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MULTITUDE OF CHALLENGES TO OPERATING IN THE ARCTIC

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Multitude of challenges to



**HARSH ENVIRONMENTS,
ICE CONDITIONS,
REGULATORY FACTORS,
LACK OF INFRASTRUCTURE
AMONG KEY ISSUES**

By ANDREW SAFER



operating in the ARCTIC

With the melting of polar ice, oil and gas and mining companies have been evaluating business opportunities in the Arctic. Tactical Marine Solutions Ltd. (TMS) of Victoria, B.C., has been advising companies over the last several years about the feasibility, vessel requirements and costs associated with Arctic shipping.

"Clients want to see shipping integral to any study," TMS principal Dermot Loughnane told the second annual Arctic Shipping North America conference held in St. John's. Using this holistic approach, a common set of assumptions can be applied to all aspects of a project. This differs from the old-fashioned approach, when "shipping was in a corner, sitting on a stool by itself," he said.

Prior to founding TMS, Mr. Loughnane worked as operations director for Canarctic Shipping Company, marine manager for Petro-Canada, and managing director for TK Australia – industry experience that informs him of the shipowner's perspective.

Mr. Loughnane pointed out that the limited draft in Arctic waters limits ship size, and added that the limited season and the long distances to markets are key factors in considering costs.

Assessing ice conditions presents a major challenge. "They are more variable and less predictable," Mr. Loughnane said. "It's ironic because it's been a struggle to get the right amount of information about the quality of the ice. In the past, at least we could rely on things being predictable in certain areas of the Arctic. In the last few years, we have 10 times better data than back then, but just because the data indicates it will do one thing, that doesn't mean it will." He explained that the melting of the polar cap and multi-year ice is resulting in the movement of ice southward, which has become less predictable.

Photo: Deborah Bentbrook

The ability to translate ice conditions into the required ice-class ship is key, Mr. Loughnane said, and is related to the level of risk the client is willing to assume. No risk equates to a higher (and more expensive) ice-class vessel.

Another challenge is determining the ship's schedule: on the export side, identifying the ports where materials will be delivered, and on the inbound side, anticipating cargo requirements including resupply calls. "Mines and terminals are going to rely on parts that come from all over, and it's difficult to find the optimum combination of loading of inbound cargoes with outbound shipments," he said. TMS uses an iterative methodology in developing these models, which become more accurate as the client supplies more specifics.

Additional considerations include: allowing for ships to run under full power in the Arctic and the additional expense of running under partial power during the off-season; taking into account off-season vessel costs; allowing for the unforeseen, such as the scarcity and extreme price increase of supplies; higher than average costs for training; more expensive hull coatings; frequent dry-docking; and estimating crew size and forward freight rates.

Business opportunities

The melting of polar ice is presenting a business opportunity for shippers due to dramatically reduced transit times, said Morten Mejlænder-Larsen, senior principal engineer, program director cold climate shipping for Det Norske Veritas (DNV). He said the trip between Amsterdam and Yokohama would be 40 per cent shorter through the north. "We would like to see in the future that it's possible to have profit going over the polar sea compared with the Suez Strait," he said, adding that it's difficult to predict when this voyage will be profitable.

Contributing to the uncertainty is the inexact science of predicting future ice conditions. "Some experts say they don't know what will happen in the next five years, so there are a lot of uncertainties involved with predicting ice conditions in 30 years," he said.

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~ Morten Mejlænder-Larsen, Det Norske Veritas

DNV has used a computer model to simulate ice conditions to the year 2050. The simulations indicate "more or less winter ice extent, but a very large reduction in the summer ice extent," as well as more first-year ice, which is easier to transit through. Summer waters will not be completely ice-free, however. Mr. Mejlænder-Larsen said a minimum PC 3 ice-class vessel will be required to cross the Bering Strait in winter 2010, with ice conditions improving until 2050 when there will be "more or less open waters" enabling a lighter ice-class in the summer.

Mr. Mejlænder-Larsen said due to the additional challenges of low temperatures, ice and darkness, risk is higher in the Arctic. Traversing either the Northern Route, Northwest Passage, or going direct over the polars entails less traffic control, dark periods during winter, less communication with shore, crew fatigue, and more challenging ship operation conditions including less manoeuvrability and the effect of the low temperature on the crew.

Among the met-ocean uncertainties are the difficulty in predicting future ice conditions and defining the hardness of the ice. "Ice is very different from day to day, depending on temperature, salinity, age and whether there are icebergs or ice ridges present," he said, adding that polar lows can occur very quickly and are difficult to predict.

The industry's preference for just-in-time delivery doesn't square with conditions of shipping in the Arctic. "If you operate in the Arctic, you have to have a different view on this – maybe trade in different goods, depending on the requirement to deliver just-in-time," Mr. Mejlænder-Larsen said. To this he added the uncertainty of regulatory and political factors, cit-



Photo: CBC – The National

ing the fact that it took almost a year for Beluga Shipping to get permission to take the Northern Route. He expects approval for successive operations to take less time.

Uncertainties related to ship design include determining the correct ice-class, propulsion and power systems, and the need to protect the cargo from low temperature and icing, with the main risk elements being related to emergency evacuation and rescue.

DNV determined that the 8,600-TEU (20-foot equivalent unit) size affords the best ice performance, and assessed the advantages and disadvantages of the bulbous bow, icebreaker bow and double-acting vessel. It concluded that the bulbous bow will achieve maximum speed in open water, but the speed will be reduced with increasing ice thickness. The icebreaker bow is slower in the open water (with equivalent propulsion) but runs at a higher speed and can better operate in thicker ice. The double-acting vessel has the dual advantage of achieving the same speed in the open water and also operating in high ice thicknesses.

DNV based the costs of building these types of vessels on 2007 numbers. According to Mr. Mejlaender-Larsen, the cost of building a regular container vessel is US\$130 million, compared to \$160 million for the bulbous bow (PC 4 ice-class), \$180 million for the icebreaker (PC 3 ice-class), and \$200 million for the double-acting vessel (PC 3 ice-class). The latter includes a double-acting stern and podded propulsion, which he said is not currently available, but is expected to be developed.

Due to the high cost of icebreakers (\$50,000 a day), two of which may be required for a very large vessel, he recommended that only vessels with built-in icebreaking capability would be cost-effective.

In an interview following his presentation, Mr. Mejlaender-Larsen said, "In the future, the Northwest Passage will be difficult to transit due to the ice drift pattern, which will send the ice from the polar sea into and block the passages in the Canadian archipelago. North of the Northwest Passage will be the last area where the multi-year ice will disappear."



Photo: Ansgar Walk, Wikipedia

It's part of our responsibility, along with Vale Inco, to let the Innu and Inuit know when the Umiak is crossing.

~ Karen Walters, Canship Ugland Ltd.



Fednav's Umiak I.

Photo: Reprinted with permission from Vale Inco



Photo: Deborah Benbrook

Arctic operations

The Arctic operations of “one of the highest horsepower class cargo vessels in the world” were described by Karen Walters, vessel superintendent for Canship Ugland Ltd. This St. John’s-based shipping company manages the Fednav-owned Arctic ice-class (ICE-15) bulk carrier Umiak I, as well as six shuttle tankers serving the Grand Banks oil fields, and two berthing tugs. Ms. Walters noted that at 56 degrees latitude, the Umiak I operates in wind chill conditions as low as -40 degrees Celsius – “nothing short of polar.”

Built by Fednav, the 30,000-horsepower vessel operates a dedicated trade from Quebec City to Voisey’s Bay. The Umiak I was purpose-built to carry 7,000 tonnes of diesel fuel in addition to cargo.

The ship moves through pack ice, is carried into rocks and shoals, negotiates passage around small islands, and undergoes several course alterations. An Enfotec IceNav system provides a separate radar overlay that assists the master in navigation. Due to the limited availability of hydrographic information for the route, and in order to facilitate local notification of the ship’s movements, the Umiak I’s passage is assisted by a shipping adviser who travels from Nain, N.L., by Ski-Doo and joins the vessel at Whale and Skull Island. What ensues is a 12- to 19-hour trek to bring the vessel through to the port at Voisey’s Bay.

The Umiak I is capable of break-

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~ Christopher Wright, *The Mariport Group Ltd.*

ing its way through 1.5-metre-thick ice with ice pressure ridges. Designed for an ambient temperature of -30 degrees Celsius, the vessel ceases shipping operations in December until the ice reaches a thickness of 20 centimetres. This allows the landfast ice to stabilize before icebreaking resumes.

A high priority for Canship Ugland is minimizing the impact on the Innu and Inuit travel routes through landfast ice. An agreement between the Labrador Inuit Association, Vale Inco and Fednav specifies that the Inuit must be able to maintain their ability to hunt and gather when vessel operations are underway. “It’s part of our responsibility, along with Vale Inco, to let the Innu and Inuit know when the Umiak is crossing,” Ms. Walters said. To facilitate this, signs are erected to give notice when the ship is coming in and when departure is expected. The master goes astern the backwash to create enough pack ice to build an ice bridge to enable the crossing by Ski-Doo. In April and May, shipping ceases again to accommodate the Innu and Inuit’s increased hunting activity during the season when seals are melting.

Regarding operations and working conditions, Ms. Walters stressed the importance of having personnel who are knowledgeable about working in harsh environments, adding that they’re in short supply. In the cold clear air, the ultraviolet rays can cause sunblindness, so deckhands wear ski goggles. She pointed out that working in the long unbroken hours causes fatigue, and that the amount of time required to carry out a task doubles with every 10-degree drop in temperature below zero.

Consistent with the class notation of -30, the Umiak I was built with low-temperature steel to avoid brittle fractures. The hydraulic oil systems and the main steam line are protected from freezing, and pipelines on the open deck

are fitted with drainage valves, also to prevent freezing.

The vessel has not been dry-docked in the three years Canship Uglund has operated her. Dry-dock is scheduled for 2011.

Ms. Walters discussed the need to protect the crew from the danger of polar bears. The vessel has broken through the ice only once, which was the only time the level of the railing was low enough to allow access. In that instance, the polar bear wasn't close enough to present a danger. "We don't want the deckhands on deck when the polar bears are nearby," she said.



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Multitude of challenges

A multitude of challenges are involved in operating in the Canadian Arctic, said Peter Woodward, vice-president of operations for the Woodward Group of Companies, based in Happy Valley-Goose Bay, Labrador.

The company operates three ferries, and four ice-class tankers that supply 300 million litres of petroleum products annually to communities in the North. The Woodward Group has been distributing refined petroleum products (jet fuel, gasoline, home heating oil and diesel fuel) for the Nunavut government for eight years – approximately 160 million litres annually.

The company has a four-month window in which to provide service in the North (late June to late October/early November). The economics of significant downtime during the off-season dictates its vessel acquisition strategy, which is to buy 10- to 15-year-old ships, most of which have operated in the Baltic. One 3,000-horsepower, 3,000-ton ship delivers as little as 90,000 litres to small sites over a three-week period. A 12,000-horsepower, 16,000-ton vessel is the only commercial ship that enters certain Arctic communities. "Until three years ago, they had all of their fuel products flown in," Mr. Woodward said. Another ship, outfitted with a gantry crane and a roll-on/roll-off ramp, is "the elephant of the Labrador coast," moving 1,500 tonnes of materials in and out of isolated communities.

From a business perspective, the company's chief challenge is getting only 20 months of revenue (four months per year) out of a five-year contract. In addition, with the rationalization and inventory sharing that's occurring in the oil industry, Mr. Woodward cited reduced demand for tankers, and as much as 30-per-cent excess capacity in the Canadian-flag fleet. The fact that there is only five metres of draft in some locations dictates the ship size and, therefore, the economics of the trade. The ship must offload a significant amount of cargo before reaching these points, the ballast is discharged, and then loaded on the other side.

Bringing the vessel offshore is not feasible, Mr. Woodward said, as the day rates for 10,000- to 12,000-ton vessels, at the time of the conference in October, were lower than the company's Canadian crew costs.

The ships do their own icebreaking, except when the draft is too great to break ice in the harbour. Mr. Woodward recalled one time in Iqaluit in 2008 when a ship had to wait 10 days for the Canadian Coast Guard to break the ice.

Woodward Group ships carry skimmers, slack tanks, and a lot of extra boom. "The coast guard is responsible, but they don't have the resources," Mr. Woodward observed. "Because of the density of the (fuel) products (8 pounds/gallon), they would dissipate within hours. Unless the coast guard vessel is within 10 miles, you're down to what your own vessel can do."

Beyond the nuts and bolts of business and economics, "the most significant problem in the Arctic can easily be fixed," Mr. Woodward said, adding that "the port facilities in the Arctic are non-existent," pointing to a photograph of a bulldozer. "This is all we have to tie onto in Pangnirtung. There isn't even a concrete or metal ball there. I don't know what a bollard would cost for Pangnirtung. We've been asking for one for 10 years and we haven't seen one yet." He said that the federal government committed to build a port in the Arctic but has yet to deliver, adding that the port the federal government announced was built 30 years ago by a mining company and is not well located in relation to the communities.

"There are a couple of bollards and the layout of a proposed port everyone was hoping to build," he said.



Photo: CBC — The National

Mr. Woodward added that northern communities depend on shipped goods for everything that is not canned, and cited a price of \$9 for two litres of Tropicana juice. "There's no reason for it," he said.

In addition to bollards, he recommends floating docks in most locations, because of the tides, and fixed docks where there are quick turns. These would accommodate quick offloads with ro/ro vessels, to replace offloading from a barge — the method used in the North for 50 years.

"There's a lot of work to be done other than big megaprojects, and a lot of great stuff that everyone is talking about here today," Mr. Woodward said. "There are 27,000 people up there. There's nowhere in the world that has the lack of infrastructure that is evident in the Arctic Inuit communities."

High costs

Christopher Wright, president of The Mariport Group Ltd., which provides advisory services for ports and the shipping industry, responded to Mr. Woodward's contention that the federal government has not invested sufficiently in port infrastructure in the Arctic. "I hate to disabuse the notion of Iqaluit becoming a distribution hub, but the economics do not work," he said. "We have looked at it extensively: how fast cargo can be discharged. Iqaluit is so far from Frobisher Bay, there would be backtracking and the re-handling of cargo" to enter Hudson Strait or go around Baffin Island.

Referring to government investment in infrastructure, he noted that Nunavut's Department of Economic Development and Transportation is working diligently to put bollards in all 26 communities, but only has between \$100,000 and \$150,000 to put into new projects each season because most of its \$600,000 budget is spent on maintenance. "They know there are deficiencies, and they're working on them," he said.

Mr. Wright pointed out that 14-metre tides in Iqaluit present a major challenge to installing port facilities there, adding that the infrastructure cost of \$30 million to \$40 million, plus high maintenance costs combine to make the total cost "somewhat outrageous."

Due to climate change, Mr. Wright noted that the opening of the season is moving from late June into July and even early August in some communities, and the close of the season is moving from September/October to November,



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and in some communities, late November when there is less light, it's a lot colder, and there is the opportunity for snap freezes.

At best, the season lasts 120 to 150 days, and at the other end of the spectrum, as little as 45 days. He estimates it would cost between \$150 million and \$200 million to build small-craft harbours in the 26 communities in Nunavut. ■



Photo: Niklas Montonen

ABS ESTABLISHES HARSH-ENVIRONMENT TECHNOLOGY CENTRE IN ST. JOHN'S



Photo: Arlorm Radonezhskiy

The American Bureau of Shipping (ABS) and Memorial University are partnering to establish a harsh-environment technology centre in St. John's.

At the second annual Arctic Shipping North America conference, Roger Basu, director, research and development, corporate technology, American Bureau of Shipping, signed a memorandum of understanding with Ray Gosine, vice-president (research), Memorial University.

The new centre will support the development of technologies for ships and offshore structures operating in harsh environments, particularly the Arctic. Applied research will be conducted to study vessels and units operating in ice-covered waters, low-temperature environments and severe wave and wind climates.

"This joint initiative with Memorial is timely and a natural outgrowth of our working relationship with the university," Mr. Basu said. "Their strong naval architecture and ocean engineering program dovetails neatly with our Arctic program initiatives."



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