

The polar road to riches

Novel ways to navigate and break through Arctic ice are bringing the region's untapped resources within reach

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ON 17 August 1977, the Russian nuclear-powered ice-breaker *Arktika* became the first ship to reach the North Pole. It was 10 years before the feat was repeated. But what was once a remarkable achievement is now relatively commonplace: in the past two years 17 ice-breakers visited the pole.

Shrinking ice cover in the Arctic Ocean is gradually making it easier for ships to travel through these waters. But while scientists focus on the causes and consequences of this climatic change, industry is lining up to take advantage of the greater freedom to move around the region and exploit its untapped resources. And it will be helped by the appearance of ice-breaking and satellite technologies designed to ease the passage through one of the planet's final frontiers.

The commercial attractions of better access to the Arctic range from tourism to pristine fish stocks and mineral wealth. With a quarter of the world's remaining oil and gas reserves, the Arctic is also on the verge of an oil rush. In the past, the region's inhospitable nature has deterred fuel companies, but declining reserves and crude oil prices of around \$60 a barrel are encouraging them to venture northward. To do this they will need vessels to carry

the petroleum prospectors, supply ships to set up production platforms and tankers to transport the oil and gas.

Travelling through Arctic waters also opens up the prospect of shorter sea voyages between Europe and ports in China, Japan and Korea. The Northern Sea Route round the north of Russia is about 40 per cent shorter than the journey through the Suez Canal. The fabled North-west Passage between the Pacific and the Atlantic is an alternative to the Panama Canal for ports in Europe and the US eastern seaboard, and there is even the increasingly busy route straight over the top of the world.

So the shrinking ice could ultimately lead to a reorganisation of the world's trade routes. "It's intriguing, but it's the wild card," says Lawson Brigham of the US Arctic Research Commission in Anchorage, Alaska, and a former ice-breaker captain who sailed to the North Pole in 1994. "There is still a heck of a lot of ice. No one knows how this will develop."

Since the 1970s the area of seasonal ice that is laid down each winter has shrunk by 3 to 4 per cent per decade. More significant for shipping is the loss of older ice, which is shrinking twice as fast as the seasonal ice. Because old ice becomes compacted and hardened after several

cycles of freezing, thawing and amalgamation with other loose ice, it is a far tougher obstacle to shipping than first-year ice.

The Northern Sea Route is already free of ice for several days a year. Models predict that by the end of the century the entire route will be easily navigable for at least half the year. But long before that there will be a boom in shipping in the western parts of the route, thanks to the lure of oilfields in western Siberia. Pipelines linking these reserves with St Petersburg and the rest of Europe are already near capacity, so the Russians will have to begin shipping the oil out.

The warm tail end of the Gulf Stream licking round the top of Scandinavia keeps Murmansk, at the western end of the Barents Sea, virtually clear of ice. But the eastern end, where the oilfields are, is only ice-free for about 110 days a year. Although Russian ice-breakers keep a channel

relatively navigable year-round, ice-strengthened ships still have to cope with ice up to 1.5 metres thick at times.

To get round this problem, the Russians plan to operate a shuttle service using ice-breaking tankers to take oil across the Barents Sea to Murmansk for transfer to conventional ships. To run this service the Russian shipping company Sovcomflot has ordered three 70,000-tonne ice-breaking oil tankers of a novel design developed by Aker Arctic Technology of Helsinki, Finland.

Traditional ice-breakers slide their bows up onto the ice to break it with their weight and push the debris aside. But the stubby, strengthened bows needed for the task are far from hydrodynamic in open water, and mean ice-breakers can burn up to 40 per cent more fuel than conventional ships across open sea.

Instead of ploughing into the

ice with their bows, the new tankers will use reinforced sterns instead. They will move stern-first when breaking the winter ice at the eastern end of the Barents Sea and then switch direction and travel forwards in open water, meaning their bows can be more hydrodynamic.

The new design is possible thanks to a kind of rotatable thruster called an azipod (*New Scientist*, 27 March 2004, p 24). Suspended beneath the stern on rotating mounts, each watertight pod houses an electric motor that drives an external propeller. Azipods can be swivelled through 360 degrees to produce the maximum level of thrust in any direction, unlike conventional fixed propellers that can only produce maximum thrust going forwards.

Naval architects have spotted their potential for ice-breaking,

“The new ice-breakers will move stern first through the ice and forwards in open water”

since experiments show that ice-breakers are far more effective when travelling astern than going forwards, because the churning of the water beneath the ice by the propeller helps to break it up. Tests in Aker’s ice tanks in Helsinki show that a model ship can crunch through 80 centimetres of flat ice at 3.5 knots when travelling astern, but only 30 centimetres when going forwards.

“The efficiency of azipods is very impressive in first-year ice,” says David Snider of Canadian Arctic navigation consultancy Martech Polar of Brentwood Bay, British Columbia, an adviser to the Canadian government. But he warns that azipods still have to prove themselves in sea trials

through difficult ice. “Multi-year ice has a nasty habit of sliding under the ship. You’ve got to be careful with an azipod. You don’t want it lopped off by ice.”

The Arctic also lacks some of the basic modern navigational aids that mariners take for granted in other waters. GPS coverage at latitudes above 70° north is very patchy. Meanwhile the most useful satellite images for avoiding ice come from a craft that is about to be mothballed, the Canadian Space Agency’s Radarsat-1. Experienced ice navigators can use Radarsat-1’s images to cut journey times by 20 to 30 per cent.

The satellite is now near the end of its life, and is supposed to

be replaced this year by Radarsat-2, which will carry remote-sensing radar with a resolution down to 3 metres rather than Radarsat-1’s 50-metre resolution. It will also produce more up-to-date images of the ice for navigators by imaging locations more frequently. However, although this is due to be launched from the Baikonur Cosmodrome in Kazakhstan in December, its launch date has been repeatedly delayed.

Mariners will also be confronted with a far more basic problem as the Arctic opens up to shipping. Many parts of the Canadian and Russian coasts have never had a modern hydrographic survey: many of today’s depth charts are based on soundings taken in the 1800s. The ice may be shrinking, but these northern waters are still a long way from plain sailing. ●