Offshore experts ensure safety

Aker Arctic has recently re-organised its ice technology business into three strategic business units in order to better respond to customer needs: Ship Design & Engineering, Research and Testing Services, and Offshore Services. New Head of Offshore Services, Ilkka Rantanen explains what Offshore Services really is about.

“Most of our offshore projects derive from oil and gas production and their support functions. We have been involved in designing arctic harbours, cargo vessels, vessels for harbour infrastructure as well as designing products related to production such as drillships, oil rigs and production platforms. Floaters and semi-sub structures for either arctic use or other freezing conditions are included in the latter," Ilkka Rantanen, Head of Offshore Services, outlines.

Aker Arctic had already begun offshore conceptual design and model testing in the mid 1970s. Over the decades, unique information has been gathered from various testing, arctic expeditions, shipbuilding and offshore industry.

Preventing emergency

"One of our core services is ice management, an area which will grow in importance in the future. Ice management in short means planning how to operate safely in challenging, freezing circumstances. Accurate predictions and planning are essential when drilling for oil and gas in arctic conditions and this is something we assist the oil, gas, research and drilling companies with globally. We help them to plan when and how to safely operate and when operations need to stop taking into account their equipment, ice situation and ice development. If an operation has to be ended as an emergency, there is a great risk of losing valuable and expensive equipment, which might never be recovered. The very fragile environment must be taken into account and all risks need to be minimised. Therefore predictions are worth putting an effort into," Mr Rantanen emphasises.

Many projects Aker Arctic has been involved in involve so-called winterisation projects. "This means that we make sure that everything works in freezing conditions. We can also assist in converting a structure so that it can function in cold conditions, including the conversion plan, providing a team of specialists and supervising the alteration work onboard. Sometimes our engineering is to analyse conversion plans and help larger organisations in Arctic Packages of design scope.”

“We cover all the cold areas globally, such as Northern Russia, Barents Sea, USA, Canada, Europe and Asia. Our customers are oil and gas companies, ship operators and engineering offices, which don't possess arctic know-how in the same extent as us," Mr Rantanen says.

Fragile environment

"Environmental aspects are an important part of our work, especially at Offshore Services where we deal with fragile areas. Safety in operations, oil spill prevention and oil spill recovery are part of our offshore services," Mr Rantanen continues.

"Our concept at Aker Arctic is unique as we have know-how in both ice management and offshore, in addition to our model testing facility and long history of arctic ship design. This is why our customers turn to us with the most complex projects as we can offer them partnership across an entire project, from initial planning to designing, testing and finally supervising construction and full-scale verification."

Offshore team

Aker Arctic's core offshore team comprises Ilkka Rantanen, Sami Saarinen, Esa Ritari and Cayetana Ruiz de Almiron de Andres. For each customer project these Project Managers gather a project team consisting of experts from Engineering and Testing units within the company.

Cayetana Ruiz de Almiron specialises in harbour design. She is originally from Spain and works with us as a Project Engineer.

Ilkka Rantanen joined Aker Arctic in August 2014. He transferred from STX Finland in Rauma, where his home currently is, and he divides his time between Helsinki and Rauma. Ilkka has a long background in Offshore, both from STX Finland and his earlier work at Hollming Works Group.

Sami Saarinen has been with Aker Arctic for many years and is our true ice expert. He has been on numerous expeditions to the Arctic in order to gather valuable ice knowledge.

Esa Ritari has a solid background in ship design and offshore projects, especially in conversion and retrofit. He joined Aker Arctic from STX Finland in 2013 and has previously worked in Houston, USA, as an expatriate for Metso.

Arctic drillships extend operative window

A common requirement for all drillships operating in arctic areas is ice capability and suitability for cold or arctic climates.

Characteristic for normal drillships intended for open water use is open deck areas. In arctic drillships, on the contrary, enclosure is preferred to effectively enable any required winterisation. Winterisation means ensuring that the vessel, all machinery and equipment function at all times in icy and freezing weather conditions. This poses substantial challenge for the design work. All interior areas as well as crew areas have to be planned with safety as a top priority, with sufficient ventilation and clear evacuation plans. Other challenges are ice related, such as ice loads.

Riser protection essential

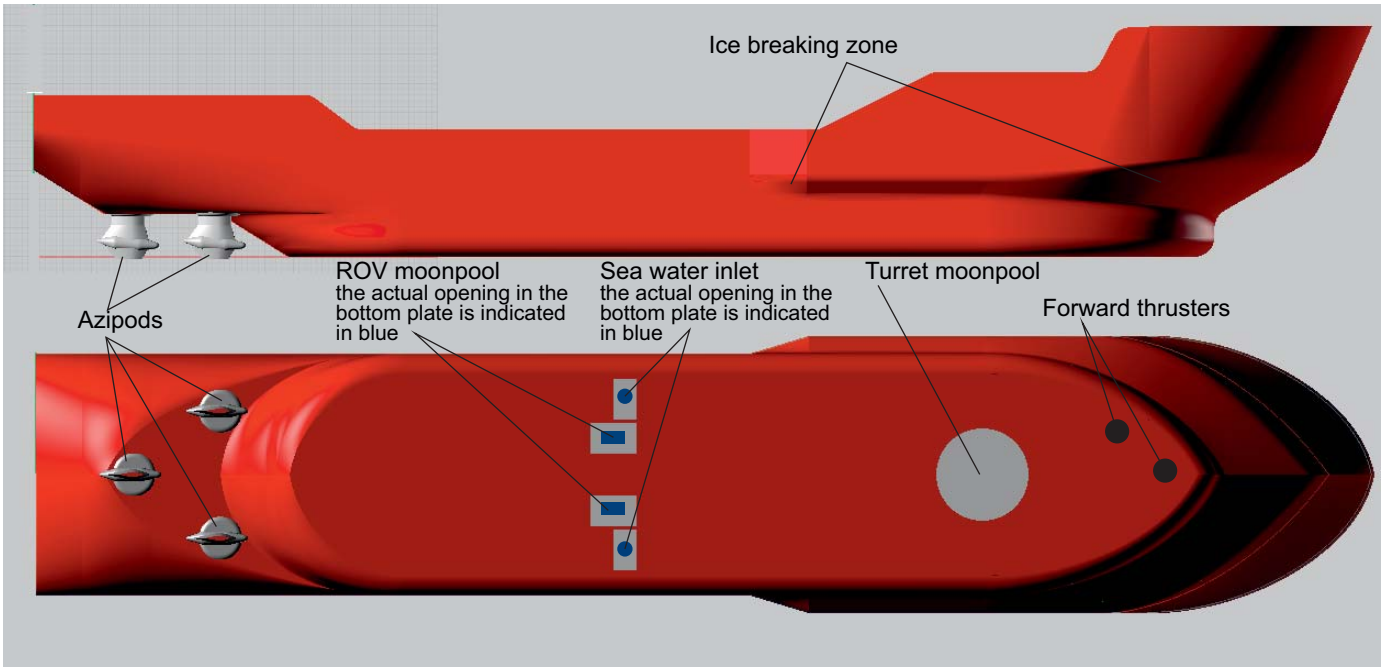
Drillships are either moored to the seafloor with anchors or maintain position using propulsion and dynamic positioning (DP) system.. Essential for both is riser protection, meaning that ice is not allowed to move under the ship to the moonpool area and reach the drilling equipment. This can be managed for example through the hull shape.

"In the Arctic waters, drilling operation is performed during the summer months. With a specially designed arctic drillship, the operative window can be extended. The drillship can arrive safely at the site and begin operations when there is still ice and stay longer towards winter, adding great value to our customers and operators," Esa Ritari, Project Manager at Aker Arctic Offshore Services, highlights.

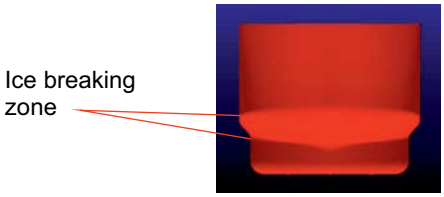
Ice Management Plan

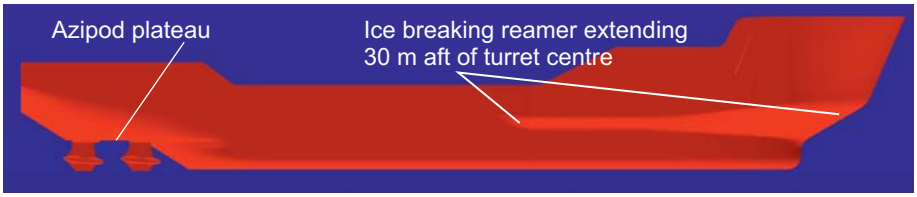
An essential part of designing drillships and planning drilling operations is to make an Ice Management Plan (IMP). The plan is necessary when arriving at the operation site, during operations and when leaving the site. It explains e.g. how to supervise ice movement, what are the safety zones, what is the time needed to make alteration in the operation mode if ice is coming closer or when does disconnecting become necessary. The Ice Management Plan also includes plans for the Ice Management vessels, possibly a supply vessel and evacuation procedures. Equally as important as the Ice Management Plan is to make an Oil Spill Plan. The contents are similar and the plan should already be outlined in the Pre-Feed phase of a project, when equipment and vessel selections are made. Criteria for the recovery equipment depend largely on the area where the operation takes place.

"We have been fore-runners in oil spill recovery in ice and performed pioneering tests already in the early 1980s in our ice laboratory model basin. The Finnish government made a decision in 1979 to research oil spills in ice, after the oil tanker Antonio Gramsci had an accident in the Baltic Sea. After many laboratory tests, we also conducted a full-scale test in 1985 in the harbour of Helsinki Shipyard and results from those tests still form the basis for oil spill recovery in ice today. Development work has naturally continued in cooperation with various interest groups and recently resulted in the development of an icebreaking Trimaran, a concept which can be efficient for oil spill recovery in icy waters," explains Mr Ritari.



Last year we jointly developed the concept of a Moored drillship with Aker Solutions. The drillship is intended for Kara, Beaufort and Chucki Sea drilling, with the hull geometry and propulsion system specially optimised for ice interaction. The ambient temperature design is -40°C and it can work in ice conditions equivalent to 1.5 m level ice.





Challenges in designing arctic harbours

Photo: J.E. Sosnov

Nuclear powered shallow draft polar icebreakers Vaygach and Taymyr at quay in Dudinka harbour.

Docking test in an icy harbour situation.

Arctic harbour design is a hot topic around the world and the need for experienced partners is growing. The challenges are many and Sami Saarinen advises against stepping into projects without strong ice knowledge.

Vessels operating in an arctic harbour and the design of the harbour need to be integrated more closely when compared to an ordinary open water harbour. The reason is simply that operating a vessel in an icy harbour area is much more demanding than operating in open water. Therefore, it is highly beneficial to simultaneously design the harbour layout and the vessels that will operate in that harbour. The same applies whether planning vessels for an existing harbour or planning a harbour for existing vessels, the present design should be taken into account in the design work.

"When designing an arctic harbour, there are a few specific issues that have to be addressed in the design. First of all, it is important to explore how ice is moving both inside and outside the harbour. The prevention of ice from outside the harbour drifting into the harbour is essential, as ice accumulating at the piers can in a worst-case scenario stop operations for a long time. Ice Barriers are used to avoid this and they protect the harbour both from waves in open water situations and from drifting ice when it is cold," Project Manager Sami Saarinen explains.

“Secondly, ice developing inside the harbour needs to be taken into consideration in the operations planning and logistical analyses. Too much ice will slow the process of a vessel reaching its docking place. One method to prevent this is the mechanical removal of ice with icebreakers if the harbour is big enough. Another method is to lead warm water into the harbour basin to minimise ice formation. This can be combined for example with air bubbling, where air creates water movement leading the ice away from the pier. Thirdly, all assisting vessels need to be compatible with both the harbour design and the tankers arriving and departing the harbour."

Designing Sabetta harbour

Aker Arctic has recently been involved in delivering a major project for Yamal LNG, which included developing and designing the LNG-carriers for exports of LNG to the market, the Sabetta harbour and assisting icebreakers to ensure efficient all-year operations in the port and associated region.

"For the Sabetta harbour, we participated in the development of the port concept and the layout. The Liquefied Natural Gas (LNG) poses challenges for the entire logistical chain. LNG is susceptible to transportation stream fluctuations, thus the cargo vessels have to be at the pier ready for loading according to a schedule, otherwise the entire production system has to be turned off, with huge costs involved. With that in mind, we evaluated the performance of the LNG carrier and assisting vessels before beginning the design of the harbour layout. For ice formation control in the terminal, we designed a brash ice control system (BIMS), with warm water directed into the terminal basin combining with an air bubbling system. Furthermore, we optimised the ice barriers for surrounding ice conditions and also considered possible future terminal expansion plans," Mr Saarinen tells.

Aker Arctic has recently been involved in a major project for Yamal LNG, delivering designs for the LNG-carriers for exports of LNG to the market, developing and designing Sabetta harbour, as well as the assisting icebreakers to ensure efficient all-year operations. Pictures from Sabetta harbour in February 2015. (Sami Saarinen)

"There are new harbour projects scheduled to begin in the near future, which we will participate in. It is important to keep in mind that the arctic harbour design is much more suited to the surrounding environment and expected vessel traffic than traditional "open water"-harbour designs. Without know-how in ice behaviour, there will be challenges that are impossible to overcome, so I strongly recommend making use of the arctic know-how we have acquired over the years." ■

Ice expeditions

As part of Aker Arctic's services, we conduct arctic expeditions to gather ice information about new areas. Sami Saarinen has been on numerous trips and lists a few:

"Pechora Sea, Barents Sea, Gulf of Ob, Yamal peninsula, Bay of Bering, Baffinland in Alaska. It is always easier to conduct design work when you have been to a location and have seen what kind of area we are talking about, what type of ice there is and what is the prevailing ice situation. When we travel to a new place, we take measurements that we then compare to the history of the current ice season's weather conditions in order to know if the winter is classified as hard or easy. We can then quite reliably estimate the ice situation during other winters. This is part of our services for our customers as the expeditions support our design work."

Sami Saarinen has been on numerous arctic expeditions gathering information about the ice conditions in these harsh areas. Here in Sabetta February 2015.