Striving for SAFER POLAR SHIPPING

The Polar Code provides tools for assessing operational limits, but there is still work to be done to ensure greater safety for vessels in polar waters. By John Dolny and Han Yu of ABS

T he International Maritime Organisation (IMO) formally adopted the Polar Code in 2015 as the culmination of a 20+ year international effort to promote safety and reduce the potential for environmental pollution from the increasing number of vessels operating in Arctic and Antarctic waters. The Code will enter into force for new ships on January 1, 2017. Existing ships have until their first intermediate or renewal survey after January 1, 2018 to comply. The Polar Code introduces a broad spectrum of new binding regulations covering elements of ship design, construction, onboard equipment and machinery, operational procedures, training standards, and pollution prevention. In general, the Polar Code is mandatory for all new and existing ships certified in accordance with the Safety of Life at Sea (SOLAS) Convention, operating on international and domestic voyages within the IMO-defined boundaries of Arctic waters and the Antarctic area.

One of the new mandates affecting the operations is the requirement to maintain comprehensive documentation, providing the crew with sufficient operational safety guidance in the anticipated environmental conditions and defining how the crew should respond to incidents that could arise. A Polar Water Operational Manual (PWOM), required for all polar ships, is intended to support decision-making during operations. The PWOM has to include relevant procedures for operations in ice and in low temperatures, communication and navigation capabilities in high latitudes, voyage planning to avoid ice or temperatures that exceed the ship’s design capabilities or limitations, and arrangements for receiving forecasts of environmental conditions.

Meeting the requirements

From a structural risk perspective, the Polar Code emphasizes the need to have documented ice operational limitations in the PWOM and referenced on the Polar Ship Certificate. To help define the limitations, the IMO developed a harmonised methodology based on several existing systems used throughout different domestic jurisdictions. The Polar Operational Limit Assessment Risk Indexing System (POLARIS) can be used for ice class selection in the early stage of design, voyage planning for operations, or on-board decision-making in real time on the bridge. While it is not intended to replace an experienced master's judgment, POLARIS offers a valuable tool for risk analysis to assess ice conditions. A Risk Index Outcome (RIO) is determined from the following simple calculation as a function of ice types in a particular ice regime, ice concentrations, and a ship’s ice class.

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RIO = (C1 \times RV1) + (C2 \times RV2) + (C3 \times RV3) + (C4 \times RV4)
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In the calculation, \(C1\)…\(C4\) represent partial concentrations of ice within an ice regime and \(RV1\)…\(RV4\) represent the corresponding risk index values for a given Ice Class. The Risk Values (RV) are a function of ice class and ice types. They can be modified according to the season of operation and operational state (i.e. independent operation or icebreaker escort). Risk levels increase with increasing ice thickness and decreasing ice class.

A positive RIO indicates an acceptable risk level for normal operations. A negative RIO indicates a higher level of risk (i.e. independent operation or icebreaker escort). Risk levels increase with increasing ice thickness and decreasing ice class.

A positive RIO indicates an acceptable risk level, while a negative RIO indicates a higher level of risk.

RIO = (C1×RV1)+(C2×RV2) + (C3×RV3) + (C4×RV4)

POLARIS helps to illustrate its value in interpreting available sea ice charts. In this case, POLARIS is used to evaluate ice charts provided by the Arctic and Antarctic Research Institute (AARI), a Russian state scientific research centre focused on the study of polar regions. The POLARIS methodology is used to evaluate the operability of three ice classes in the NSR region: IA (Polar Ship Category C) and PC6 and PC7 (Polar Ship Category B). The POLARIS Risk Index Outcomes (RIOs) for a 2015 transit of an Ice Class 1A ship transiting the NSR in mid-September – leaving northern Europe on 12 September and exiting through the Bering Strait eight days later toward a destination in East Asia – were notably positive. The charts indicate favourable ice conditions, with the route being practically ice free throughout the voyage.

The POLARIS RIOs for the same time period in previous years tell a different story. A comparison of the ‘average’ POLARIS RIOs for the same time period based on the previous five years of ice data (2011-2015) provide a general sense of the severity of ice conditions for which ships with Ice Classes 1A, PC7, and PC6 are evaluated. Results indicate that 2015 was a light ice season with relatively benign conditions, mostly open water or ice free. However on average, more difficult conditions should be expected.

POLARIS demonstrates that Ice Class PC7 and PC6 would be able to make relatively regular transits along the NSR in September, but conditions should still be addressed. POLARIS permits Polar Class ships to navigate in negative RIOs (0 < RIO < +10) but do so under “elevated operational risk,” which generally implies slower transit speeds. The outcome of this kind of study illustrates the need for informed decisions about ice class selection and voyage planning can be made using POLARIS so risk can be managed appropriately.

Limitations and improvements

While POLARIS offers guidance, it is important to recognize that limitations and uncertainty in the ice chart data affect the extent to which POLARIS can be relied upon. For example, ridged ice and rubble fields are not included in the charts and therefore not reflected in the POLARIS analysis. Ice classification, in addition, is typically produced on a weekly basis and therefore do not fully capture the short-term variability of conditions, which can be highly dynamic and can change rapidly over very short time periods.

This risk evaluation system was created as a first step to enhancing and refining standards for Arctic operations. While there is room for improvement, POLARIS marks the beginning of the journey toward safer management of Arctic and Antarctic transit.

Additional guidelines and standards are needed, and ABS will continue in its role of helping to develop tools for safer Polar operations.