Arctic Research Vessel

General

The discussion about the operability of this Research vessel is a general one. The intent is to indicate what the actual operational limitations, introduced by ice, are expected to be, and what is operationally and structurally safe for this vessel.

The introduction of various regions of ocean into this, are intended for general assessment, ensuring that the operational targets are set realistically. It is possible to perform a more rigorous and even probabilistic analysis of the operability of this vessel in various regions. However, such analysis may not be accurate either, as the history appears not to be such a solid basis for basis of forecasting the future. Especially in the middle of the apparently changing arctic ice conditions and decay of the polar pack, it is entirely possible that the operational regions and time frames when it is possible to operate this research vessel could significantly be altered by the global changes. It is more likely that any such global change would be associated with increased operability of this Research vessel, on a long-term average basis. However, on a year to year basis it is entirely possible that significantly more severe conditions are met than indicated in current document, or based on a more rigorous statistical analysis.

Overall the basis of the design of current Research vessel is sound. The main ingredients incorporated into the vessel follow and adopt the latest proven technology and clearly apply very well into this Research vessel operational profile and need to perform research in the ice covered regions. The most obvious limiting factor in operations of this vessel in thick ice is its shallow draft. Significant thick ice will surround the hull of the vessel with ice and thus cause significant amount of propeller ice interaction, which would be avoidable for a deeper draft vessel. However, the azimuth propulsion intended for this vessel can be designed to account for such propeller ice interaction and to ensure that the propulsion system maintains its operability and integrity in all ice conditions, where the operations take place.

The independent operability of current Research vessel is significantly better than that for a similar size and power regularly, longitudinally propelled icebreaker. The azimuth thrusters will ensure that the vessel has a maximum ability to extract itself from severe ice conditions.

The introduction of the azimuth thrusters into this vessel also ensure the dynamically positioned operation as well as the ability to clear ice from around the vessel, create open water alongside the vessel for various research activities. Also towing lines behind the vessel, equipped with azimuth thrusters will be considerably easier with a longitudinally propelled icebreaker. The azimuth thrusters maintain a clear, near ice-free channel behind the vessel, with orientation of the propulsion units to a small angle outboard.

South of Bering Straight

South of Bering Strait the ice season is relatively short, and the ice thickness is mostly thin and limited medium thickness first year ice. Highest-level ice thickness south of

Bering Strait is under 1 m. The ice season length varies considerably. Freeze up south of Bering Strait starts late December +/- a month and the break-up occurs late May +/- more than a month.

The ice conditions are typically highly dynamic, ice pressure is present a significant proportion of time. This implies significant ridging and rubble formation in the ice regime.

This Research vessel is capable of year round operation in this region. The ice class of this Research vessel is sufficient in all ice conditions in this ice regime, without a need to set limits to the operations.

Chukchi Sea

This region is governed by mostly first year ice and considerable ice dynamics. The ice thickness grows to about 1.5 meters in thickness in the southern sections of this and 1.8 meters in the northern regions. The freeze- up starts from the northern regions, typically late September and in the southern regions in October. The break-up of ice starts in southern regions mid May and in northern regions as late as early September.

The northern regions contain occasionally a significant amount of multiyear ice.

This region is also associated with dynamic ice conditions and occasional ice pressure.

In the region of Chukchi Sea the Research vessel is able to operate independently well into the shoulder ice seasons. The operation is limited in efficiency in the January – April time frame. Similarly the ice class; hull and propulsion system strength limit the speed at which the operation can safely take place, if the vessel operates during the January – April time frame in the Chukchi Sea. The operation can be considered to be structurally safe, and limitations to operations are more in the line of inability to continue operation independently, very slow in operation, or getting stuck in ice, are the actually expected limiting factors for this operation of this Research vessel mid winter in Chukchi Sea.

North of Alaska

This ice region is represented by a short summer season, average season free of significant ice one to three months, depending on the exact location, and varying drastically from year to year. Presence of a multi-year ice as a significant portion of total ice cover is a fact.

The operational season in the Beaufort Sea varies from a few weeks to perhaps two months or even slightly longer.
The ice class of the Research vessel requires that operations in presence of ice will take place with restricting the operational speed according to actual ice conditions. Unlimited operations would put the hull and propulsion of this vessel at high risk of local as well as global damage in the presence of multi-year ice.

Physical performance and structural limits

The initial powering of the vessel and draft lines indicate a level ice performance ahead in cold mid winter conditions of 0.95-m level ice at 2 knots continuous icebreaking speed.

The ice class of the vessel indicates structurally safe unlimited operations in about 0.9-m thick winter level ice, with all ice conditions which go with it, such as rubble and ridging.

The actual physically safe limit for this vessel to operate is highly dependent on the due operator diligence and caution, which is, as all know a difficult one to define accurately. However, today tools exist to tell what the dangerous speed would be. Use of the Russian Ice Passport, at a generic ice class specific level, indicates that CAPPR Type A, which corresponds closely to required class of this vessel, indicates that for example that 1.5 m ice is dangerous to structure operated at 7 knots speed. The so-called safe speed is typically about half the dangerous speed.

It appears an accurate assessment that the requested ice class matches reasonably the operational requirements for current vessel.

The conditions where the vessel is envisages to enter structurally most risky situations, is in the presence of multi year ice, in the presence of ice pressure. This could cause the sides of the vessel and the bottom part of vessel to be exposed to ice loads potentially causing not only local damage but also being of significant risk on larger scale global loading and damage. This is why a recommendation for any extended stays in the northern part of Alaska offshore are recommended to occur with access to support by another icebreaker which is more ice capable, as a backup support to get the vessel safely, and within reasonable time away from severe polar pack ice conditions. This very same reason suggests that forecasting of weather and resulting ice dynamics would be highly beneficial, in support of any such extended operations in the northern regions of Alaska offshore.