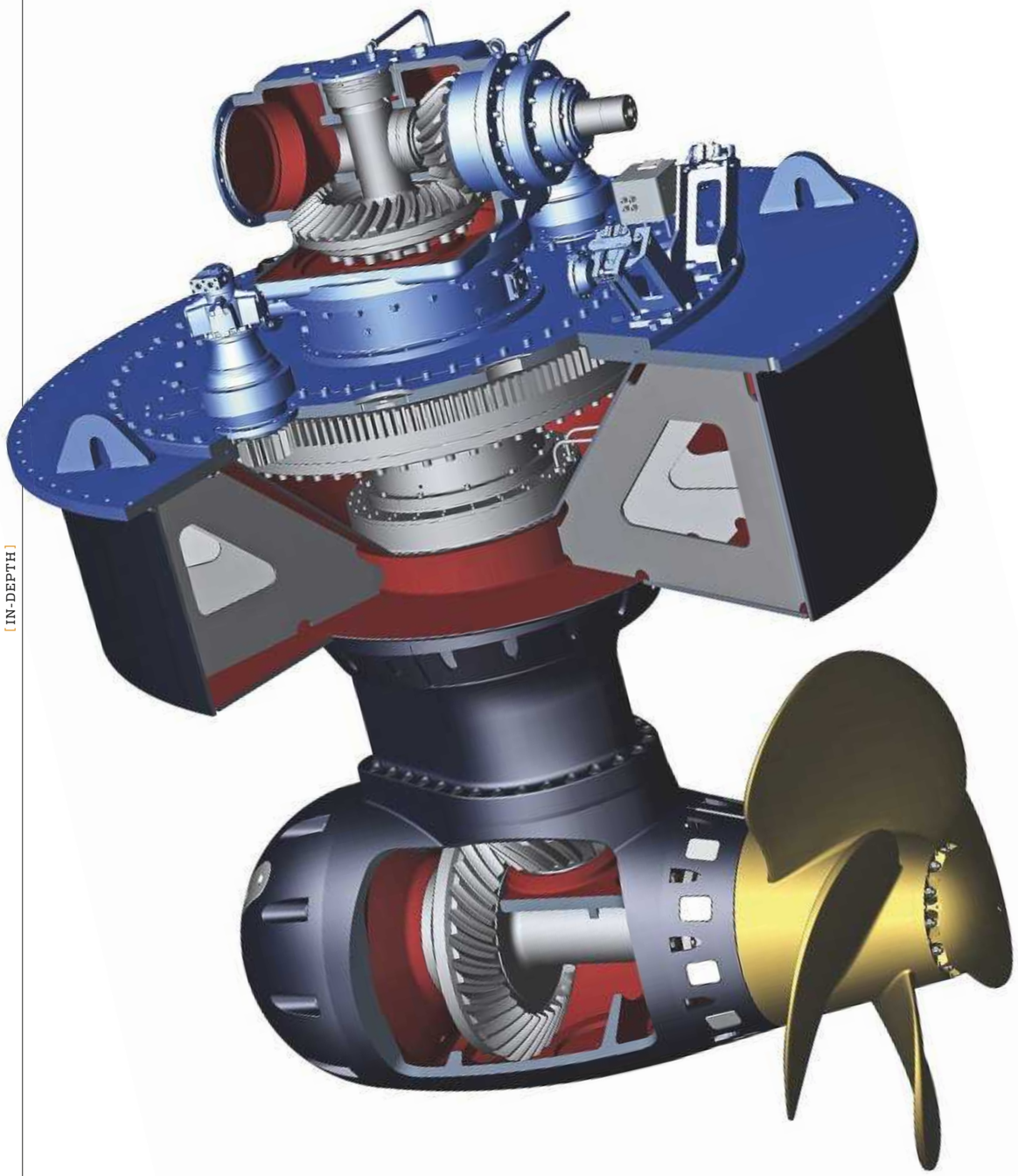


THE ICEPOD REVOLUTION

Ice and polar applications require special solutions because of extreme weather conditions. Markets can also shift like icebergs, as laws change and customer needs evolve.

TEXT: JUKKA VISKARI **PHOTOS:** WÄRTSILÄ, WAGENBORG AND SHUTTERSTOCK

A traditional vessel operating in ice opens a channel by moving forward, but more and more vessels are being designed for astern icebreaking. Icepod is an innovative, steerable pulling thruster designed for 1A Super Ice Class or higher. It allows for astern ice breaking operations, where the open fixed-pitch propeller is actively used in ice milling and flushing.

"This type of new thruster can withstand the loads caused by the impact of large ice blocks on the thruster components and systems," points out **Elias Boletis**, Director of Propulsion Programs and Technologies at Wärtsilä, responsible for R&D in the Netherlands and Norway.

MEETING FUTURE REQUIREMENTS TODAY

A few years ago, developers of propulsion systems started to look at steerable thrusters for several applications, says Boletis.

"They make a vessel much easier to manoeuvre, especially under extreme conditions. We are developing a new family of products suitable for ice and polar applications."

The main market at present is the Baltic Sea including the Gulf of Finland, where vessels and their propulsion systems need to be ice-classed to access St. Petersburg and Helsinki in the winter.

There is lucrative future potential in the Northeast Passage, the northern sea route along the Russian Arctic coast from Murmansk to the Far East. It can cut freight delivery times for goods from Asia to Europe by a third and provide great fuel savings compared with the current Suez Canal route.

"In the years to come, freight operators are certain to be interested in opening the northern route," says Boletis. But it is ice-free for only few months in a year and navigable only by vessels with high ice capability.

Large tankers will also want to use the northern route. Special vessels for oil drilling may spread to polar areas. And steerable thrusters could also be used in Russian rivers and the Caspian Sea.

ADVANCED SOLUTION

Icepods differ significantly in shape from steerable thrusters designed for open water conditions. Structurally, an icepod has a larger pod size but a smaller, faster running propeller. With special steels used in construction, it is several times

stronger than a normal thruster. Its ice-strengthened propeller is driven by gears enclosed by a protective and sturdy casing.

The thrusters rotate 360-degrees around a vertical axis, enabling versatile ice operations. Yet they offer good open-water efficiency, mainly because of their open pulling propeller configuration. The Z-drive configuration allows a low-height thruster room, which maximizes work deck space.

For now, icepods are available in two power classes: 1750kW and 2500kW, but it can be expanded in response to customer needs, says Boletis.

"The capability to use thrusters for ice milling is an advantage. You can open a path by drilling the ice out."

NAVIGATING THROUGH THE RULES

The ice and polar market is influenced by a combination of local and international classification rules, making the situation complex for ship operators.

Different areas in the world such as Russia, Sweden/Finland and other legislative authorities use slightly different definitions. Global certification authorities all have their own certification requirements, and there are more global rules for vessels operating in the polar areas.

Ice classes depend on hull structural design, engine output and performance in ice.

At the risk of simplification, there are three generic ice classes. Ice-classes one and two, mild and moderate, which refer to vessels that, when they enter icy Baltic areas or inland waters in

	IACS	
Winter Navigation in Sub-Arctic Waters	IA Super	PC6
	IA	PC7
	IB	
	IC	
	FSICR	
	PC1 PC2 PC3 PC4 PC5	Year-Round Navigation in Arctic Waters
	PC6 PC7	Summer navigation in Arctic Waters

IACS:
International Association of Classification Societies Ltd.

FSIR:
Finnish Swedish Ice Class Rules

Launch of Wagenborg's IMSV 'Serkeborg'. This transverse launching is a spectacular event which is typical for shipyards in the northern part of the Netherlands.

AN ICEPOD FOR THE CASPIAN SEA

ROYAL WAGENBORG approached Wärtsilä in 2007 to request thrusters for new ice-breaking support vessels. The Wagenborg requirements, based on operational experience in the North Caspian sea since 1998, could not be met with existing steerable thrusters as they included ice milling operations in environmentally sensitive, shallow waters.

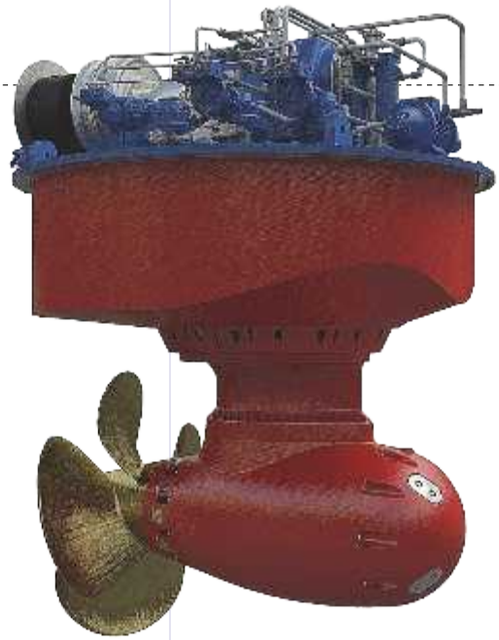
The main design challenge was to understand how a steerable, 360-degree rotating, pulling thruster would be operated in ice, says **Joost van Eijnatten** from Wärtsilä Propulsion Centre of Excellence in the Netherlands.

The ice loads on the propeller and other parts of the thruster also needed to be defined. The name "Icepod" was coined in planning meetings that year, to describe a high ice class thruster.

Because both a vessel and her thrusters need to be certified by a classification society, Wärtsilä used their guidelines and mandatory rules in the design, more specifically the new IACS Polar Class rule requirements.

Wärtsilä has developed tools and in-house design guidelines based on rule requirements, plus its own specifications where rules did not exist. Ice class rules for thrusters are scattered and general.

The development work was performed in close cooperation with Wagenborg and involved external parties such as Aker Arctic, VTT, DNV and Vicura.



To break ice, icepod propellers run at 300 rpm, which is much faster than a normal thruster. Splash lubrication reduces efficiency losses and fuel consumption.

Central and North Asia areas, are aided by ice breakers. The third, high ice class vessels can operate under all-year ice conditions.

Wärtsilä concentrates on high-volume ice-class categories one and two. The company and its acquisitions boast more than 300 high ice class CP propeller references and 40 for ice classed thrusters. It aims to provide customers with competitive integrated solutions where Wärtsilä's propulsion system, engines and ship automation form one entity.

EXTENSIVE REFERENCES

The Wärtsilä propulsion solutions family currently ranges from 400 kilowatts to 60 megawatts. This covers the majority of practical applications; in addition to icepods, controllable and fixed pitch propellers, waterjets, normal azimuthing thrusters, tunnel thrusters and marine gearboxes are available.

"This is a demanding market where solutions need to be validated in the field. We have now taken the initial steps for more future applications," says Boletis. The legislative changes are foreseeable. Emissions and fuel consumption will be vital future factors in the success of steerable thrusters.

SELLING ICEPOD TO ALASKA

Wärtsilä provided the first-ever icepod for the University of Alaska Fairbanks. The two can-mounted Icepod 2500 thrusters were delivered in the first quarter of 2012 for the R/V Sikuliaq, built at the Marinette Marine shipyard in Wisconsin.

The University had dreamed of a new research vessel since 1973. The 80 metre-long oceanographic research ship will finally take scientists to icy waters in 2014. The American Reinvestment and Recovery Act, a stimulus package devised to fight the recession, helped realise the dream.

"They had done their homework, made some designs. Now they are actually modifying the whole port for the vessel. This is a really big and exciting thing for Alaska," says Brian Fariello, the business sales manager in the project.

Sikuliaq, one of the world's most advanced university research vessels, can break ice up to 90 centimetres thick. Both the vessel and its thrusters are ice class PC5 (classed by ABS).

Fariello is proud of Wärtsilä's 30-year history in demanding propulsion solutions for arctic applications.

"In this project there has been a lot of customisation, particularly in the propeller design. This research vessel needed to be able to break and mill ice but also maintain low levels of underwater radiated noise when operating on a scientific mission. It was a key achievement in the project."

As special requirements Van Eijnatten lists cavitation-free operation in multiple conditions, resilient mounting of the electric drive motor and the redundancy requirements for support systems.

The can-mounted thrusters of Sikuliaq can be replaced with the vessel afloat. Handy, if you sail in remote areas with an operating range of 18,000 nautical miles at 10 knots.

The 4-lip shaft seal used in icepods prevents oil leakage, water ingress and oil contamination in sensitive polar waters.