

# Introducing an icebreaking Arctic container ship

Aker Arctic has designed an 8000 TEU container ship for independent use in both summer and winter along the Northern Sea Route (NSR).

Aker Arctic has developed a completely new concept for the Northern Sea Route, an icebreaking Arctic container ship, which can be used year-round to cover the much shorter distance between Asia and Europe.

Using the experience gained from the breakthrough Arc7 LNG carriers, which have now successfully transported liquefied natural gas from Sabetta for more than three years, and the new Arctic LNG carrier design for independent year-round operation in the Arctic, Aker Arctic designed an 8000 TEU container ship for independent use in both summer and winter along the Northern Sea Route (NSR).

"No such type of container ship has been available before," says Luigi Portunato, Naval Architect at Aker Arctic.

## Double-acting containership

Besides an ice-strengthened hull, an icebreaking bow and winterisation features, there are other specialities incorporated in the design which sets the vessel apart.

"The vessel comes with two optional designs: either using our Double Acting Ship (DAS™) technology with a hybrid propulsion solution of one shaftline with propeller in the centre and two azimuthing propulsion units on the sides, or a design with two conventional shaftlines and rudders," Portunato explains.

The double-acting ship can manage independently on the NSR year-round by turning stern-first in heavy ice, whereas the shaftline version will need the assistance of an icebreaker during extreme winter conditions, as it has lower icebreaking capabilities.

## Secondary steering position

In other double acting ships, the deckhouse is usually located in the stern and it is possible to navigate backwards from the bridge. In a container vessel, this is not practical as the area is needed for containers, and the deckhouse is usually positioned in a midship location.

"Therefore, in this case, we have positioned a special aft wheelhouse at the aft mooring deck for navigating stern first," says Portunato.

The machinery is separated from the accommodation and wheelhouse. Because of the freezing temperatures in the Arctic winter, a covered passageway has been arranged under the deck instead of the usual transfer path along the deck.



## Profitability explored

In the economic study, prior to beginning the vessel design, three possible options were explored and compared in terms of profitability:

1. A normal open water vessel using the Suez Canal; the only route currently available for container shipping.
2. A new Arctic container vessel for shipments between Asian and European ports.
3. A new Arctic containership used only on the icy parts of the NSR, with two new re-loading hubs at either end for further transportation of containers, one in Murmansk and another in Kamchatka.

The results showed the obvious: the unit cost per TEU decreases when the size of the vessel increases for all options. Although the drop was more significant for the Arctic alternatives, it is, however, difficult to establish the exact point when either of the two Northern Sea Route options becomes more profitable than the Suez Canal route, as there are many factors influencing the costs, such as fuel price, type of fuel and filling ratio of the container ship.

"In the current market situation, transportation with the independent Arctic container ship is slightly more costly than with a Suez Canal open water vessel," Portunato says. "Yet, using LNG as fuel would be

more profitable, and is additionally available in the area. The new Arctic containership design with hybrid propulsion can also manage on its own without icebreaker assistance, which further lowers the cost. The smaller size, 8000 TEU, is additionally more flexible in terms of cargo compared to open water container ships."



## Reloading adds time

The currently-used Suez Canal option has the economic advantage of allowing big vessels carrying up to 20,000 TEU of cargo, which would be too large for the NSR. There are also many ports along the way, allowing cargo to be added when the ship is not full.

"The third option we investigated is also economically feasible, but comes with the drawback of reloading which is time-consuming. Additionally, the entire route is in Russian waters along with the envisaged transshipment hubs, hence it would most likely have to be a Russian internal ship unless cabotage is allowed."

## Schedules are essential

Shipping with containers is a different market from other shipments. The advantage with containers is that they are of standard size and model, making them easy to use in worldwide shipping. For optimal business profitability, a large flow of goods, fully-loaded ships and a fast turnaround is best. The traffic also has to be steady as the schedule is fixed for all players.

"Therefore, the much shorter northern distance becomes interesting if a decent speed can be achieved in winter and schedules can be relied on, which is now possible with our

new design," Portunato highlights. "Summer traffic speed and timetable reliability is not a problem."

The environmental impact of growing traffic on the NSR has raised concerns, as the Arctic area is fragile. However, looking at the overall picture; the much shorter voyage requires less fuel and creates fewer emissions, especially as cleaner fuel options can be utilised.

## Freezing challenges

Although the Arctic containership concept design is ready, there are still certain questions which have to be evaluated.

"We need to investigate if there are any types of cargo which cannot be transported in cold winter conditions. Heated containers or coverage inside or outside the containers could be solutions," Portunato ponders.

"However, refrigerated containers are commonly used, so inventing other types of special containers should not pose a problem."

## Previous reference concepts

Aker Arctic has, over the years, designed a wide range of different icebreakers and cargo vessels. The closest existing concept would be the first double-acting cargo vessels designed for Norilsk Nickel in 2006, although they are half the length of the new Arctic containership and used for general cargo. The container cargo capacity is 648 TEU as opposed to the new 8000-TEU design.

The module carriers built for transporting construction modules to Sabetta harbour were the first Arc7 carriers for the NSR, but they were not intended for regular traffic.

"The most similar vessel in terms of size is the Arc7 LNG carrier design used for the *Christophe de Margerie* and its sister ships. The Arctic container ship will also incorporate design ideas and solutions from the soon to be built, advanced Arctic LNG 2 concept," Portunato adds.

## Technical details:

- Container capacity 8000 TEU
- Length over all 300 m
- Breadth 46 m
- Draught 13 m

### Installed propulsion power

- A version 56 MW (1x22 MW shaftline, 2x17 MW thrusters)
- B version 44 MW (2 x 22 MW shaftlines)

### Icebreaking capability, level ice performances ahead (3 knots)

- A version 2.3 m
- B version 1.9 m

Ice class RMRS Arc7

## Meet Luigi Portunato



Luigi originally comes from Genova in Italy, where his family still lives. He finished his Bachelor of Science degree in his hometown and then pursued his Master of Science at TU Delft in the Netherlands, becoming increasingly interested in Arctic shipping and offshore operations. He took Arctic courses at the University Centre in Svalbard and wrote his Master's thesis on the concept design of a drifting research vessel. He applied for an open position at Aker Arctic and moved to Finland 18 months ago, a decision he has not regretted.

Luigi likes the cold and snow and enjoys the nature in Finland. The past year was not the best time to explore the country, but he has, nevertheless, managed to indulge in his favourite pastimes of hiking, mountain biking and being outdoors. ■