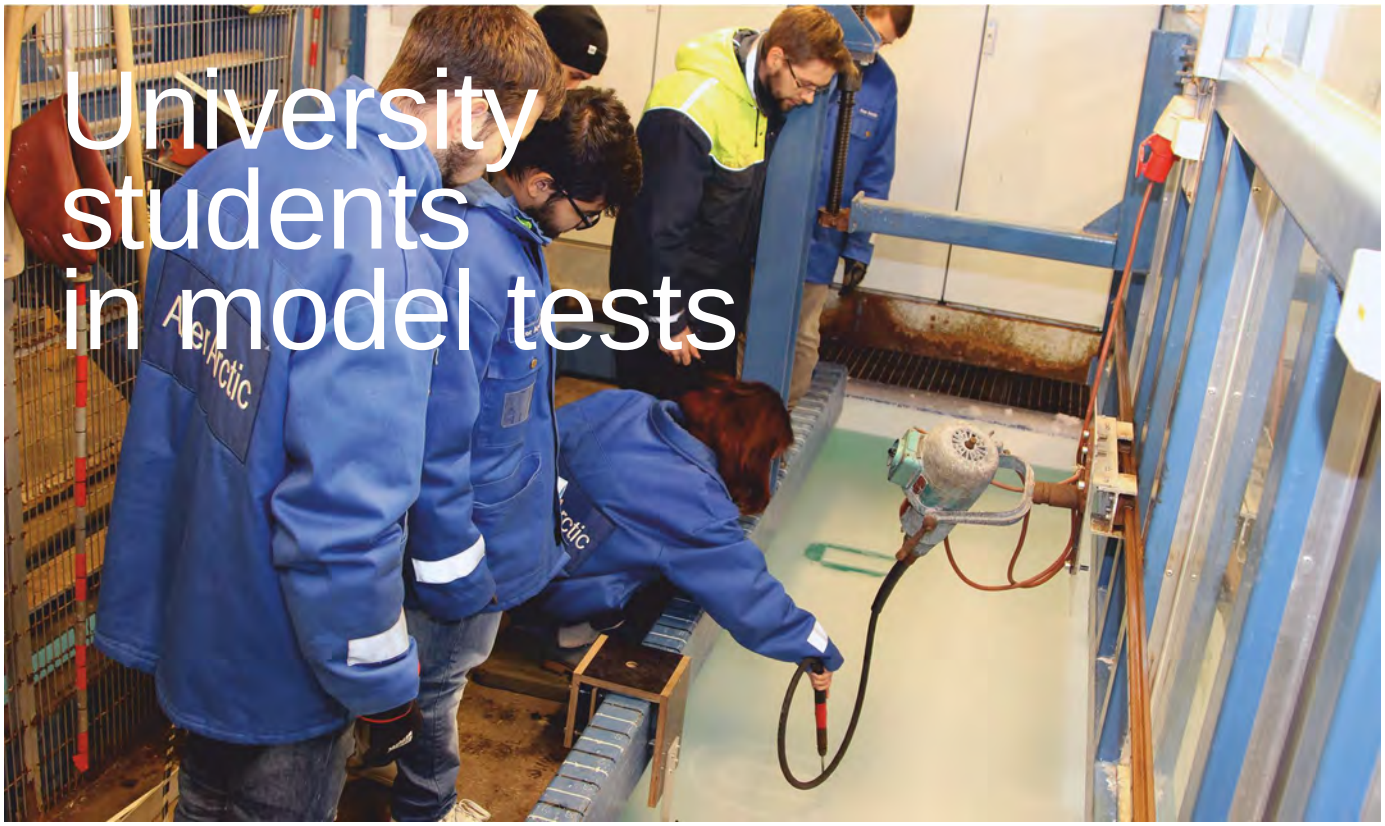
"We have gathered information from the main facilities worldwide, developed a standardised method for making an ice channel as well as defined the parameters for the two different ice channels we intend to use in the research," Leiviskä explains.

"The next step is to test the two channels with a model of an existing ship in two ice model basins. Tests will be conducted in two defined ice sheets and they will be repeated in each channel once. The channels will then be reconstructed and the tests repeated in all channels at least three times, both in our model basin and in Aalto's basin."

The project will be ready by the end of 2017.

"We hope to then have good recommendations for procedures on how to prepare the brash ice channels used for the definition of the power requirement with ice model tests according to the FSIC Rules," Leviskä says.

University students in model tests



Naval Architect students learning to prepare ice at the ice laboratory.

Aker Arctic regularly employs students who are studying to become Naval Architects to help out part-time at the ice laboratory. They help in e.g. preparing the ice, forming the ice to channels or ridges, measuring the ice, and in filming the actual tests.

"In this way the students get acquainted with working life, they earn a bit of money, and they also learn about icebreaking and other technical topics," Topi Leiviskä says.

Many of these students eventually do their master's thesis for Aker Arctic, and start working full-time after graduation.

One of our newest employees, Jesse Lehtonen, began his career at Aker Arctic as a part-time employee during his studies.

"I visited Aker Arctic for the first time four years ago, with Aalto University's Shipbuilder's club," Jesse Lehtonen says.
"Topi Leiviskä asked me to come for an interview the next day, and I began working one or two days a week at the ice laboratory, helping out with preparing the ice, equipping the vessel models and assisting during tests."

Lehtonen also worked during his summer holidays at Aker Arctic, and when his studies advanced he began helping out in more demanding tasks in ship design. In his master's thesis he studied simulation of propulsion system dynamics under propeller-ice interaction. From January 2017, Lehtonen is a full-time employee working with machinery system design.

"It is an excellent idea to have a student pool. I don't know of any other engineering office offering a similar system for younger students," Lehtonen says. "It has provided me and many others with working experience and interesting job opportunities."

Jesse Lehtonen started his career at Aker Arctic as a part-time employee during his studies and is now working full-time with machinery system design.

Intelligent de-icing for winterisation needs

Finnish companies Aker Arctic and Pistesarjat have jointly founded a new company that provides intelligent de-icing systems for winterisation needs. Ilkka Rantanen from Aker Arctic is stepping in to lead the new company Starkice Oy.

Winterisation is needed in many areas on a vessel or platform in order to keep areas ice-free and functioning properly in freezing conditions.

Winterisation is a general term for solutions needed in vessels, platforms and equipment to function efficiently in freezing conditions. Examples are passages and stairs, which need heating in order not to become slippery, or doors, handles, hatches and machinery that need de-icing to function properly, and decks, which need to be kept ice-free for cargo space.

"Many modern Arctic vessels and offshore structures have a system in place for de-icing, because it is needed to be able to work properly when temperatures go below freezing point," Ilkka Rantanen explains. "However, until now these systems have been manually controlled, which means they are either turned on or turned off, and can easily be in the wrong mode."

"The idea with our new Intelligent De-Icing System (IDS) is that in addition to the heating element intelligent software is included. This controls the de-icing function based on actual physical ice-accumulation, not only temperature or humidity," Rantanen says. "This brings significant cost savings, because heating is only activated when it is really needed. It also means increased safety because walking areas are not slippery, and it frees people from control functions and manual de-icing work."

Remote supervision

The de-icing system is set to work automatically, but all the details are available on the control system, which works even on a tablet. This remote control system allows supervision of the system even from the other side of the world if needed. Fully automated cargo loading constructions can in the future work on their own, because no people are required on site to make sure the system is ready to operate.

Development work has been ongoing for nearly two years. The first pilots are now underway, where information and practical experience about the system in a harsh environment is gathered. It is ready to use for interested customers immediately.

Rantanen visualises other potential areas for Starkice Oy in addition to safety and cargo handling. "Think of e.g. cruise ships with heated paths to the pool where people can walk barefoot in winter. There is obvious market potential."

"Two world-leading companies in their own fields have joined forces and created a much-needed contractor for winterisation services. Now all components and a fully functional system delivery can be ordered from one location."

Read more from www.starkice.com

Ilkka Rantanen from Aker Arctic is head of the new company Starkice.

The Finnish economy relies on icebreakers

How did Finland become a top-class icebreaker designer and constructor? As part of the Finland 100 year celebration, the University of Helsinki together with the Finnish Transport Agency, Arctia and the Society for Maritime History arranged a lecture about Finnish icebreaker history.

Without icebreakers, Finland would have been a completely different country. In the 19th century, and still today, ships transported most of the goods to and from Finland. During winters, the Baltic Sea was frozen and as a result no goods arrived nor departed Finland. This also meant unemployment and even possible starvation during wintertime. The first icebreaker was bought from Sweden in 1889 and was used to keep the southern seaport of Hanko open. Slowly more icebreakers were acquired from abroad and more seaports kept open year-round. In 1924, the first Finnish made icebreaker was ready. However, after World War II, Finland had to give two of its icebreakers to the Soviet Union, and the only way to get replacements was to build up Finland's own winter navigation industry. In the mid-1970s, icebreakers *Sisu* and *Urho* were ready and from this time twenty seaports around Finland were kept open all year.

Icebreakers *Otso* and *Kontio* followed *Sisu* and *Urho* in the 1980's. The multipurpose vessels *Fennica* and *Nordica* were built during the 1990's, followed by IB *Botnica* in 1998. The newest addition to the Finnish icebreaker fleet is the LNG powered icebreaker *Polaris*.

Icebreakers are essential to this country. Apart from their obvious function in making sure that the Finnish industry can export products and Finland can receive a steady flow of goods, the icebreakers also have a symbolic value for both the Finnish economy and politics. Because of the need to have, build and design icebreakers, the Finnish government has supported companies developing icebreaking technology, machinery needed in icebreaking as well as ice know-how. Finland has therefore become the world-renowned country in this field that it is today, and other countries can rely on Finnish expertise.

Based on a presentation by PhD student Aaro Sahari, University of Helsinki, in a research project on winter seafaring with PhD student Saara Matala, Aalto University.

Construction of Chinese research icebreaker has started

The polar research icebreaker for the Polar research Institute of China (PRIC) is now in construction. It is being built at Jiangnan Shipyard in Shanghai, China.

Aker Arctic received the design contract and made the concept design for the highly advanced vessel in 2012 and carried out model tests in both open water and ice to verify the performance of the vessel. Tests were carried out in Aker Arctic's own ice laboratory in Helsinki, Finland. This was followed by an extensive amount of feasibility studies in 2013-2015, and basic design in 2016. Construction started recently at Jiangnan Shipyard.

"Basic design is now completed and we will support the owner in the construction, especially in areas typical for icebreakers," says project manager and head of ship design Kari Laukia, Aker Arctic.

These are for instance follow-up of hull weight development, stability, hull surface quality and hull form.
"For example, hull form is an essential part of our design. We have to make sure that the design targets in the areas which are critical for performance are met," Laukia explains.

The vessel schedule has been confirmed and it is planned to be ready in 2019.
"Once the trials begins, we will join some of them. One of the most important is the set of full-scale ice tests to verify that the Polar Class 3 icebreaker manages up to 1.5 metre thick level ice with a 20 cm snow cover. This is necessary for independent operations in the operation areas for this vessel in Antarctica," Laukia says.

"The end result is a highly successful design, and the customer seems to be very pleased with the result," Laukia adds.

French polar logistics vessel under construction

The Polar Logistics Vessel L'Astrolabe at Piriou shipyard in Concarneau, France.

The construction of the new Polar Logistics Vessel for France is currently ongoing, and it is being outfitted and finalised at the shipyard in Concarneau, France. Specialists from Aker Arctic have visited the hull building site to observe the construction and to inspect the workmanship in relation to hull and ice-related matters in close relationship with French shipyard PIRIOU.

The 72-metre Polar Logistics Vessel is a logistics ship and patrol icebreaker that can accommodate up to 60 persons on board, carry 1,200 tonnes of cargo and fit two helicopters. The new vessel will be delivered in summer 2017. It will be deployed to the Indian Ocean in autumn 2017, and will carry out the first supply mission to the Dumont d'Urville Station in Adélie Land, Antarctica, in winter 2018. The Polar Logistics Vessel is based on a concept developed by Marine Assistance (France). Aker Arctic was responsible for the basic design of the vessel, and verified the icebreaking capability with ice model tests in Helsinki, Finland. In addition, Aker Arctic is providing technical support in hull and ice-related matters to the shipyard during the construction of the vessel.

Arctic condensate tanker under construction

The gas condensate tanker designed for Yamal LNG, has moved into construction phase. The steel cutting ceremony was held in November 2016 in Guangzhou, China.

The basic design has been completed for the Arctic gas condensate tanker, which will be used to transport the valuable by-product of the natural gas fields in the Arctic. Guangzhou Shipyard International (GSI) is in the process of performing the detailed design and production design, as well as the first phases of construction.

"Our role is now to support the shipyard in their detail design work, as well as in construction," says project manager Riku Kiili. "When the vessel is ready and delivered, we will also be responsible for the full-scale testing in ice."

The vessel is scheduled for delivery in 2018. She will be used year-round to transport gas condensate from Ob Bay to the markets in Europe and Asia. The tanker can later also be used for transporting various types of oil cargoes.

Aker Arctic has designed the tanker to the Aker ARC 212 - concept with a high Arc7 ice class of Russian Maritime Register and with two 11 MW azimuth propulsion units to allow independent operations in the demanding Arctic conditions she will be facing.

Aerial view of the GSI Nanshan factory on Longxue Island where the Arctic condensate tanker is under construction. The shipyard is located outside Guangzhou city centre, in the Pearl River delta. Typical products are bulkers, tankers and general cargo ships below 50.000 dwt, various ro-ro and heavy lift ships as well as ship repair and conversion jobs. Largest bulkers and tankers delivered are in excess of 200,000 and 300,000 dwt respectively.

Antarctic Vessel for Chile

The Chilean Navy is in the process of acquiring a new icebreaking logistic support vessel for Antarctica, which will also be used for research and rescue operations. Aker Arctic is supporting Canada-based Vard Marine in the design of the hull form and will be performing the model tests as well.

ITTC Ice Committee meeting at Aker Arctic

The International Towing Tank Conference (ITTC) was originally formed by open water model testing facilities to reach agreements on basic procedures and methods of presenting results. Today there are also other special technical areas included, such as the Specialist Committee on Ice, which tries to develop testing methods and guidelines for ice model testing.

Head of research and testing services Topi Leiviskä represents Aker Arctic in the Specialist Committee on Ice. He hosted their meeting at Aker Arctic in February 2017. Other participants in the committee are from Russia, Germany, Canada, China and Japan.

From left: Mr Yinghui Wang (CSSRC, China), Dr Franz von Bock und Polach (Hamburg University of Technology, Germany), Prof. Akihisa Konno (Kogakuin University, Japan), Prof. Yan Huang (Tianjin University, China), Dr John Wang (NRC, Canada), Mr Nils Reimer (HSVA, Germany), Mr Topi Leiviskä (Aker Arctic, Finland), Dr Kirill Sazonov (KSRC, Russia), Ms Natalia Fatieva (KSRC translator). Missing from the picture: Mr Mikko Suominen (Finland) and Dr David Molyneux (Canada).

Novy Port icebreaker launched

Aleksandr Sannikov, the first of two icebreakers under construction at Vyborg Shipyard for Gazprom Neft, was launched in November 2016, in order to make way for the hull assembly of the second vessel.

Both icebreakers are scheduled for delivery in 2017 and will be deployed at the Arctic oil terminal operated by LLC Gazprom Neft Novy Port in the Gulf of Ob. *Aleksandr Sannikov* and her sister ship are based on the Aker ARC 130 A concept design by Aker Arctic. The design is a further development of the Baltic escort icebreaker concept that was originally developed for the Finnish Transport Agency. The new vessels will use a similar propulsion concept consisting of three azimuth propulsion units: two in the stern and one in the bow of the vessel. The propulsion power has been increased to 21.5 MW and ice class to RMRS Icebreaker8 according to the operational requirements of the Arctic seas. The new icebreakers are designed to break 2 m thick level ice with 30 cm snow cover in both ahead and astern directions, operate in thick consolidated brash ice, and have excellent manoeuvrability in all ice conditions. The excellent icebreaking capability has been successfully demonstrated with model tests at Aker Arctic's ice laboratory in Helsinki, Finland.

Ice load measurements on large diameter propellers

In September 2016, Aker Arctic and Maritime Research Institute Netherlands (MARIN) performed propeller tests to explore if propeller size could be increased for better efficiency.

Five years ago Aker Arctic in co-operation with MARIN of Netherlands successfully carried out measurements of ice loads acting on the propeller blades. As part of the LeanShip European Union project, MARIN is now investigating the possibility of increasing the propeller size to gain better efficiency. As the propeller diameter increases, the propeller tip distance to the water surface decreases, and the minimum propeller - hull clearance requirement according to the ice class rules is violated. With the ice model tests, MARIN measured the actual propeller loads on the blades to show that the ice loads do not exceed the maximum allowable. Three different types of propellers were tested in two different loading conditions. Three different sizes of ice disks were fed to the propeller flow, both in ahead and in astern mode.

Virtual reality in ship design

The VR bridge allows the operator to jump into the bridge of the vessel already during the design process.

Aker Arctic is looking for possibilities to use virtual reality in ship designing, especially in bridge design.

In co-operation with University of Turku, Mixed Reality Research Group and Meidänstudio graphic designer and visualisations company, Aker Arctic has developed a concept for an interactive virtual reality bridge design – the VR bridge. The VR bridge allows the operator to jump into the bridge of the vessel already during the design process, and to modify certain parameters to see how the various alternatives in the bridge design affect the visibility sectors and operability of the vessel.

The first VR bridge concept was based on the new Finnish icebreaker *Polaris*, for which Aker Arctic made the concept design for the Finnish Traffic Agency.

"We have received positive feedback about the virtual reality device from customers who have tried it," sales and marketing manager Arto Uuskallio says. "The world itself is more visually appealing and originating from the gaming world, which is somewhat different from the typical VR world found in engineering VR systems."

The aim is that the VR bridge concept can be used in the early phase of a project, in co-operation with the operator, to select the optimum combination for bridge layout and equipment setup.

Christmas party in Åland

Every year, Aker Arctic employees plan some fun get-together before Christmas. This time the destination was Åland, an autonomous group of islands situated in the Baltic Sea between mainland Finland and Sweden.

We all gathered at Helsinki airport for an early departure in the end of November. On arrival to Mariehamn, the capital of Åland, we were transferred by bus to the Maritime Museum. Åland consists of 6700 islands and has therefore a strong maritime history. The collections in the museum cover all aspects of Åland's maritime history from 18th century farmer-seafaring to modern global shipping. The world-class collections have been built up through the generous donations of individuals, shipping companies and other businesses.

After lunch we visited Åland University of Applied Sciences, where the headmaster Edvard Johansson gave us a general overview of the University and the programs they offer. Project leader Anna Friebe held an interesting presentation on the Sailing Robots project.

Mariehamn is a beautiful seaside city, and is very pleasant to explore on foot. We had some time to walk around before dinner at a local restaurant, followed by the arrival of Santa Claus with a huge bag of gifts. We had all been really good last year!

In the late evening we boarded the ferry to Helsinki, which brought us safely home the next morning.

The Maritime Museum in Åland covers the maritime history from the 18th century farmer-seafaring to modern global shipping.

Santa brought us many gifts!

Meet us here!

We will participate in the following events:

LNG Congress Russia, Moscow
15 - 17 March 2017

Arctic Exchange, Stockholm
23 March 2017

International Arctic Forum,
Arkhangelsk, Russia
29 - 30 March 2017

Arctic Shipping Forum, Helsinki
25 - 28 April 2017

Maritime & Naval Test & Development Symposium, Amsterdam
6 - 8 June 2017

NEVA, St. Petersburg
19 - 22 September 2017

Marintec China 2017, Shanghai
5 - 8 December 2017

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