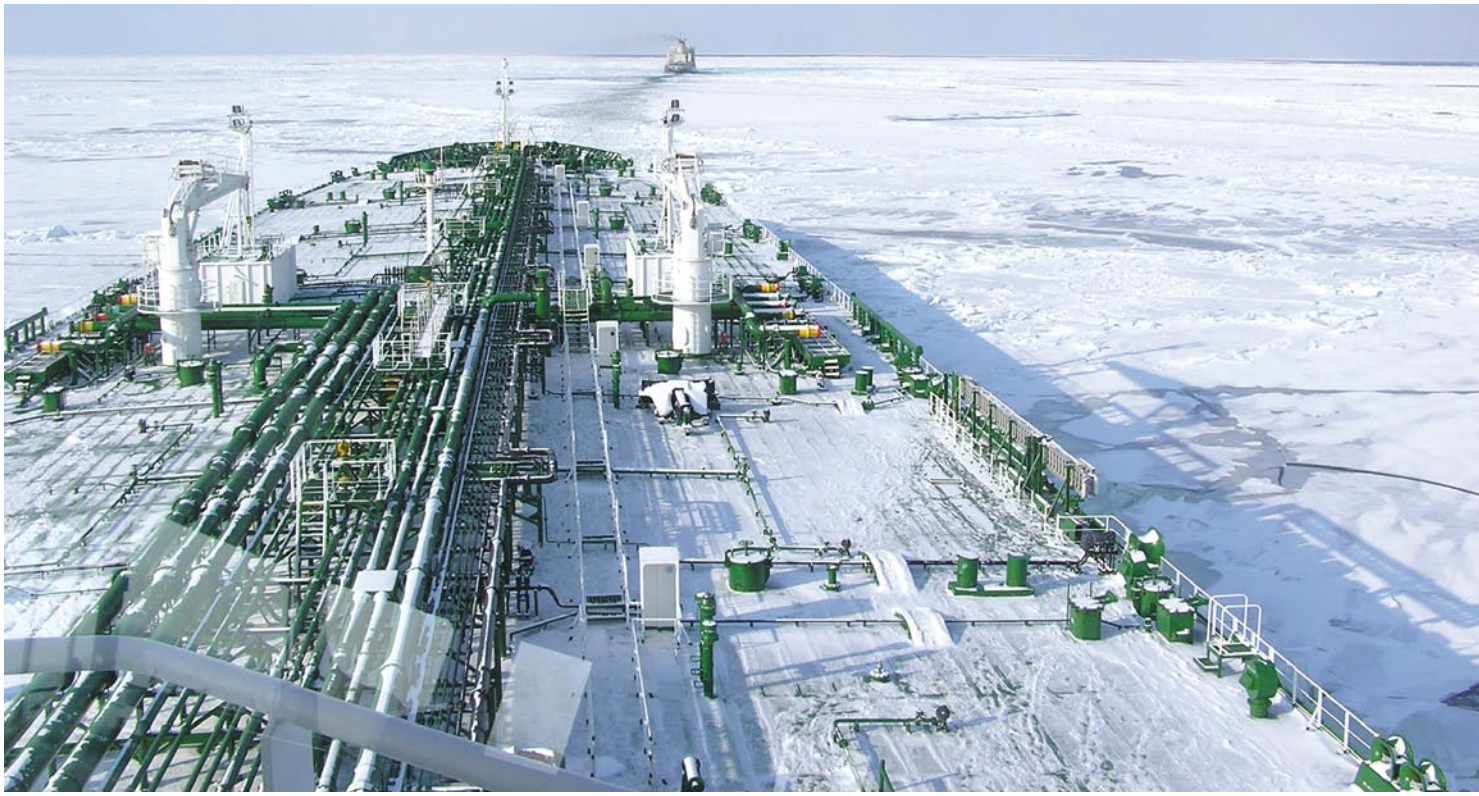
Coatings and cold hard truths

The sophisticated ships destined to recover hard to reach resources under ice-covered polar seas have required new thinking on design and construction. No matter how profound that thinking has been, however, owner preference for the protective coating Intershield® 163 Inerta 160 has remained a constant.



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While the wider newbuilding market for ships may only now be showing any signs of recovery, few can doubt that sustained high oil and gas prices dictate the future need for increasing numbers of vessels capable of operating in the harshest of environments.

Despite the challenges posed by their recovery, the Arctic Circle promises to yield around 22% of the world's oil and gas still known to be available, in the shape of up to an estimated 90 billion barrels of oil, 1,670 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids.

More than a fifth of Russian territory lies north of the polar circle. The nation's Arctic and sub-Arctic regions account for 90% of its gas reserves and over 20% of its crude oil. Accordingly, Russian gas giant Gazprom, for example, has gone on record as saying

that field development offshore Russia to 2020 alone will drive orders for over 10 production platforms, over 50 ice class tankers and other specialised ships, and at least 23 liquefied natural gas carriers. Such ships will be required to operate year round, and many will need to operate through ice that is up to 1.5m thick.

If the firm orders supporting such intentions have been slow to emerge, much depends on the Russian desire for its own shipyards to be in place to take a slice of available orders. Here, progress is clearly being made.

In March, Russian prime minister Vladimir Putin proposed "a joint production of ships and services" to Finnish president Tarja Halonen on building new ice class ships for Arctic exploration. Earlier in the month, Mr Putin expressed interest in a similar cooperation with Denmark. Samsung Heavy Industries and Daewoo Shipbuilding and Marine Engineering (DSME) have already signed technology transfer agreements with Russian builders, while Mitsubishi Heavy Industries, shipowner NYK and trading house Mitsui have investigated how to modernise the United Industrial Corporation's (OPK's) Severnaya Shipyard and Baltiysky Zavod for LNG carrier construction.

The coming need for more ships capable of operating in ice year round is also witnessed by plans from the oil majors and North American owners for a totally new fleet of icebreakers and tankers to operate in the Beaufort Sea.

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Class action

Class Societies have been very active in dealing with the challenges posed by operating in these most remote and unforgiving conditions; harmonising rules on polar ships, beefing up ice strengthening on propellers and propeller shafts, amending guidelines on winterisation, and working jointly to bring different skills developed on ice going ships by different societies to bear on specific newbuild projects.

It is fair to say that there has been less debate about the first point of contact between a ship and ice – the paint covering its hull. Whether they are dedicated ice breakers operating in multi-year ice with ice inclusions or tankers trading for only three months a year in first year ice, all ships face the challenges set by severe ice abrasion on the hull, and ice adhesion. Traditional anticorrosive systems, including standard pure epoxy systems, are unable to meet these challenges.

However, some class societies, such as Lloyd's Register and DNV explicitly recognise the benefit of applying a specialised, low friction, ice resistant coating on the hull. Such coatings are shown to aid the passage of the vessel by virtue of low frictional resistance. They also protect steel from corrosion by providing a physical barrier to the elements.

Lloyd's Register, for example, states that if a recognised low friction coating is applied in way of the main ice belt and is maintained in good condition during service, then scantling thickness can be reduced by 1mm. DNV states that if a special coating is applied, that by experience has been shown to be capable of withstanding the abrasion of ice, and is properly maintained, then lower values for the 'increment due to abrasion and corrosion due to ice trading' may be approved.

To get the optimum level of protection from a specialist, abrasion resistant ice coating, it is advisable to coat the complete underwater hull up to 0.5m above the Deep Load Water Line.

Because of the way ice breaks under pressure, ice breakers in particular benefit from complete coating of the underwater hull. Generally, all parts of the hull could be in contact with ice whether it is during the initial ice break, or the subsequent impact of large ice inclusions as the vessel proceeds.

While ice class vessels trading in first year ice do not require complete coating of the underwater hull, they should, as a minimum, be coated in the 'ice belt' region.

Some coatings suppliers offer paints which exhibit low abrasion characteristics compatible with working through ice. However, it may be significant that ice conditions did not drive their conception.

First in Class

In fact, the first Classification Society-recognised abrasion resistant ice coating was Intershield® 163 Inerta 160, from International Paint. Not a standard coating, this product was instead specifically designed for ships trading in the Baltic Sea region, and in temperatures down to -50°C.

With a track record now stretching back 35 years, Intershield® 163 Inerta 160 has proven itself as exhibiting up to 2.5 times the impact and erosion resistance of standard epoxies. Its smooth surface assists ice slip and resists ice adhesion to the coating's surface. It is also abrasion resistant – controlling mechanical damage and hull roughness, and saving on future maintenance and repair costs.

These are not idle claims. Over the last 35 years, close to 1,200 applications of Intershield® 163 Inerta 160 have been made, with 141 applications being made to dedicated ice-breakers.

Nor is it the case that the product's performance attributes can be said to have been surpassed as technology has moved on. The multipurpose icebreaker *Varandey*, delivered last year by Keppel Singapore to Lukoil, needs to break 1.7m thick ice. She joined the icebreaker tug *Toboy*, also built by Keppel for Lukoil, which can break ice that is up to 1.5m thick. Both operate in *Varandey*. Both have Intershield®163 Inerta 160 applied to their hulls.

Again, the latest of the Aker Arctic Technology-designed tankers to be built to the revolutionary double-acting principle, wherein ice is broken by a ship when going either ahead or astern, was delivered in March by Admiralty Shipyard to Sovcomflot.

The 70,000dwt shuttle tanker *Mikhail Ulyanov*, the first of a pair to be delivered by the St Petersburg yard, will be deployed at the Prirazlomnoye field in the Pechora Sea off northern Russia. She will be required to achieve three knots when going astern in first-year ice up to 1.2m thick, and a 20cm snow layer; and three knots when going ahead in first-year ice up to 0.5m thick. This ship, too, has been coated with Intershield® 163 Inerta 160.

The same is true of three state of the art 71,000dwt Sovcomflot double acting tankers built at Samsung HI - *Timofey Guzhenko*, *Vasily Dinkov*, and *Kapitan Gotsky* - which operate from the Varandey oil terminal in the Barents Sea.

Robert Thompson, First Deputy Managing Director, SCF-Unicom, which provides technical services for Sovcomflot, offered an insight into the continuing appeal of 'Inerta'. He said that, in the case of the Samsung-built ships, a range of alternative coatings were discussed at the design stage. "A combination of previous experience and the results of comparative test patches on other vessels proved decisive in favour of Intershield®163 Inerta 160.

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"The *Vasily Dinkov* has now completed approaching two years of trading in ice thicknesses over 1.5m," explained Mr Thompson, "and the coatings remain in good condition throughout."

Earlier, the nuclear ice-breaker *Vaygach*, belonging to FGUP Atomflot had test patches of various ice coatings applied to her underwater hull. These were inspected after 12 months and Intershield®163 Inerta 160 was deemed to be in the best condition. This is cited as the main reason why JSC Norilskiy Nickel decided to use Intershield®163 Inerta 160 on four new container vessels deployed in the carriage of

metallurgical products from Siberia to Murmansk – the first double acting containerships of their kind ever built (again, these ships were Aker Arctic Technology-designed).

Tried and tested

Research has shown that a steel hull with a traditional anticorrosive system trading in ice can experience abrasion and subsequent corrosion that increases average hull roughness in the first year from 100 to 225 microns, resulting in an increase of up to 4% in the power required to maintain the same vessel speed.

Intershield® 163 Inerta 160's coefficient of friction has been measured and compared to a traditional anticorrosive system and corroded steel with a measured surface roughness of 100 microns. These tests demonstrated that it is possible to achieve an annual fuel saving of 7-10% with a typical vessel trading in the Baltic region if the vessel is coated with Intershield® 163 Inerta 160 compared to a standard coating system.

Despite these findings, and evident shipowner preference for Intershield® 163 Inerta 160, it is fair to acknowledge that some shipyards have expressed reluctance when asked to apply it. And, since proper application is critical with any hull coating, their concerns must be addressed.

Because Intershield® 163 Inerta 160 has a very low solvent content, it cures rapidly, 'going off' within minutes. It is so viscous that it must be heated for spraying and must be applied to steel with a relatively deep 75-micron blast profile in one coat, 500 microns thick.

Here, the solution is application by way of a hot twin-feed spray machine, where the curing agent and the base are heated and mixed at the point of application immediately before spraying. In short, the ratios of the curing agent and the base are preset, and delivered automatically.

Some shipyards more accustomed to single pump coatings delivery have expressed concern over the perceived complexity of this method. However, it might be noted that this is an industry that has increasingly prided itself on its willingness to embrace the benefits of new technology - three dimensional modelling, automated process engineering, the installation of increasingly complex electronics and fuel saving solutions, to name but a few.

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It is perhaps ironic, then, that a simple pre-set, automatic selection to mix two ingredients should be seen as a stumbling block to delivering the sophisticated ships that will, in part, sustain the shipbuilding industry itself in the years ahead.

To meet the challenges posed by operating in ice covered seas, and to sustain the economic model adopted across the globe, all sectors of the shipping industry will need to invest in the future. *(April 2010)*

Intershield® 163 Inerta 160 after 60 months in service.

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