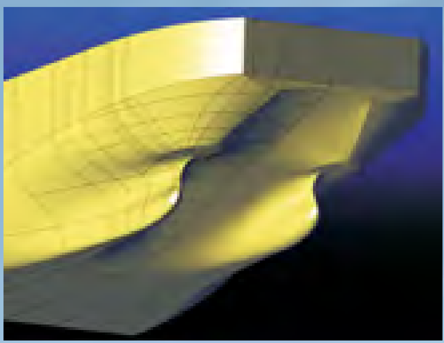
March 2011

Arctic Passion News

1 / 2011



Improved Double-Acting Ship

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Announcements

Pekka Salmi
Senior adviser Pekka Salmi retired in September 2010. Pekka served AARC and the companies preceding AARC during his 40 year long career and can now enjoy his well earned retirement days.

As part of the Christmas preparations a brief gathering by AARC staff was arranged to celebrate awards for employment anniversaries.
Mr. Esa Hakanen (in the picture) and Mr. Sami Saarinen were celebrated for their first 10 years with the Group, Mr. Kauno Sarkkinen and Ms. Ann-Cristin Forsén for 20 years, Mr. Mauri Lindholm for 30 years and Mr. Mikko Niini for 40 years.

Front cover
The latest of Aker Arctic's design achievements are five Shallow-Draught Icebreaking Tugs for STX Norway Offshore AS.
First of the series "Mangystau-1" was delivered last August from STX Braila shipyard in Romania and has successfully met the harsh North Caspian ice conditions.

Towards risk assessment based safety ruling

Dear reader,

When writing these words for the previous Arctic Passion News the Macondo well was still leaking and the industry shocked from the consequences of the accident. The leak was rather quickly stopped and the well closed. BP has to be praised on the fact how well they managed to work in finding the solutions to cut the deepwater leak. Now the investigation committees have published their reports and authorities in all oil producing nations are reviewing their rules, practices and safety standards.

The offshore industry, as well as the world shipping, is among the most globalised branches of economic activity. The ships and floaters are moved quickly from one ocean to another and the operators need to cope with various national practices. This is one of the major industry challenges. The differences in rule and regulations over one single border line are well demonstrated in the Norwegian initiative called Barents 2020, where the safety regime in the North Sea and the Russian Arctic are being analysed and compared in order to find a way towards more harmonised rule settings.

Similarly the world shipping is encountering the safe ice operation standards differently in Northern Europe, Canada, the Caspian Sea and Russian Arctic. There is today an ongoing process led by IMO to find harmonised practices, with a goal set for 2012 to something called Polar Code, incorporating an effort to find uniform thinking also in the technical guidelines for safe ship construction.

These ongoing processes have put an unfortunate time-out in short term for further investments in new harsh environment operations as the industry is waiting for authorities' attitudes in the post-Macondo world. On the other hand the new situation has changed the overall situation dramatically; the trend appears to be that now the operator himself needs to start thinking on his risks in any planned activity and create his own risk assessment and his own decision-making on acceptable risk levels, which then need to be demonstrated to the authorities.

I expect this trend and these processes to bring rapidly new findings and potential for new solutions, as well as new technologies and practices into harsh environment operations. One of such key activities is rapidly evolving philosophies for Ice Management, protective icebreaker operations to mitigate the risks in offshore and shipping operations in icy and cold Arctic conditions. In this newsletter you will find also articles on how Aker Arctic is participating in solving the problems for these new demands.

Last year we started publishing this newsletter as an experiment which our customers had expressed the need for, in order to better follow what we are doing and how technologies for Arctic operations are developing. The feedback from our customers has been entirely positive. Therefore we are now encouraged to continue with the tradition and you now have in hand the first issue for 2011. We hope you will enjoy your reading and learning on how much there still is room for improvement and potential for better practices and solutions in safe and sustainable Arctic operations.

Mikko Niini

Aker Arctic Technology Inc will participate in the following events. Come and meet us there.

12-15. April
Arctic Shipping Summit 2011
Helsinki, Finland

2-5. May
OTC 2011
Houston, Texas
Stand number 1325, hall E

21-24. June
Mioge 2011
Moskow, Russia
Pavillion 2, hall 1

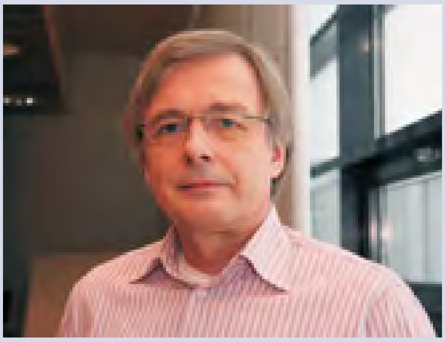
11-14. July
POAC 2011
Montreal, Canada

20-23. September
Neva 2011
St. Petersburg, Russia
Hall 7

12-16. September
RAO 2011
St. Petersburg, Russia

Improved Double-Acting Ship

AARC is an independent Arctic technology provider and is working in cooperation with many international clients, oil companies, shipowners and shipyards in developing new solutions. One of such regular client over the years has been Daewoo Shipbuilding & Marine Engineering Co., Ltd. (DSME) with whom AARC has recently developed a new Double-Acting ship design with improved open water performance and reduced fuel consumption.



Risto Kurimo is a hydrodynamics specialist with experience from shipyards, model testing and developing Azipods. He is a Naval Architect and has worked in the industry over 30 years and at AARC since 2006. In his free time Risto enjoys boating both at sea and in Finnish Lake Päijänne together with his wife and two sons.

The Double-Acting ship concept is designed to run ahead in open water and astern in heavy ice conditions. The actual bow form can be optimized for the selected route and the superior ice going performance when running astern reduces the need to use icebreaker assistance. The benefit from the freedom in bow form design is that the Double-Acting Ship has much better open water characteristics than conventional ice going vessels. Anyhow, as a keen seeker of continuous improvements AARC started to investigate in co-operation with DSME if it would be possible to develop a new type of Double-Acting Ship with further improved open water characteristics without compromising on ice going features.

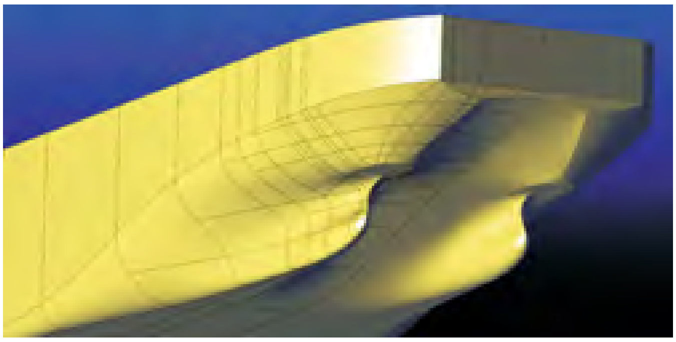
Twin gondola stern

AARC has extensive knowledge of ice going vessels and DSME of open water vessels. By combining their knowledge the companies managed to develop a new hull form that can efficiently be used both in ice and in open water.

“The vessel we designed is an Aframax size tanker with a completely new type of ice breaking stern. The aft body has twin POD propulsion, twin gondola type hull and cut-off transom,” says Project Manager Mr. Risto Kurimo from AARC, who has also been responsible for the project in AARC.

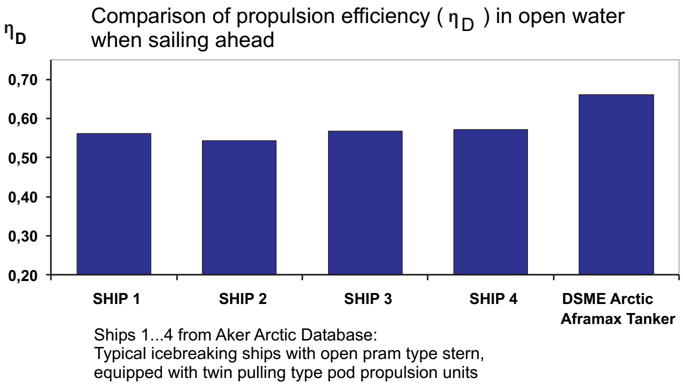
The twin gondola stern results in high propulsion efficiency. In spite of a slightly higher open water resistance of the twin gondola a fuel saving of around 10% in open water can be reached compared to a conventional open pram type stern with twin pod propulsion. This improved performance in open water is possible because of a very favourable flow interaction between the stern gondolas and the propulsion units. The successful fine-tuning of the gondola form means no sacrifices of ice going capability were made. Running astern the vessel can penetrate consolidated ridges almost continuously with creeping speed and by turning the PODs from side to side.

The vessel is intended for shipping crude oil from Pechora Sea to Murmansk, but ice model tests demonstrated that from ice performance point of view the vessel could be capable to operate also on Kara Sea.



The newly developed ice breaking twin gondola stern form

Model ready for astern running ice tests with pulling type pods turned for backing position



Fuel savings

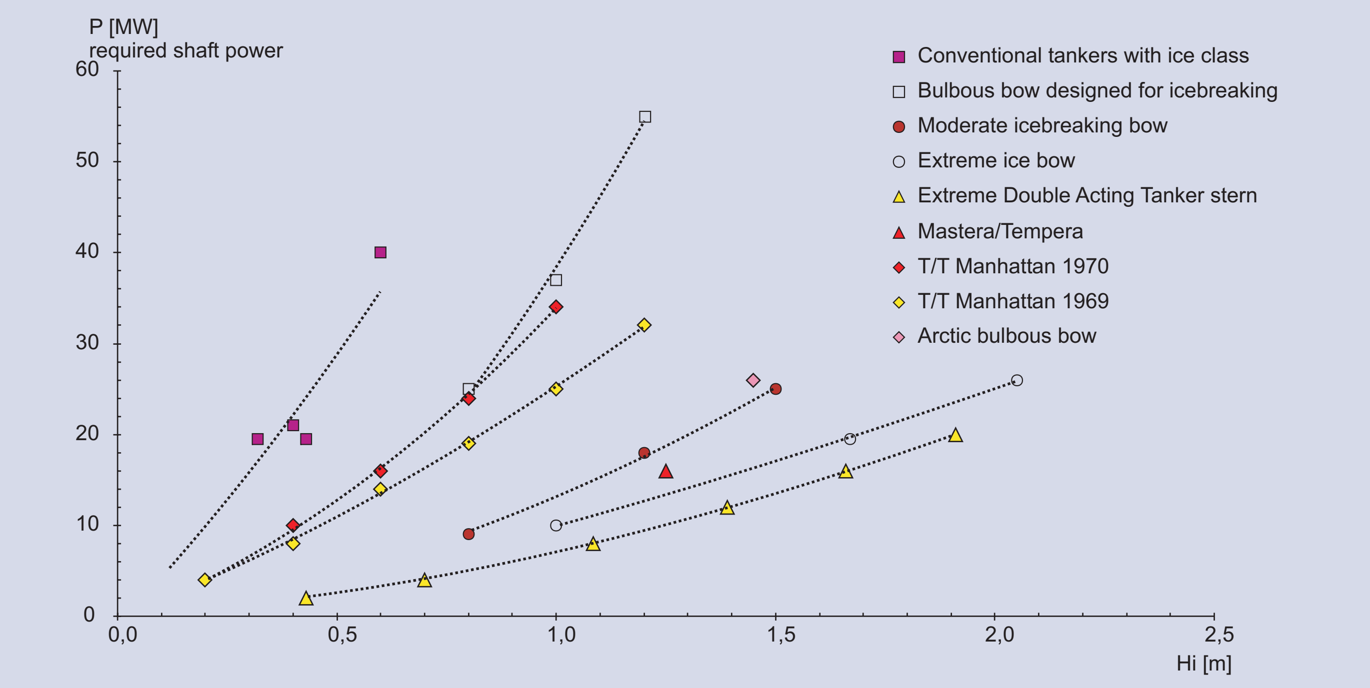
“This has been a two-year interactive development project with the customer. All ice model tests have been performed in our testing facility whereas open water features have been tested at SSPA in Sweden,” Mr. Kurimo continues. “This highly ice capable vessel works well also in open water and clear fuel savings are achieved by adopting this new twin gondola stern form.”

The concept design was presented at the Arctic Shipping conference in Montreal in November last year (Sung-pyo Kim, Young-bok Choi and Risto Kurimo: “Hull Form Development for DSME 100k TDW Class Arctic Tanker”). ■

Complete solutions for transportation needs

Developing transportation systems can sometimes last as long as 20 years. AARC follows its customer projects from the early stages until the operation is running.

Ice performance characteristics for tankers in 80.000-100.000 tdw size class (level ice)



AARC's database contains information about ice conditions and correlations generated from model tests and tests from real vessels. For instance the AARC designed DAS-ships are the only ones designed and constructed. The above comparison was made by comparing model tests with real tests.

”There are three things that set us apart from our competitors: the spectra of services we offer, the vast time frame we operate in, and the world's largest database of icebreaking vessels tested in model scale and in full scale. No other company can offer this in a package,” says Mr. Arto Uuskallio, Sales and Marketing Manager at AARC.

When an oil or gas company starts to consider developing an arctic hydrocarbon field, AARC aims to assist in evaluating different transportation and operation scenarios and also in selecting and designing the optimum vessel types for the operation. Sometimes AARC designs have enabled operation by providing economically feasible and environmentally friendly solutions.

“Typically we start working on a project, when basic ice and environmental data is gathered. The target is to form a design basis for the vessels, platforms and terminals from the beginning in order to reach the optimum solution. We help our clients to solve problems at every stage and to choose the right solutions regarding transportation during the whole cycle,” Mr. Uuskallio explains.

Continuity reduces risks

Mr. Uuskallio tells that the time frame for a project development can span from a few years up to 20 years and AARC follows it the whole time.

“In very long projects the licence holder can vary over time. We may start the project with one oil company and then continue it with another until the project finally reaches a stage, where actual ships are built. At that point we may continue the co-operation with a ship owner or a shipyard. This offers our clients a huge advantage as we represent continuity in the project. Continuity reduces risks and the overall responsibility is clearer compared to a case, where there are many partners at different stages of a project.”

Tools for every stage

“All places are unique and therefore require custom tailored solutions,” Mr. Uuskallio says. He illustrates the development process with an example.

”Oil has been found in a remote arctic area with no infrastructure. Our client needs to find the best transportation solution in order to get the oil out on the market as efficiently and safely as possible and approaches AARC for help.

We need to know project limitations and then our experts can start work in order to generate the optimal solution. The first step is to check our database on the information already gathered on ice conditions, bathymetric information and other environmental data in the specified area. Then we analyze what information is further needed and expeditions to gather the necessary data are planned. This phase can take a few years and at the same time there are usually other teams exploring e.g. environmental issues in the area on behalf of the client."

After this "setting design basis" stage AARC experts evaluate what would be the best way to transport the oil to the market. Usually the outcome is to use ships as oil quality is kept best that way compared to pipelines and the client therefore gets a better price for the oil. AARC experts further evaluate where the terminal would optimally be located taking into account the effecting parameters together with the customer. Finally specifications for the vessels, assisting icebreaking supply vessels and other installations are made.

"At this stage we start to design the optimal ship for the operation and other necessary vessels and installations as well," Mr. Uuskallio continues. "When the concept design process is ready the vessels are tested in our ice model testing facility to verify that they fulfil the requirements we have set jointly with the client. In the last stage of planning we finalize the evaluation of the construction cost."

When the planning is ready, the oil company puts the ships up for charter or tendering. Usually AARC is part of this process too. When decision is made about who will operate and build the vessels, AARC can continue to design the vessels further or act as an advisor and supervisor during the whole construction process and finally assist in full-scale testing when the vessels are delivered.

"We provide the full range of services and tools at every stage, which is definitely beneficial for our customers in many ways," Mr. Uuskallio emphasizes.

World's largest database

AARC is proud to have the world's largest database of tested icebreakers and vessel models. All this derives from the long history of building and designing icebreakers in Finland. The follow-up from built icebreakers has been very systematic over the decades and therefore such a huge amount of data is available today. This database enables designers to make accurate performance predictions of vessels with different hull forms and propulsion systems.

"Our database is unique in many ways. We have gathered information on ice conditions during many years and the knowledge we have is extensive. In addition we have facts based on ice model tests, but also by testing ships we have designed that are already constructed. We have been able to correlate results from ice model tests and full-scale tests for the same ships. One example is the Double-Acting concept, where AARC has developed a totally new ship concept, which has enabled efficient operations in difficult ice conditions and has reduced the need of icebreakers therefore resulting in considerable fuel savings and reduction in emissions," Mr. Uuskallio says.

Northern Sea Route

"The Northern Sea Route is a challenging topic. It is important to remember that the route has already been open during summer months but there is no regular traffic yet because there are too many uncertainties involved. For instance next summer around 15 ships will use the Northern sea route," Mr. Uuskallio points out.

Ship operators now prepare for the possibility to use the Northern Sea Route when conditions are favourable and when there is a price advantage to ship to e.g. China instead of Europe using the shorter route. Also governments need to do their preparations i.e. assess environmental risks; prepare icebreakers and procedures if a ship gets in trouble e.g. because of a machinery failure. ▶

Last year the Northern Sea Route was open till October, but some years this might not be the case. The operative window is short and changes annually and therefore ship operators cannot take the risk to plan regular transit shipments yet as they might get to Asia but not back and the delay would ruin their schedules completely.

Uuskallio believes future shipments in this area will increase, but in steps only. "Every year more experience is gathered and the operative window extended little by little. It depends on the technical development of ships but also on market requirements and prices in Asia compared to Europe. In order to start regular traffic conditions have to be stable and risks low. Regularity is more important for ship operators than savings on one trip."

"The impact for AARC will be that we need to create new solutions and also update our ice knowledge and gather ice data from new areas. We have already started to prepare for this so our clients can remain confident that we always have updated know-how necessary to guide them," Mr. Uuskallio assures.

Approximate correspondence between Finnish-Swedish ice class rules and RMRS ice class is 1 A Super ~ ARC 5.

Permissible service areas for ships of Arctic ice categories

Category of ice stregthe-nings	Type of ice naviga-tion	Winter / spring navigation in seas					Summer / fall navigation in seas				
		Barents Sea	Kara Sea	Laptev Sea	East Siberian Sea	Chuckhi Sea	Barents Sea	Kara Sea	Laptev Sea	East Siberian Sea	Chuckhi Sea
		ENHMea	ENHMa	ENHMa	ENHMa	ENHMa	ENHMa	ENHMa	ENHMa	ENHMa	ENHMa
Arc4	IO	- - - +	- - - -	- - - -	- - - -	- - - -	+ + + +	- - + +	- - - +	- - - +	- - + +
	IP	- * + +	- - - +	- - - -	- - - -	- - - *	+ + + +	* + + +	- - + +	- * + +	- * + +
Arc5	IO	- - + +	- - - +	- - - -	- - - -	- - - -	+ + + +	- + + +	- - + +	- - + +	- - + +
	IP	* + + +	- - * +	- - - +	- - - +	- - * +	+ + + +	* + + +	* + + +	* + + +	* + + +
Arc6	IO	* + + +	- - - +	- - - +	- - - +	- - - +	+ + + +	+ + + +	- + + +	- + + +	- + + +
	IP	+ + + +	* * + +	- * * +	- * * +	- * + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
Arc7	IO	+ + + +	- - + +	- - - +	- - - +	- - + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	IP	+ + + +	+ + + +	* + + +	* + + +	* + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
Arc8	IO	+ + + +	+ + + +	- * + +	- * + +	* + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	IP	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
Arc9	IO	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +
	IP	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +	+ + + +

EN : Extreme navigation (with mean reoccurrence one time per 10 years) *Source: Russian Maritime Register of Shipping*

H, M, Ea : Heavy, medium, easy navigation (with mean reoccurrency one time per 3 years)

IO : Independent operation +:Service is permissible * : Service is connected with an increased risk to get damage

IP : Icebreaker pilotage -: Service is impermissible

Arto Uuskallio is a Naval Architect from the Helsinki University of Technology and did his Master thesis for the company in 1992, after which he stayed. At that time he worked as project engineer and went every year on ice expeditions to Sakhalin, Varandey and Yamal among other destinations. In 1999 he transferred to ABB and worked in sales for eight years and then led the Azipod concept development team. He returned to AARC in 2009 and is now responsible for sales and marketing.

"My driving force in this work is that it challenges me every day. Ship building in general is not an industrial surrounding but specialist work where one needs to combine knowledge with serial work. Working with ice is one challenge further."

Arto enjoys biking and swimming during summer and skiing during winter. His wife and two teenage kids keep him busy during free time.

Case: Transportation system for Varandey

Varandey is a village by the Pechora Sea where oil and gas findings were made in the 1980's.

Starting in the beginning of the 1990's, AARC experts went on several ice expeditions to Varandey area in order to gather information about the area, the climate and the ice conditions at different times of the year. These expeditions were made for several clients and partners. During every trip detours were also taken in order to get a comprehensive understanding of the conditions prevailing. Based from Varandey-village ice reconnaissance helicopter flights were made around the area to get an overview of the ice conditions and locate possible places for terminals. This knowledge served as a

base for evaluating what type of vessels could fit in this area. By combining the knowledge of prevailing conditions with the technical knowledge of vessels that could function in this area, AARC made a transportation economy feasibility study.

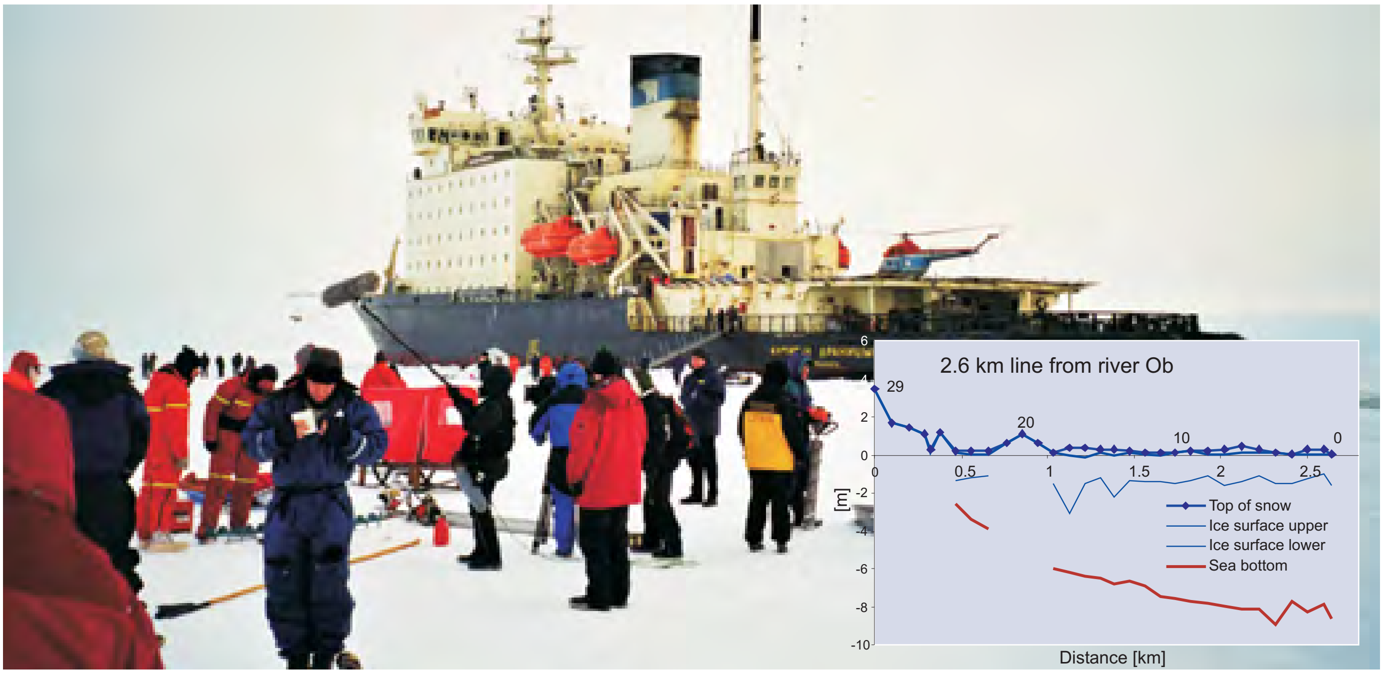
At the same time AARC was developing the concept of the Double-Acting Ship and made different models and performed tests in the ice model basin. After some quiet years, in 2005 Lukoil and ConocoPhillips formed a company for the oil production (Naryan-Mar Neftegaz) and asked AARC for a study on developing a suitable ship for evaluation of the marine transport alternative. AARC was well prepared and compared several options for them while they negotiated with the shipbuilders. AARC made further tests on the loading and unloading systems and how well they worked together In 2005 the negotiated deal was transferred to Sovcomflot. In 2008 the first ship was ready.

The economically best solution was calculated to be a transportation system with three Double-Acting ships that can manage without icebreaker assistance. The ships constructed are MT Vasily Dinkov, MT Kapitan Grotskiy and MT Timofey Guzhenko. ▶

The development of the Arctic "double-acting" ship concept was a long-lasting evolution, requiring a lot of field data to be acquired and service experiences to be gained.
The prototype Azipods were installed in converted high ice class tankers "Uikku" and "Lunni", which sailed on the Northern Sea Route for several years under the ownership of J/V companies Nemarc Shipping of Finland and Arctic Shipping Service in Murmansk. Here "Uikku" is loading her first experimental cargo from the Tambey gas field in 1995. The tankers are today known as "Varzuga" and "Indiga" under Murmansk Shipping Co operation.

The Prirazlomnoye oil field shuttle transport was agreed with ZAO Sevmorneftegaz in 2003 to be based on a "double-acting" ship concept.

Case: Transportation system to Yamal



In the beginning of 1990 natural gas had been found in Yamal Peninsula. With the Soviet Union falling apart there was no one to take charge of exploring the area. A group of scientists decided to sell some of the gas condensate to Finnish company Neste Oil Corporation in order to finance further explorations so in 1995 a group from Finland initiated a trip to Yamal to load the gas condensate Neste had bought. Mr. Arto Uuskallio from AARC was one of the participants on the trip.

The next ice expedition to Yamal was made in 1996 to gather facts from the area.

In 1998 EU funded a large expedition to Yamal for the scientific FP 6 program ARCDEV. More than 100 people joined the expedition including sea men, scientists and business people.

“Neste Oil Corporation bought gas condensate again and wanted also to evaluate economical possibilities in the area, which was the reason I joined the expedition,” Mr. Uuskallio tells. “The ARCDEV project was made public and revealed for the first time to Western operators the real cost level of transporting gas condensate to the Western markets.”

As seems to be more a rule than an exception in the Arctic, players change, oil and gas companies sell and buy. Neste Oil Corporation decided to concentrate on refining oil instead of upstream operations and sold all of its field rights in the North of Russia.

Ice expeditions to Pechora Sea were made during the following years: 1992, 1993, 1998, 1999, and 2006. During some years there were several different expeditions, both ship based and land based. The inserted graph reveals the investigated sea floor and ice profiles on the river Ob.

Today CB & I Lummus is the company engaged indeveloping the area. In 2009, AARC agreed with CBI Lummus and Novatek to make a transportation study in the area as ice knowledge had already been gathered during several expeditions.

The overall LNG plan is that by 2016 gas deliveries should be going on. In order to meet this goal ship orders should be in place in the nearest future. ■

Simulation program calculates the optimal solution

Making use of its extensive database, AARC has developed a simulation program for ice-going ships that can be used in full-mission bridge simulators. It is based on mathematical calculations and gives as a result the economically optimal solution for a specific purpose.

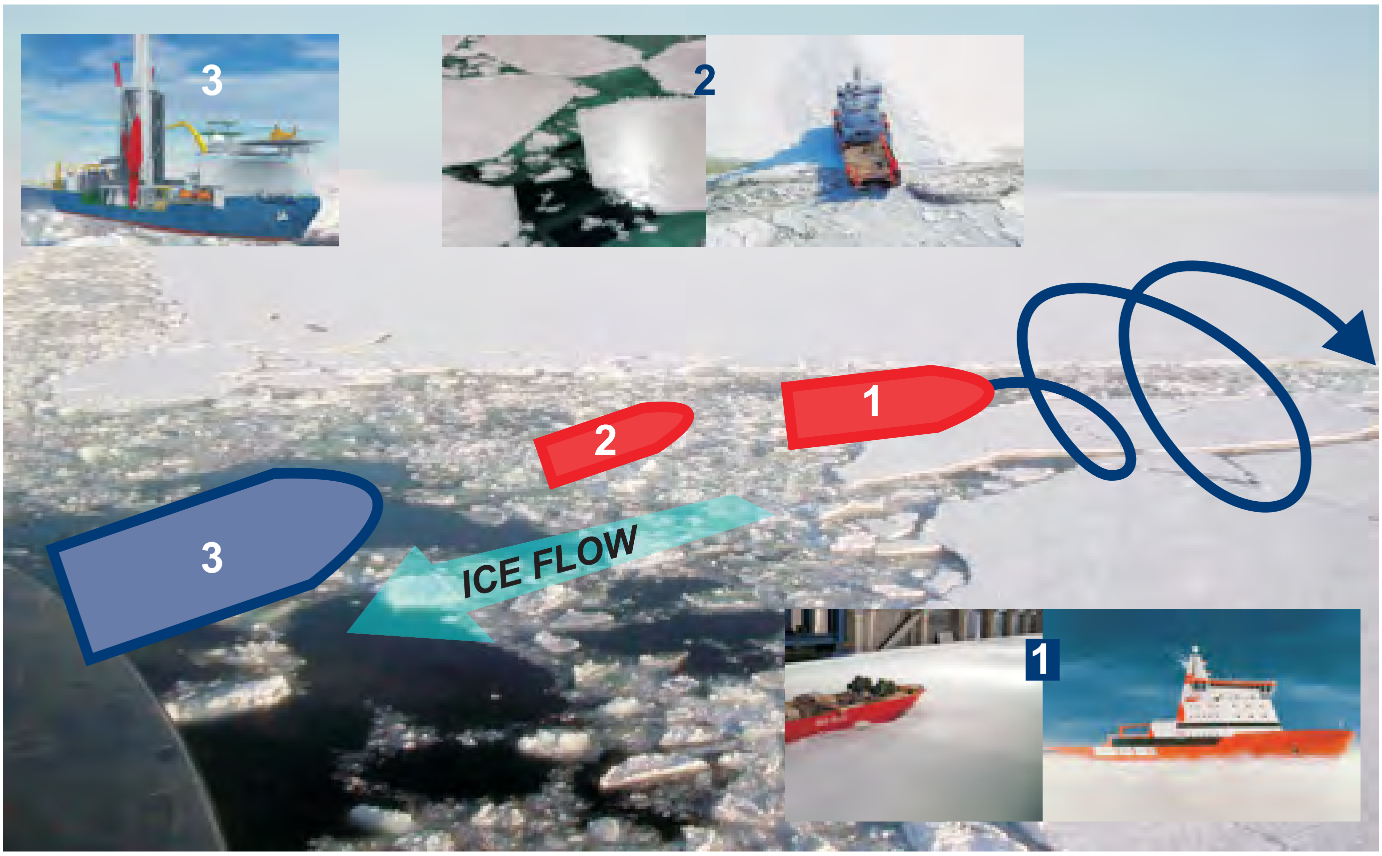
First a certain ice-condition at a certain time of the year is modelled and then the vessel specifications are put in. The vessel is then simulated to drive through the ice back and forth while measurements of average speed, used energy etc. are registered. This can be made for several dates to get the variation. The simulator then calculates fuel consumption, how many vessels are needed for a certain transportation task or volume during winter and during summer. The results indicate the economically best solution. This is crucial especially for LNG terminals as stopping the production is extremely expensive and therefore not an option. Storage is also costly so the best solution is to have enough ships for winter time but not too many for summer time. The simulator also takes into account the construction costs. In for instance the Varandey-case (see previous page) the calculated result was that three independently operating ships was the economically optimal solution for that transportation need.

AARC continues to develop the simulator for operative purposes and training.

Ice Management protects ships and floaters at work

Ice Management means protecting a drilling ship, FPU or production vessel from ice by breaking the ice around it into smaller pieces and keeping an ice-free area around the object so that no ice can disturb the work.

AARC has made a wide range of tests in order to get full knowledge about how to manage ice in different circumstances and has developed simulation tools to assist is planning of ice management operations.



The picture shows the principals of ice management in two stages:

1) The primary icebreaker splits the ice into smaller floes.

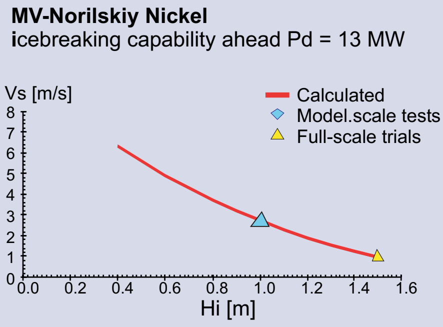
2) In this case the secondary icebreaker uses the propeller wake to flush the ice sideways to create an ice free area in front of the protected object, in this case a drillship.

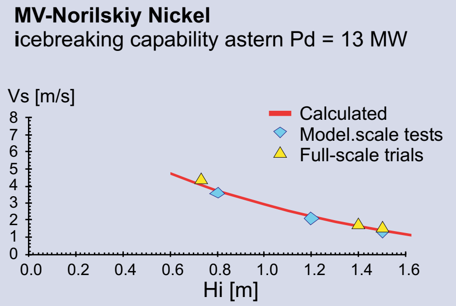
Each part of this can be tested separately, and the results can be evaluated for the whole ice management procedure, as the efficiency of the Primary IB, the flushing efficiency of the Secondary IB and the forces acting on the protected object.

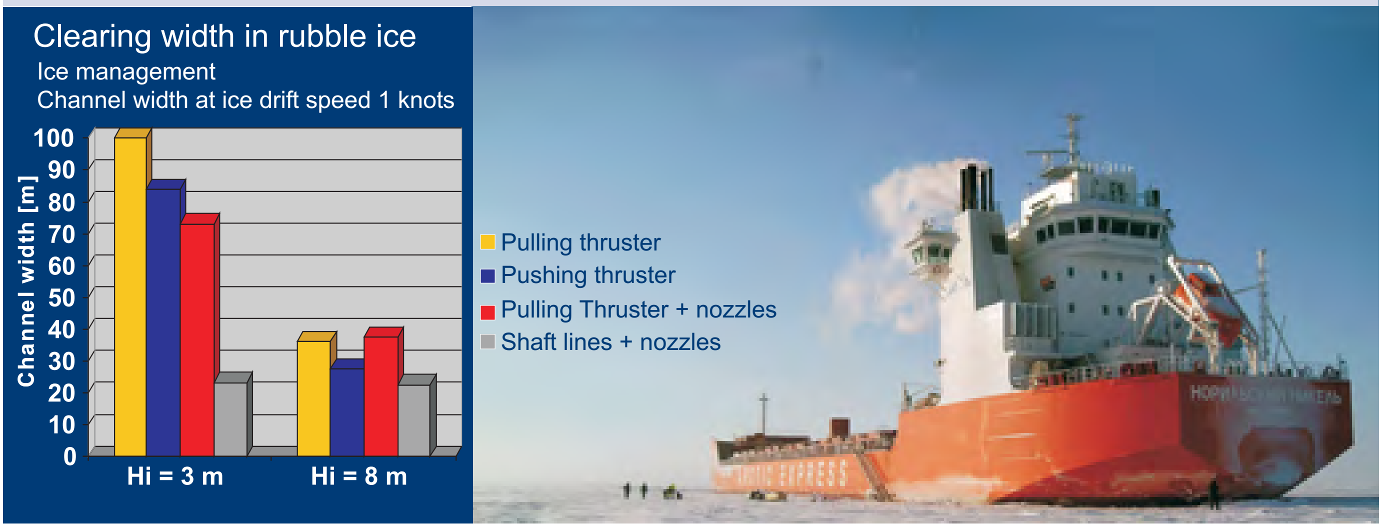
Ice Management is about managing the force induced by ice, which constantly moves in different directions. Drilling ships, tankers or production vessels are all 200-300 metres long vessels. If they would be required to manage on their own, they would need to be very powerful because of their size, which would increase the construction price. A drilling ship also has the riser down which means it has to stay almost still in an envelope dependent of the water depth. If the vessel moves more than the allowed offset, the drilling has to be stopped and in some cases even the drilling equipment disconnected. In the most severe ice conditions the vessel has to be disconnected from the mooring system, an operation which ends up being extremely expensive and leads to a stop in operation. In a worst case scenario the anchor chains are broken and the riser damaged due to a sudden ice impact on the vessel. Therefore the optimal solution is to have a separate ice management fleet in order to keep an ice free area around the target at all times.

How to achieve an ice-free area

"There are usually at least two steps in Ice Management. We talk about a Primary Icebreaker and a Secondary icebreaker. The Primary icebreaker is a big and powerful icebreaker, which breaks the outer ice cover into large ice floes. Then depending on the ice situation the primary icebreaker breaks the large floes into smaller ones or a second primary icebreaker breaks them further. The purpose of the Secondary ▶







Comparison between calculated, model-scale prediction and performance confirmed at full-scale trials.

icebreaker is to protect the target,e.g. a drilling ship," Tom Mattson, R&D Manager Test Services at AARC explains.

"Drillships and arctic vessels are huge investments so in order to minimize costs they need to be optimally designed. We wanted to gather information for the benefit of our clients on how to best manage ice in different situations and decided to make a series of tests we called the" Ice Management Series". We started from the situation above. Our first test was to investigate what can be done with azimuth thrusters that turn 360 degrees. We found out that with the help of these thrusters a vessel can stand still and blow ice slowly in a chosen direction. Further we wanted to research if by blowing the ice away we could achieve an ice-free area so big, that the drilling ship could be an ice strengthened open water vessel. The results showed that this is possible. We also found out that drifting ice moves very slowly compared to normal icebreaking. The ice drift speed seldom exceeds 2 knots so the power needed to keep the icebreaker still is therefore very small and most of the thrust can be directed in the wanted direction."

"There are many different kinds of thrusters, both pushing and pulling, so next in our series we tested the performance of various kinds of thrusters in ice and how they differ in performance. It gives the designer a bigger range of flexibility if the choice of suitable thrusters is wide when designing a vessel," Mr. Mattsson points out.

"Sometimes a big bollard pull is needed and a nozzle is used around the propeller. The problem with the nozzle is that ice can be clogged. We also investigated for what circumstances a nozzle thruster could be used. Additionally we tried to turn the nozzle around to a pulling nozzle and found that the icebreaking capacity actually increased 30-40% because the ice could go through instead of blocking the nozzle."

"We got very good results on how big ice-free areas we could achieve with different types of thrusters in different ice conditions. This will serve our clients as we now have an even better knowledge of ice management than before," Mr. Mattsson says.

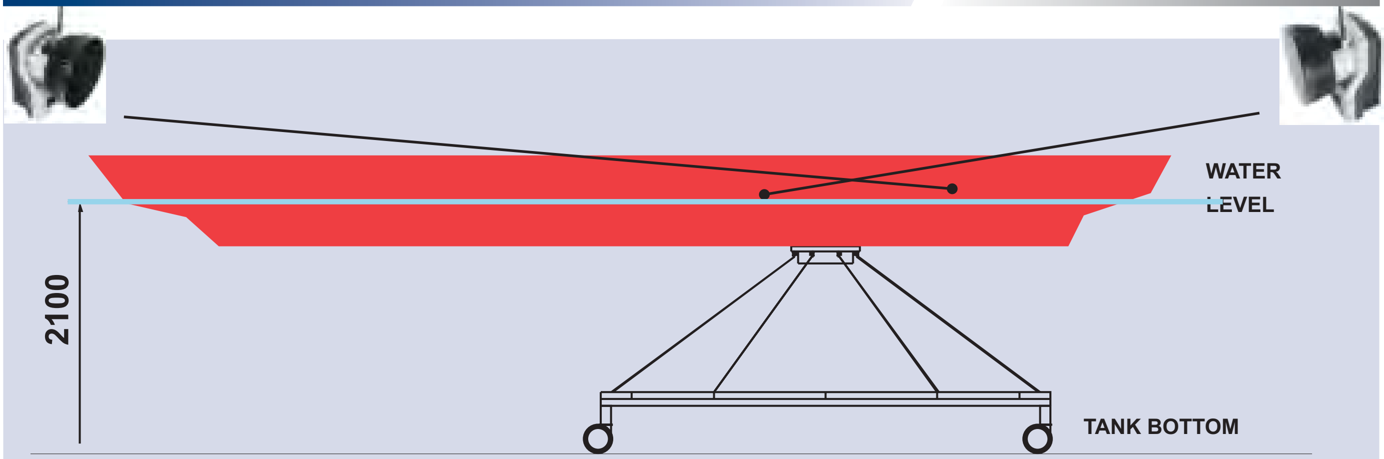
Continuous learning

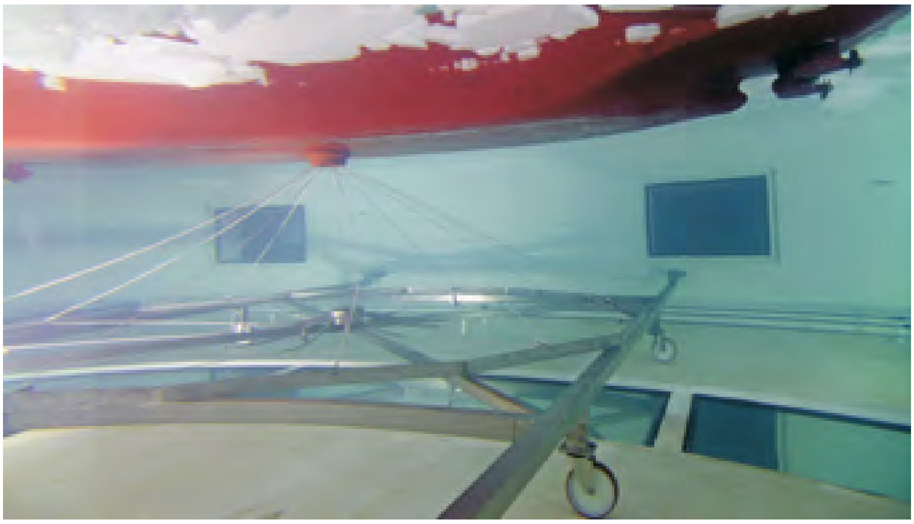
Apart from the Ice Management Series, AARC has learned from many customer projects on ice management. In one of the most extreme projects recently ice-going in 3-5 metres thick ice was tested. Other on-going projects continue to deepen the knowledge.

AARC is not only focusing on icebreakers but also on drillships, mooring systems and floaters with own ice management. One recent study was conducted on how to improve the ice management of a big floater concept. The result showed that this can be achieved by using three thrusters. The side thrusters keep the floater in place and the middle thruster blows the ice away. Another solution is to install thrusters in vertical position, pumping the water upwards in front of the bow, which creates an ice free area in front of the ship.

The optimal solution is green

AARC offers its customers optimal vessel designs for ice management in different circumstances. With the extensive database AARC has built up and its experienced designers, AARC can calculate and design optimal solutions for any purposes. Therefore a lot of savings can be achieved in addition to environmental foot print. If the same work





The underwater carriage with the wet mooring system. The amount and the characteristics of the mooring lines can by changed according to specifications. Even the angle (simulated different water depths) of the mooring lines can be varied. Model position is measured by four cameras, possible detection in 2D, 3D and 6D of freedom.

can be done with less power, then both money and environment is saved. AARC has the knowledge of what is needed for different circumstances and can therefore tell a client what size of vessel with what kind of power they will need and what design the vessel should be. More and more governments are also restricting emissions which can be a limiting factor in the operative window. The optimal solution is also the green solution.

"When a client approaches us they either know what they want or ask us for recommendations. The optimal solution is a combination of many things such as propulsion, hull design, power, turning ability etc. Often it is also a compromise, as arctic features are not good for open water use and vice versa," Mr Mattsson tells.

Reliable testing

"Our testing services are fully reliable. We can confidently tell through ice-testing that a vessel or drilling ship will function in the real world in the circumstances agreed. With our history of testing we have been able to optimize the testing facility and verify results by full-scale testing. By comparing calculations, ice-testing and full-scale testing we can confidently say that they comply. We also double-check all results and try to reach as close as possible instead of leaving safety margins," Mr. Mattsson emphasizes.The AARC ice testing facility is the newest one. It has windows to all sides so it is possible to follow tests from all directions. It functions well and ice behaves naturally. According to Mr. Mattsson it is the only ice testing facility that can make 200 mm thick ice in a reasonable time and therefore correct scaling is achieved.

"Other ice-testing facilities don't do shipbuilding projects and consulting companies do not have ice-testing facilities so they lack the full-scale knowledge we have at AARC," Tom Mattsson concludes.

Case: Transatlantic primary icebreaker

Transatlantic Rederi AB approached AARC with the task of developing a primary icebreaker which was not a thruster ship. The client also wanted to know how a shaft line vessel can manage to make an ice-free area. AARC added these tests to the Ice Management Series of test.

The vessel designed for Transatlantic is intended for ice thickness up to 2 metres. AARC investigated in what sizes the primary icebreaker breaks the ice and how a smaller ship manages behind. The results were then compared to another similar icebreaker with another type of propulsion. The results showed that shaft line vessels equipped with ducted propellers are very efficient as primary icebreakers in ice management tasks and even the possibility to use this kind of vessels as secondary icebreakers is not excluded. The shaft lined vessels are a bit cheaper to construct and can be used in a little harsher ice conditions as in multi-year ice. Vessels with Azimuth thrusters are usually designed for use in one-year-ice.

Trans Arctic Design

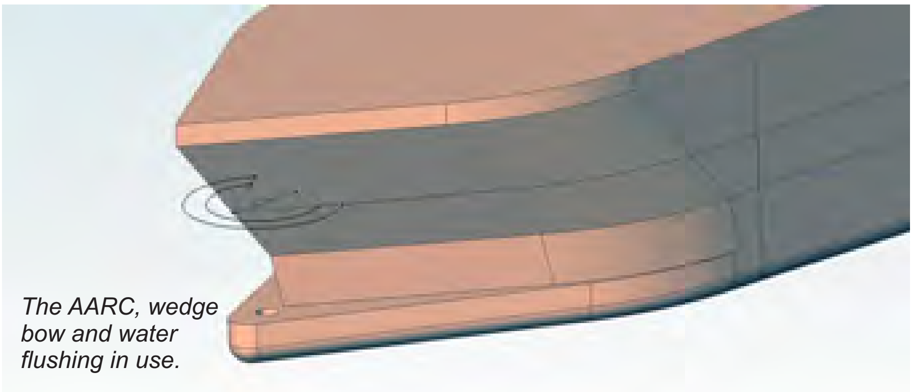
This ARC 109 ship concept is ready for construction.

Case: Frontier drillships

One of the pioneers in the recent effort to develop tailored solutions for drilling in an extended seasonal window in the Arctic has been Frontier Drilling, recently merged with Noble Drilling in the U.S. AARC has been involved in testing and in the development of two of their drillship types; The “Frontier Discoverer”, which was converted in Singapore according to principles created by Aker Arctic, and the “Bully”-series for which Shell is co-owner. Several tests measuring the horizontal forces through a six component balance, XY-force measurements and turning moments were made for both of these ship designs.

One of the requirements in Arctic drilling is a ship design where no ice is going under the flat bottom as no ice is allowed around the drilling risers. The solution made in order to protect the moon pool area from ice was to equip the bow area with an edge in the bilge area. This ice protection solution prevents effectively the ice from going under the bottom. In further studies AARC found out that the optimal stem solution is a wedge-bow design equipped with an edge and with a vertical water flushing system that moves the ice to the sides. This kind of bow has been tested with six component system and the model has also been attached to the underwater turret mooring system. Movements of this bow type were measured to determine the offsets and the loads on the mooring system.

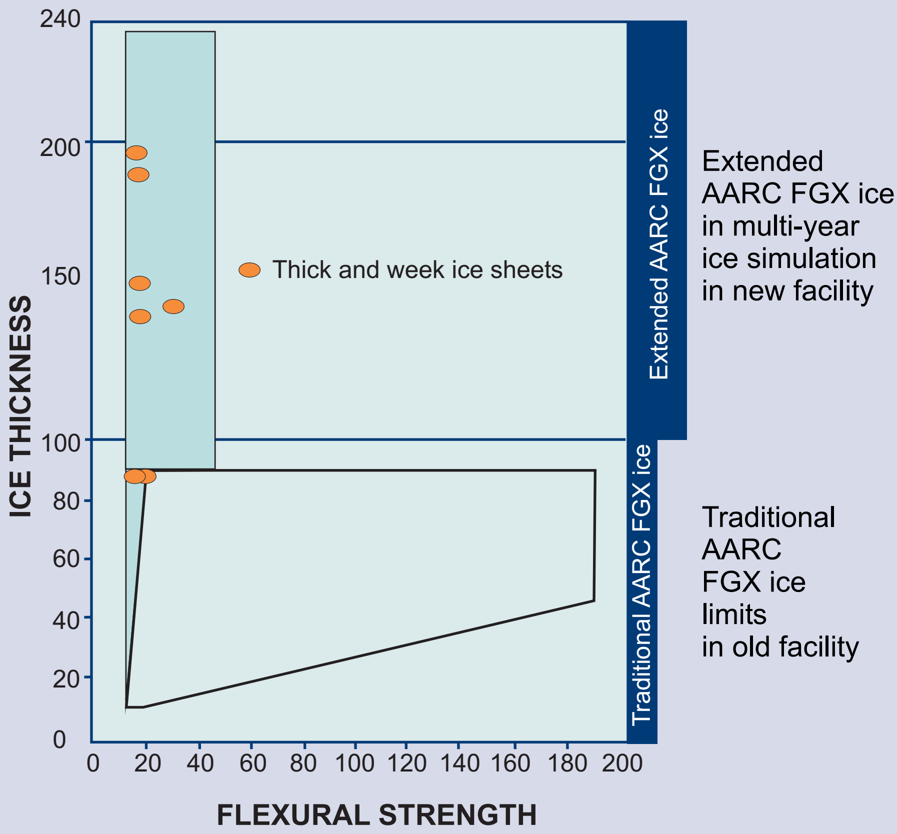
This efficient self-ice-managing bow form is now proposed to new drillship and FPU projects under preparation in the industry. International patent has been applied for the invention.


The AARC, wedge bow and water flushing in use.

Mr. Tom Mattsson has been working with ice model testing for 27 years. From last August he is responsible for Research and Development for test services at AARC. His work includes being part of developing hull forms and gathering parts together for a complete customer solution when the target is to achieve an ice-free area in front of a tanker, ship or a floater.

"I studied ship building and by chance came in touch with Wärtsilä Arctic Research Centre, as was the name at that time. My passion to work in this area derives from the creativeness it offers every day. It is necessary to use your expertise combined with your imagination in order to create new solutions as every model test is a prototype," Mr Mattsson says.

Mr. Mattsson spends most of his leisure time in outdoor activities with his best friend, his 12-year old Golden retriever.



The possible range of the model ice used at Aker Arctic is wide

Multi-model testing starts this spring

In traditional ice model testing the vessel model is driven back and forth in the ice testing basin. In multi-model testing several vessels are tested at the same time. AARC has developed a solution to multi-model testing, which will be launched this spring.

In traditional testing the vessel is attached to a power and measurement system by electric cables. This would be impossible when testing several vessels and therefore a remote power, steering and measurement system is required.

"Oil companies are especially interested in multi-model testing as the whole operation in ice can be tested at once. In harsh ice conditions the drilling ship has to be protected by an ice management fleet and it is necessary to know how ice moves, with what speed and what force. By testing the whole process we can be certain to design the optimal solution for different purposes," says Mr. Topi Leiviskä, Senior Research Engineer at AARC.

"In the system we have developed battery-driven vessels will be used and measurements will be made remotely. One important feature is that the data generated needs to be compatible with existing data in order to make comparisons. Also model sizes have to be downshifted so that there is enough space in the basin to move."

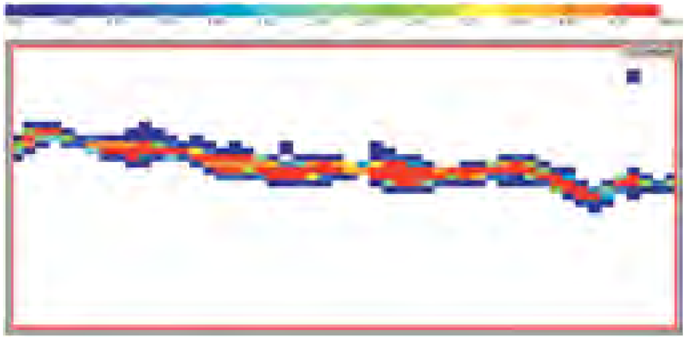
The new remote measurement system will also be useful in operational tests, where an otherwise free moving vessel has until now been attached by cable to the measurement system. This will eliminate the risk that the cable has any impact on the movement.

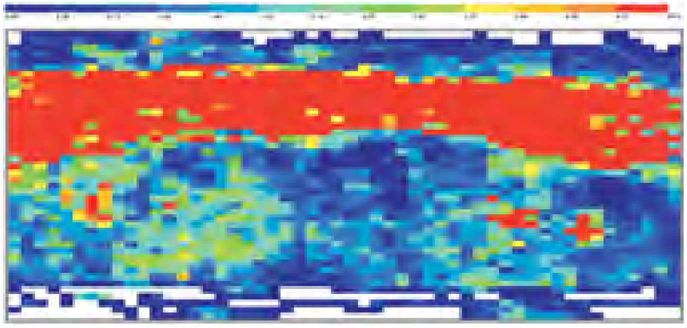
Mr. Topi Leiviskä has worked three years at AARC with ice model testing and measurements. Previously he worked with similar tasks at the ice laboratory at the Helsinki University of Technology.

Ice pressure on fixed structures

Oil rigs and other offshore structures face the challenge of crushing ice differently than moving ships. The nearly full-scale tests conducted in AARC's test basin have enabled a unique approach to study the local ice load build-up phenomena.

To deepen the understanding of ice-structure interaction, the ice pressure evolution during compression against the instrumented vertical structure was measured with a tactile pressure panel and strain gauges.





Examples of tactile sensor panel measurements. Above: line-like nature of ice pressure; Below: Individual pixel maximum values achieved during a test.

To learn more on the ice crushing phenomena against a compliant stiffened plate structure, near full-scale (1:3) ice crushing tests were conducted in Aker Arctic's test basin in spring 2010. The tests were part of a Finnish joint industry project called STRUTSI (Ice-structure interaction modelling and simulation) with Technip, AARC and VTT (Technical Research Centre of Finland) and funded by Tekes (The Finnish Agency for Technology and Innovation).

Test procedures

The dimensions of the ice sheet and the stiffened plate were chosen to represent a full size ship or offshore structure vertical steel panel designed to withstand the crushing loads of 60 cm thick level ice. The dimensions of the stiffened plate and ice sheet were modelled in a ratio of 1 to 3. In addition, to study the effects of the stiffness, the test set-up included a possibility to reduce the stiffness of one stringer in relation to the others. The instrumentation included both strain gauges for load distribution recording at the stiffeners and a tactile sensor plate for accurate direct crushing pressure distribution measurements.

In order to have correct and homogeneous model ice properties the ice was manufactured by a specific technique where ice block moulds filled with snow were impregnated by saline water. Impregnation was done by vacuum technique to prevent air-trapping inside the mould. The material of the moulds was plywood with the exception of the bottom plates which were steel to guarantee even vertical freezing of ice. Altogether 22 ice blocks were crushed with different ice velocities and plate compliancy (stiffness).

Results

Ship or offshore steel structures under ice action typically consist of surface plating and supporting frames or stringers. One major objective of the tests was to study the vertical and horizontal ice pressure distribution at the stiffened plate during the crushing phenomena.

The measured strain gauge data indicates that with increasing compliance more of the total load is carried through the neighbouring stiffeners, while the ice pressure according to the tactile sensor data is relatively even in the horizontal direction. This state persisted even though the centre stiffener compliance was increased,

The well-known horizontally orientated “line-like” contact prevailed in continuous crushing (red colour in the Figure 1). The tests also indicated that this line-like pressure distribution was independent from the underlying stiffeners within the structural compliance range applied in these tests.

The performed tests supported the fact that the ice-structure interaction process with associated loads is a complicated process which is still not perfectly understood. Therefore, applying the existing common practices and codes for individual design purposes should be done carefully. For example, the new ISO 19906 code assumes a parabolic or square pressure distribution profile through the ice thickness. The performed tests indicate that the proposed load profile may be vertically narrower and have higher local pressure.

Future implications

“The results from these tests are intriguing, as the applied measurement system provides new possibilities to observe and learn more from the ice crushing process,” says AARC's Project Manager Mr. Sami Saarinen, who has also been responsible for the practical implementation of the tests and ice preparation. “The accuracy level of the results from these kinds of tests is higher than in previous cases, which naturally makes them attractive to use when, for example, applying direct dimensioning of the structures under ice loading.”

“Now that the unique test procedures and arrangements have been successfully trialled in our lab they are available for customized use with our client projects,” Mr. Saarinen adds. ■

Mangystau 1 nominated for best support vessel of 2011

The Offshore Support Journal introduced in 2010 the awards for the best Support vessel of the year, the best ship owner of the year, the Innovation of the year and the Lifetime achievement award. The awards this year were presented at the Annual Offshore Support Journal Conference Gala Dinner in mid-February 2011.

AARC designed icebreaker Mangystau 1 was one of the nominees for best support vessel of this year.

The othernominees were Seven Havila, Skandi Aker and Skandi Vitoria. DSV Seven Havila got most votes in the worldwide poll and received the award this year. The vessel is owned by a JV between Havila Shipping and Subsea 7.

"Naturally it would have been great to win the award, but the fact that Mangystau was nominated is an achievement we are very proud of," says Chief designer Mika Hovilainen from AARC.

Ice monitoring in the Caspian Sea

AARC jointly with KazEcoProject (Kazakhstan) is conducting ice monitoring in the Northeast Caspian Sea during winter 2010-2011 (November-April). The project is divided into two parts: underwater ice profiling with sonars and satellite image analyses which is being conducted with Finnish Meteorological Institute FMI.

Co-operation with the Russian oil and gas industry

Within the Governmental Commission for Economic Co-Operation between Finland and Russia a new Working Group for Oil and Gas has been reactivated.

The WG met in January 2011 with Russian oil and gas organisations in the RF Ministry of Energy, under the chairmanships of Sergey Khrushchev (Russia) and Mikko Niini (Finland). A co-operation scheme with the Finnish offshore industry cluster project IFCO and the Russian organisations was being planned.

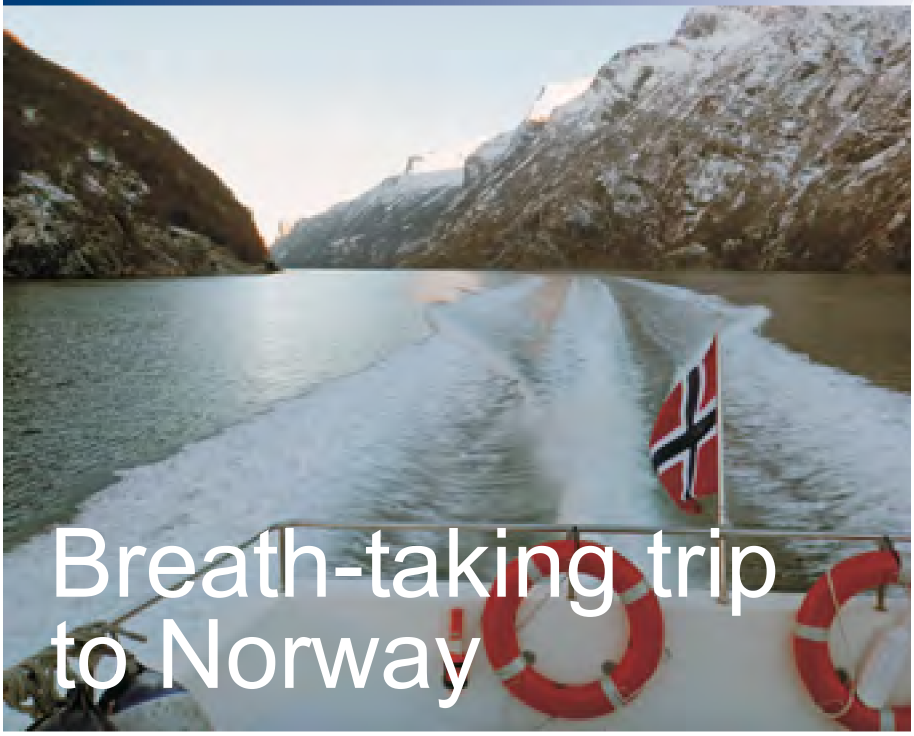
100 years of icebreakers from Finland

Last December the Swedish publishing house Breakwater Publishing launched their annual shipping handbook Finnish Maritime Index 10-11, in which the main articles this time were about Aker Arctic and the 100-year anniversary of the first Finnish-built icebreaker "Mercator" for the port of Vyborg. This publishing was celebrated by AARC customers, partners and other stakeholders together with traditional Finnish hot wine "glögi". Close to eighty guests and employees gathered in AARC premises to receive the book directly from the printers. In the picture Robin Berglund, VTT, Riikka Hietala and Ari Seinä, FMI, Torsten Heideman, ABB Marine and Hanna Suutarla, Arctia Shipping, hosted by Mikko Niini, AARC

Evolution of Icebreakers on TV

Television channels National Geographic and Discovery Science will be covering the amazing evolution of icebreaker technology over the last 100 years as part of their hit engineering series Big, Bigger, Biggest.

The production company visited AARC to learn about the R&D process from a pioneer in icebreaker technology. The filming is planned on MT Timofey Guzhenko, a ship designed by AARC and owned by Sovcomflot as an example of an advanced ship with icebreaking capabilities.



Breath-taking trip to Norway

The teambuilding trip included many interesting company visits.

AARC employees made a tour on the famous Geiranger fjord with incredible scenery.

AARC employees' yearly teambuilding trip was this fall a study trip to Norway. The purpose of the yearly excursion is to familiarize employees with a different environment and different actors in the industry in a relaxed way. The destinations chosen always represent interesting places useful for daily work.

All on-board

All AARC employees gathered in mid-November at the Helsinki-Vantaa airport and boarded the flight to Oslo and then further to Ålesund in the middle of Norway.

After a good night sleep, first on the program was an interesting visit to the headquarters of STX Norway Offshore AS, followed by a catamaran fjord tour. Norway is famous for its fantastic fjords, which are narrow inlets with steep sides or cliffs, created in valleys carved by glacial activity. One of the most famous is Geiranger-fjord.
"We had the chance to go on a catamaran-tour of the Geiranger-fjord, which was incredible. We were really lucky with the weather, which was clear with blue skies so the scenery could not have been more breath-taking with snow-capped mountains next to the glittering water," says Ms. Jana Vamberova, Management Assistant at AARC. In the afternoon a visit to STX Söviknes Verft Shipyard was scheduled where getting familiarized with a LNG fueled supply vessel topped several of AARC experts' wish list.
The next day included two company visits, one to Ulstein Group and the other to Rolls-Royce. Then followed another highlight of the trip, which was a visit to Ålesund University of Technology and their simulator centre. "We have developed a simulator for operative and training purposes and bench-marking with other organisations is useful," says Mr. Reko Suojanen, R&D Manager at AARC. In the evening a tired but happy group returned home to Finland.

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