Aker Arctic Module Carriers for ZPMC- Red Box Energy Services

Aker Arctic

The Liquefied Natural Gas plant in Sabetta will be constructed of several hundred different modules, which are built at different locations around the world. These modules weigh up to 10,000 tons and will be gathered in a European harbour before shipment to Yamal. It will take about four years to deliver them all to the Arctic area. Due to the harsh conditions found in the area with temperatures down to minus 40 degrees Celsius for part of the year, no ordinary vessel is able to take care of this kind of transportation.

Expertise at all stages

In this project, Aker Arctic has been able to offer its know-how at all stages, making the initial feasibility studies of the Yamal area, developing LNG transport solutions, assisting in the harbour design, planning various assisting vessels, and now continuing with delivering a design for this arctic module carrier for the constructing shipyard Guangzhou Shipyard Inter-national in China.
Aker Arctic began the project in autumn 2013, construction began autumn 2014 and delivery of the vessels will be at the end of 2015/beginning of 2016.

Cargo ship with Polar Class 3

Aker Arctic has now, in close cooperation with ZPMC-Red Box Energy Services, developed two module carriers, which can operate year-round in delivering the modules to Yamal. These carriers are different from anything designed and constructed earlier. They are typical heavy cargo ships with a wide cargo deck, but designed for exceptional ice circumstances as they need to be able to move in the Gulf of Ob round the year in order to keep the construction of the LNG plant on schedule. The ice class is therefore Polar Class 3.
Two of the major challenges in designing the vessels were firstly the weight of the modules and secondly the way they will be loaded onto the ship, as the ship needs to stay balanced at all times. Aker Arctic optimised the construction so that it did not become too heavy but remained strong enough to manage the weight.
The ship draught had to be between 8-12 metres and loading needed to be done regardless of changing tides. Additionally, the tight schedule and Arctic weather had taken into account.
The stability requirements of a vessel like this requires a highly sophisticated ballast system. The additional complexity of operating this ballast system above the Arctic Circle posed a major technical challenge in the concept design phase of these unique vessels. ZPMC-Red Box contributed a new ballast system design which transfers ballast water internally in such a way as to improve the control and efficiency of discharge oper-ations. Maintaining equilibrium between the vessel deck and the loading quay throughout the tidal cycle while at the same time being able to precisely manage the trim of the vessel during the discharge of ultra heavy cargoes was a critical criteria in required specifications.

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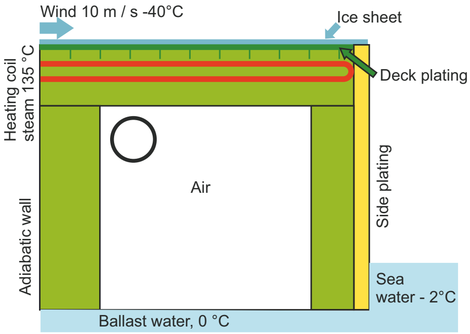
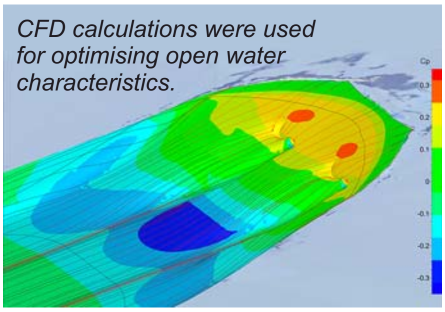




The vessel is winterized down to -50°C !

Various options were studied in order to find the best solution for the removal of the ice.

A special feature of the ship is the heating system of the deck.

Spray blown off the sea and freezing immediately on contact with the ship can create snow and ice cover on the large 43 by 175 metre deck area. Ice in particular must be removed from the deck to ensure safe operation during offloading even down to -40°C.

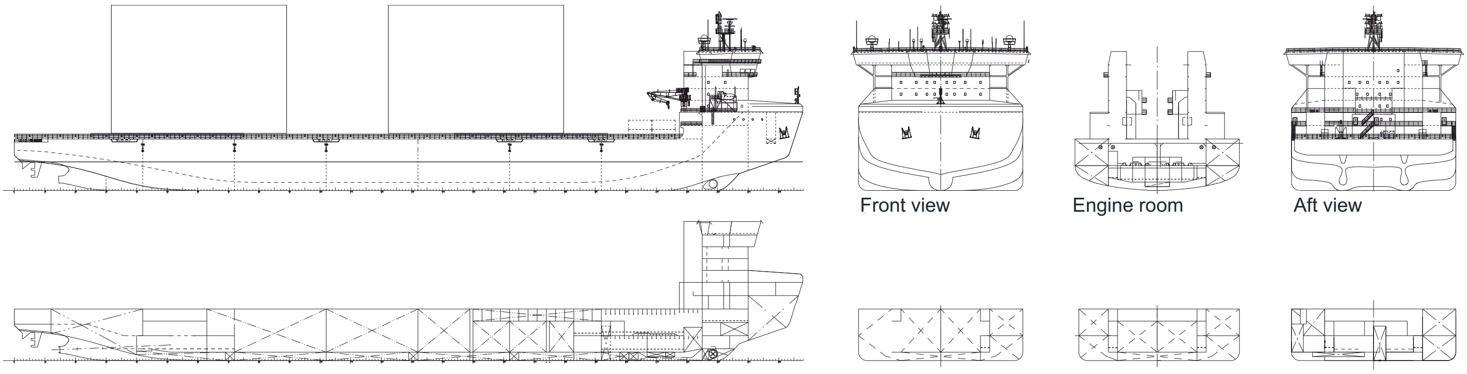
Hydrodynamic studies

An extensive amount of model testing was made in order to ensure that the requirements of both good open water features and ice performance were met without construction prices becoming excessive. Slamming pressure measurement was particularly important. CFD calculations were used extensively for optimising open water characteristics.

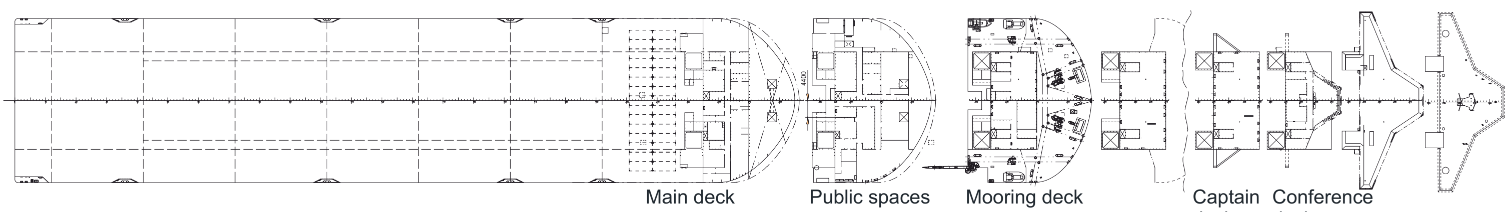
The carrier can proceed at a speed of 3 knots in 1.5 metre thick ice with 2 x 12 MW propulsion power."

Aker Arctic used CFD tools to model both radiation and convection from possible heating systems to the deck.

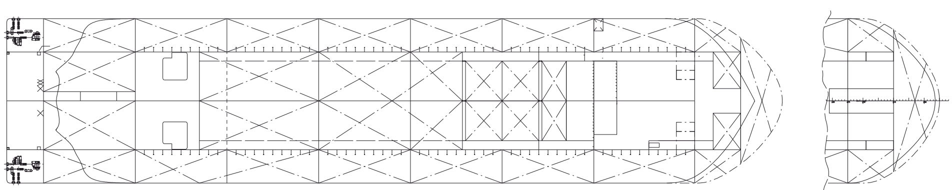
The challenge was to optimise the heating system so that it is efficient, but does not create too much weight. The final solution was to place steam pipes below the deck, which are turned on 24 hours before the arrival. The heat melts the ice enough to create a thin water layer below it so that the rest can be shuffled away mechanically.



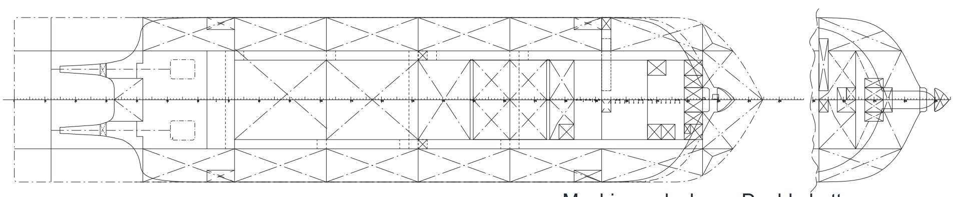
Front view Engine room Aft view



Main deck Public spaces Mooring deck Captain deck Conference deck



Tween deck Control room deck



Machinery decks Double bottom

Main dimensions

Length, over all	abt. 206.3 m
Length between perp.	193.8 m
Breadth, maximum (cargo deck)	43.0 m
Breadth, at water line	43.0 m
Depth to upper deck	13.5 m
Draught, design	7.5 m
draught, scantling	8.0 m
Draught, max. ice-going	8.0 m
Draught, max. ballasted (in harbour cond.)	12.0 m
Speed, service (at design draught) abt.	13 kn
Deadweight, at design draught	24,500 t
Deadweight, at scantling draught about	28,500 t

Ice class acc. to PC3

Classification: DNV: +1A1, GENERAL CARGO CARRIER, DK(+), PC-3, E0, NAUT-AW, CLEAN, BWM-T , BIS, TMON