Shipping and Resources in the Arctic Ocean: A Hemispheric Perspective[1]

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With the melting of Arctic sea ice as a result of climate changes, there has been an intensification of interest, and use, of Arctic waters for shipping. This article seeks to do two things: first, define and compare the transport passages of the Arctic Ocean on the basis of their geographical features, natural conditions, political significance, and legal characteristics displaying their distinctions, interrelations and eventual overlaps focusing on the Northeast Passage, of which the Northern Sea Route is the main part; the Northwest Passage; and the Trans Polar Passage. And second, to discuss how Arctic passages connect or may connect to world markets through transport corridors in southern waters. The article concludes by examining the more likely prospects for Arctic shipping in the short, medium and long term.

It is claimed that the most important contribution of geopolitics to the analysis of foreign policy stems from the *pedagogic of the strategic atlas:* how world images of states are conditioned by their own geographical location and horizon; how technological changes transform the strategic significance of an area; and how supply lines for energy and mineral resources tie regions together displaying their vulnerabilities as well as their interdependencies (Østerud 1996: 325). The geographical area addressed in this article is the *space of the Arctic Ocean* which can only be adequately understood if the strategic atlas for the region is further specified and supplemented. In terms of location the Arctic Ocean is situated in between three continents; it is assumed to be abundantly rich in oil and gas; and its sea ice regime is dwindling due to global warming.

Within this geopolitical context, the purpose of this article is twofold: first, to define and compare the transport passages of the Arctic Ocean on the basis of their geographical features, natural conditions, political significance, and legal characteristics displaying their distinctions, interrelations

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and eventual overlaps. Here the focus is on the *Northeast Passage (*NEP), of which the *Northern Sea Route* (NSR) is the main part, the *Northwest Passage* (NWP) and the *Trans Polar Passage* (TPP) running through the Central Arctic Ocean (see Figure 1). In so doing two types of sailing routes will be addressed: (1) *destination Arctic-routes*, i.e. sailing lanes between harbours inside and outside of the region; and (2) *transit routes*, i.e. sailing lanes between harbours in the Pacific and the Atlantic via the Arctic Ocean. Both of these routes relate to the fact that some 80% of world industrial production takes place north of 30 degree N. latitude, and some 70% of all metropolises lie north of the Tropic of Cancer. In this perspective, the Arctic Ocean is an industrial 'Mediterranean Sea' – a shortcut – between the world's most advanced and productive regions.

The second purpose is to discuss how Arctic passages connect or may connect to world markets through transport corridors in southern waters. The paper addresses four stretches of water: (a) the *Northern Maritime Corridor* (NMC), connecting the NSR/NEP to the European continent and the east coast of the USA; (b) the "*Northern Pacific Corridor*", connecting the NSR, TPP and NWP to Asian markets and the western coast of North America; (c) the "Fram Corridor" (FC) connecting the TPP to Iceland and the western branch of the NMC; and (d) the "*Davis Corridor"* connecting the NWP to the western branch of the NMC and the east coast of North America.

The Transportation Passages of the Arctic Ocean

The Northeast and Northwest Passages are often perceived as coastal sea lanes, whereas the Trans Polar Passage is assumed to be a mid-ocean route across the Central Arctic Ocean to and from ports in the Pacific and Atlantic. This perception is far from accurate. Due to the presence of sea ice neither of these transportation passages can offer ships a single set channel to follow. In practice, ships are forced to follow the channel that offers the best ice and navigational conditions at any one time and place. Thus, they are more like broad transportation corridors stretching out in the North-South direction, containing several alternative navigational channels and fairly huge expanses of ice-infested waters. The corridor feature of these passages implies that they occupy broad stretches of waters that under certain specific circumstances and on occasion make them overlap and impact regional politics.

Figure 2 The Three Potential Transport Passages of the Arctic Ocean
Source: meted.ucar.jpg

The Northeast Passage and the Northern Sea Route

Two approaches are often applied to determine the co-ordinates of the NSR: an *official definition* as found in Russian laws and regulations, and *an unofficial Russian functional definition* based on a mixture of organizational, operational and geopolitical criteria.

The Official Russian Definition of the NSR

According to political perception and legal regulations in Russia,[3] the NSR stretches from Novaya Zemlya in the west (meridian 168 degrees 58 minutes and 37 seconds west) to the Bering Strait in the east (parallel 66 degrees north). The establishment of the NSR as a separate part of the NEP was decided by the Council of People's Commissars of the USSR on 17 December 1932, which marks the beginning of the NSR as an administered, legal entity under full Soviet jurisdiction and control. It comprises the main part of the NEP which, with the addition of the waters of the Barents Sea, connects the Atlantic and Pacific Oceans along the entire length of the northern coast of Eurasia.

The NSR is a series of different sailing lanes, and ice conditions at any one time and place will decide the sailing course to be set. The route covers some 2,200 to 2,900 nautical miles of ice-infested waters (see Figure 2). It consists of a series of marginal seas – the Kara Sea, the Laptev Sea, the East Siberian Sea and the Chukchi Sea – which are linked by some 58 straits running through three archipelagos – the Novaya Zemlja, the Severnaya Zemlja and the New Siberian Islands. At times, surface vessels operating in convoys are forced to proceed due north of the large island masses due to the accumulation of pack ice in the straits (Jørgensen, 1991: 77-89), which may be clogged with sea ice. Ice conditions are in general more difficult along the eastern extremity of the route than in the west. In the Laptev, East Siberian and South-western Chukchi seas five *ice massifs* – large areas of close and very close ice – are identified. These massifs often block the entrances to important navigational straits along the route.

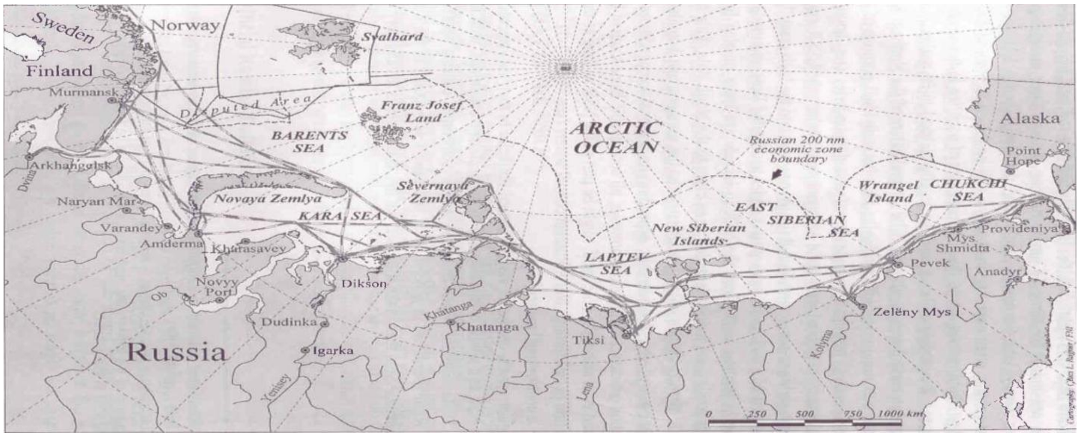

Figure 3: The Northeast Passage and Northern Sea Route
Source: Løvås & Brude, INSROP GIS, 1999.

Although some of these ice massifs are relatively stable, they on rare occasions disappear at the end of the melt season, but reoccur again in winter (Johannessen et al., 2007: 283-285). The eastern sector is also the part of the route with the most shallow shelf areas. The East Siberian Sea has an average depth of 58 meters and the Chukchi Sea of 88 meters. The shallowness of the shelf is the most pronounced in the straits, with minimum depths of 8 meters. This affects the size, volume and draft of ships. The ocean areas west of the Yamal Peninsula are fortunate in having a slightly deeper shelf and lighter ice conditions in average than the eastern sector. This is partly due to the circumstance that the Kara Sea is surrounded to the north by several archipelagos which usually prevent heavy multi-year ice from the Central Arctic Ocean from penetrating into these waters. Multi-year ice, which is extremely hard and consequently a very serious obstacle to navigation, has survived the summer melt season and is typically up to 5 meters thick. The eastern sector lacks this kind of land protection and is more open to the influx of multi-year ice from the Central Arctic Basin. However, even in the East ice conditions are changing due to global warming. Here, new extreme minima of summer ice extent have been established repeatedly ever since 1979 (Weller 2000: 43). In seven of the last ten years, the Chukchi Sea was ice free with periods extending from one week to as much as two and a half months. In contrast, there was always ice over the Chukchi Sea shelf in all of the previous 20 years.

In cases when the convoys are forced by sea ice to enter the high sea, prominent Soviet ocean law experts have claimed that the navigation lanes used are national and under full Russian control and jurisdiction: "[t]he integral nature of the Northern Sea Route as a transport route is not affected by the fact that individual portions of it, at one time or another, may pass outside the aforesaid boundaries (i.e. boundaries of internal waters, territorial waters and economic zone) where the USSR exercises its sovereign rights or sovereignty in full (i.e. it may pass into the high seas)" (Kolodkin and Kolosov 1990: 164). Thus, as long as part of the voyage includes waters under Russian jurisdiction, the Russian Federation has, according to this reasoning, the right to define the NSR to include sea-lanes running beyond its own economic zone in high latitudes, even close to the North Pole. In principle, this implies that all conceivable lanes south of the North Pole, and even across the Pole itself, might be part of the NSR as long as the voyage passes through North Russian coastal waters. In line with this reasoning, Russian scientists, employed by the Federation, recently claimed that "[v]oyages along the NSR are carried out along coastal, marine, high-latitudinal and near-pole routes. Coastal routes are the most traditional"… whereas "the fourth route, which is 700 miles shorter than the coastal route, passes the large circle across the geographical North Pole" (Johannessen et al. 2007: 21-23). In this interpretation, the NSR overlaps with the TPP, covering huge expanses of the high seas that according to the *UN Convention of the Law of the Sea of 1982* (UNCLOS) is open to all nations and where ships are subject to flag state jurisdiction only (see section "The Transpolar Passage", below).

The NSR is also part of an interconnected rectangular transportation system for the Russian North. The legs of the rectangle consist of, in addition to the passage itself, the big Siberian rivers and the east-west running railways in the south connecting with the rivers thousands of miles from the coast. Ocean-going vessels sail from the port of Igarka, which is 670 km south of the estuary of Yenisei, and to Yakutsk, which is 1160 km south of Igarka. The rivers of Ob, Yenisei, Lena and Kolyma are all navigable to the Trans-Siberian railway which is 2270 km south of the Siberian coast. The river Lena connects with the Baikal-Amur railway (Østreng, 1991: 14-15). Thus, "[t]he NSR and the river system is the primary mode of transportation in this remote part of the world apart from airborne transportation. Nearly all human activity in the Russian Arctic is in some way dependent on the NSR" (Simonsen, 1996: 73). In this interpretation the NSR extends northward and southward from the coast, servicing huge ocean and land territories, covering thousands of kilometres from the near-North pole route to the railways of the south.

Unofficial Functional Definitions of the NSR

The official Russian definition operates with fixed geographical endpoints in the east-west direction – the Bering Strait in the east and the Novaya Zemlya in the west. Functional definitions also have geographical endpoints, but there are requirements as to what should characterize these ends. A sea route, in the functional tradition, is a trading link between towns and cities – between ports with loading, service and reception facilities, transport networks, sizeable populations, etc. Neither the Bering Strait nor Novaya Zemlja meets any of these criteria. Those are desolate, environmentally hostile places with no populations and capabilities to take part in trading – not even small-scale trading. As a secluded part of the NEP, the NSR has no meaning in large-scale trading other than securing Russia gateway-control over the main part of the NEP.

As has been pointed out: "If Vladivostok is the functional Russian eastern end point of the NSR, then the neighbouring countries of Japan, North Korea, South Korea and China can easily become functional end points as well" (Simonsen, 1996: 6). Given the fact that the Barents Euro Arctic Region (BEAR), comprising the eleven northernmost counties of Russia, Norway, Sweden and Finland, used to host a Working Group for the NSR, the southernmost boundary of the route can be claimed to coincide with the Norwegian BEAR county of Nordland on the Atlantic (Østreng, 1999: 169-174). In functional terms, the NSR can be said to stretch from the ice-free portions of the North Pacific to Norway's Nordland County on the Atlantic. In this definition it is more appropriate and even accurate to use the term the Northeast Passage rather than the geographically confined term of the Northern Sea Route.

The Definition and Legal/Political Sensitivity of the NSR

Formally, Russia opened the NSR to international shipping on 1 July 1991 on the premise that the users would comply with coastal state regulations. Since the archipelagos of the NSR are legislated to become internal waters, Russia claims the same sovereignty over these parts of the route as over her land territory. This stand provides Russian authorities with an unlimited regulatory power over the NSR, which is challenged both by the United States and the European Union (EU). Their position is that the NSR is an *international strait* open to international shipping on the condition of *transit passage* as defined in *Law of the Sea Convention of 1982* (UNCLOS). On the part of the USA the "…ability to exercise these rights (freedom of navigation)" in the region concerns her ability to exercise the same rights "…throughout the world, including through strategic straits" (US Presidential Directive, 2009).

Here, US Arctic policy is defined in the context of her global interests (Brubaker & Østreng, 1999: 299-331). When it comes to the Central Arctic Ocean (TPP) the EU Commission states that "[n]o country or groups of countries have sovereignty over the North Pole or the Arctic Ocean around it…" (EU Commission, 2008). The freedom of navigation and the freedoms of the High Seas shall rule these waters. In this regard, the EU Council went one step further in reiterating the rights and obligations for flag, port and coastal states provided for in international law, including UNCLOS, in relation to freedom of navigation, the right of innocent passage and transit passage, and will monitor their observance (EU Council, 2009: item 16). The EU Parliament has also come around to agree with the Commission and the Council in this case (EU Parliament, 2009). If, as indicated in one of the definitions of the NSR, Russia extends her jurisdiction also to the high seas of the Arctic Ocean (high-latitude and near North Pole routes), diplomatic protests most likely will be heard from Washington, Brussels and capitals of smaller states (see Østreng et al., 2012: Ch. 1 and 6).

Destination and Transit Routes

At its peak in the 1980s, the Soviet fleet of icebreakers counted 38 vessels operating along the route and southward on the big Siberian rivers. Six of the icebreakers were nuclear powered of which the biggest exerted 75 000 horsepower. In addition, a fleet of close to 700 ice-strengthened vessels were built to operate along the route on a year-round basis (Østreng, 1991: 9-12). These efforts notwithstanding, on occasion convoys of ships had to over winter in the NSR before they were freed by icebreakers in late spring the following year. Accidents happened and freighters were damaged and lost. According to Russian sources, in the period between 1954-1990 the total number of ice damages to ships traversing the NSR was about 800, or an average of 22 a year. The accidents were distributed as follows: the Kara Sea: 49% (here the intensity of navigation is the highest; the Laptev Sea: 20%; the East Siberian Sea: 2%; and the Chukchi Sea: 14% (here the density of ships is the lowest and ice conditions the worst) (Lensky, 1992). In the period between 1945-90, the sailing season of the eastern part of the NSR was restricted to about 3 months, whereas ice conditions in the western part allowed for an extended sailing seasons of up to 4-5 months. Today the sailing season can be extended close to 6 months for the whole route.

Destination Sailings

Since 1978 and up to the present, the Russian icebreaker fleet has succeeded in keeping the stretch from Murmansk to Dudinka on the banks of the Yenisei River open for sailings 12 months a year.

This means that more than 1000 nautical miles, or some 30 per cent of the NEP between Murmansk and the Bering Strait, is now kept open for shipping all year round. This stretch is what throughout history has been labelled the *Kara Sea Route*. The driving force behind this achievement was the prospects of increased revenues stemming from year-round shipments of nickel from Igarka. In 1980 this transport provided revenues. Today, modern ice strengthened oil and gas tankers ply the Kara Sea Route along with the nickel industry. A clearly identifiable destination route has been established across the politically defined geographical divide between the NSR and the NEP. In 2006, regional transportation of hydrocarbons within the Barents and White Seas alone amounted to 8.5 million tonnes (Frolov and Krutskih, 2008), which is four times more than the volume of cargo transported through the rest of the NEP/NSR. Profitability is one decisive key to increasing shipping. Independent estimates indicate an increase in transit cargo by 2020 of about 5-6 million tonnes per year in the eastern direction and 2-3 million tonnes in the western direction (Ramsland, 1999). Other estimates envisage that the volume to be transported along the NSR will increase from 1.5 million tonnes in 2002 to 50 million tonnes in 2020 (Bambulyak and Frantzen 2009: 31). Oil and gas will make up the bulk of this increase.

About 91 per cent of Russia's natural gas production and approximately 80 per cent of her natural gas reserves are in the Arctic. It is also estimated that 90 per cent of Russia's offshore reserves of hydrocarbons are in the Arctic (Glasby and Voytekhovsky, 2009). In May 2008, the US Geological Survey (USGS) completed an assessment of undiscovered petroleum resources north of the Arctic Circle. The assessment showed that the Arctic might contain about 22 per cent of all undiscovered, technically recoverable oil and gas resources in the world. That is 90 billion barrels of undiscovered oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of undiscovered natural gas liquids. Thus, the Arctic is supposed to account for about 13 per cent of undiscovered oil, 30 per cent of undiscovered natural gas, and 20 per cent of undiscovered natural gas liquids in the world. Expressed in oil-equivalency terms, undiscovered natural gas is assumed to be three times more abundant than oil in the region. A significant accumulation of these resources contains recoverable volumes of at least 50 million barrels of oil and/or oil-equivalent natural gas. As much as 84 per cent of these resources are expected to be offshore and concentrated between the shoreline and the 500 meter contour line and within the 200 nautical miles limit. In this assessment only those areas that were considered to have at least a 10 per cent chance of one or more significant oil and gas accumulations were included. The study included "only those resources believed to be recoverable using existing technology, but with the important assumptions for offshore areas that the resources would be recoverable even in the presence of permanent sea ice and oceanic water depth…(USGS, 2008).” Thus, the harvesting of these resources is neither dependent on new technology nor on continued global warming and sea ice melting.

This notwithstanding, recent in-depth analysis suggests that the exploration and exploitation of these resources “…may not happen as fast and on such a scale as many observers seem to take for granted, at least not in the immediate to medium term future” (Jørgensen-Dahl, 2011: 411; see also Østreng et al., 2012: Ch. 3). Among other things, the planning and construction of new production sites for oil and gas may under polar conditions take 20 to 30 years for completion. This will affect the volume of destination shipping, which in the *short term* may increase, based on existing production sites, and also in the *long term*, based on new production sites to be developed in the *medium term*. In this perspective the medium term may be a period of relative stagnation and even decline in the transport volume for oil and gas along the NEP.

Transit Sailings

During the Soviet era, the NSR never achieved its intended significance as a transit route between the two world oceans. Transit traffic reached its maximum cargo volume in 1993 with 208 600 tonnes brought in by 30 voyages of multi-purpose ships of the Norilsk type (SA-15). In the following decade, transit sailings were rare, occasional and low key.

The interest in transit has increased significantly in recent years – from 2 vessels in 2009, 6 vessels in 2010 to 34 vessels in 2011 (Barentsobserver, 2011). According to the Russian Regional Minister of Property Relations, Yuri Chuykov, the volume of goods shipped through the NSR is expected to almost double in 2012 – from 111 000 tonnes in 2011 to 1.5 million tonnes in 2012 (Barentsobserver, 2011). The summer season of 2011 saw the highest number of vessels ever in transit through the NSR. Fifteen out of the 34 vessels transported liquid cargo (682 000 tonnes), three carried bulk (110 000 tonnes), four refrigerator ships transported fish (27 500 tonnes), two vessels transported general cargo and ten vessels sailed in ballast (Østreng et al. 2012: Ch. 5). According to Atomflot, the total cargo transported that year was 820 000 tonnes (Arctic News, 2011). Some of these transits even made commercial sense – i.e., they made a profit.

In August and September 2009, the Beluga Shipping Group sent two ships, *MV Foresight* and *MV Fraternity*, through the NEP starting out in Ulsan in South Korea and picking up steel pipes in Arkhangelsk for delivery in Nigeria. According to the company, by using this route instead of the

Suez Canal, they saved some 3000 n.m. and reduced fuel consumption by roughly 200 tonnes in total per vessel. This resulted in financial savings of about US$100,000 alone for bunker costs with Beluga F-class vessels, plus US$20,000 daily for each day that travelling the NEP shortens the usual voyage time. All in all, about US$300,000 were saved per vessel by these transits instead of taking the long route through the Suez Canal (Beluga Group, 2009: 1). At the time, the President and CEO of Beluga Shipping indicated that he expected the new generation vessels of Beluga P-class would result in financial savings of about US$600,000 per vessel and transit (Beluga Group, 2009: 5). This profitable experience was shared by others. In September 2010, the Hong Kong-flagged *MV Nordic Barents* transported iron ore from Kirkenes in Norway to Shanghai. This voyage was one-third shorter than the Suez route, saving time, fuel and carbon dioxide emissions. Estimates show that about US$180,000 worth of fuel was saved (Chircop, 2011: 11). Some of these transits also challenged traditional knowledge.

Studies undertaken by the *International Northern Sea Route Programme* (INSROP), 1993-99 suggested that if a cargo vessel is required to call on NSR ports, draught will be limited to 9 meters (m) and breadth to 30 m, with cargo capacity probably restricted to 20 000 deadweight tons (dwt). For more northerly routes (without) port calls a maximum draught of 12,5 m and a breadth of 30 m can yield a maximum cargo capacity of 50 000 dwt. Such vessels would be approximately one-third the size of those sailing the Suez Canal route (Tamvakis, et al., 1999: 221-280). In 2011, the largest vessels ever – a 160 000 dwt Suezmax loaded with 120 000 mt gas condensate and the largest bulk carrier ever, 75 000 dwt Panmax vessel loaded with iron ore – used the NSR without complications. The draught of these ships ranged between 13 and 20 m. At the same time a new speed record was set for the route, with an average of 14 knots consuming 8 days of transit (Østreng et al., 2012: Ch. 5). These achievements gave rise to this conclusion: "Although the majority of the NSR trips in 2011 involved Russian interests either as cargo owners or operators, the route now attracts quite an international mix of operators. We also see non-cargo vessels using the route... If the Russian authorities continue to price icebreaker assistance so that the fees do not exceed the corresponding Suez Canal toll, we will no doubt experience increased use of the NSR" (Østreng et al., 2012: 438). This is not to say that there are no shortcomings in navigation along the route.

The Russian government claims 41 Arctic ports to be open for foreign vessels and additional ports to be regulated for visits by foreigners on board foreign cargo ships. At present, more than half of these ports are out of operation. Although there is adequate accesses to ice-breaker assistance, only a very few of the ports have the essential facilities such as adequate water depth, berths and mechanizations needed for increased shipping. Adequate marine communication systems exist in some parts of the NSR, but not in others. Communications using VHF-radio, MF- and HF-systems and satellite are generally adequate for the lower parts of NSR, but data transmission becomes problematic when the High Arctic is reached. Several search and rescue centres are located along the NSR, but only a few can give the support needed for ships sailing along the route. Russia has made structural plans for implementation of search and rescue technology along the NSR up to 2020, but needs great financial support to complete the plans (Østreng et al., 2012: Ch. 5). This state of affairs may well explain why 71 heads of 98 shipping companies answered "no" to the question "if they are considering developing operations in the Arctic" in a recent opinion poll, whereas 17 answered "yes" and 10 "maybe" (Lasserre and Pelletier, 2011: 1472).

The Northwest Passage

The Northwest Passage (NWP) is the name given to a set of marine routes between the Atlantic and Pacific Ocean, spanning the straits and sounds of the Canadian Archipelago, the Davis Strait and the Baffin Bay in the east, and the Beaufort Sea in the west. The base of the archipelago stretches some 3000 km along the mainland coast, covering about 80 degrees of ocean and land territories (Riska, 2011: 57). The Archipelago is one of the largest in the world. If islets and rocks are included, the Archipelago comprises approximately 36 000 pieces of dry land above sea level, making it one of the most complex geographies on Earth. From Baffin Island to Banks Island, it covers a distance of about 2 400 kilometres, and the size of this whole archipelago is approximately 2.1 million square kilometres, i.e. about the size of Greenland (AMSA, 2009: 20).

The Canadian Archipelago is subdivided into two main parts by the Parry Channel: the northern part consists of the Queen Elisabeth islands, whereas the southern part comprises all islands located north of the Canadian mainland and south of the Parry Channel. Thus, the most troublesome part of the NWP, as seen from a mariner's point of view, runs through a continuous archipelago with narrow straits often jammed with impenetrable multi-year sea ice drifting in from the Central Arctic Ocean. The NWP consists of seven different routes of which six run through the southern part of the archipelago (see Figure 3).

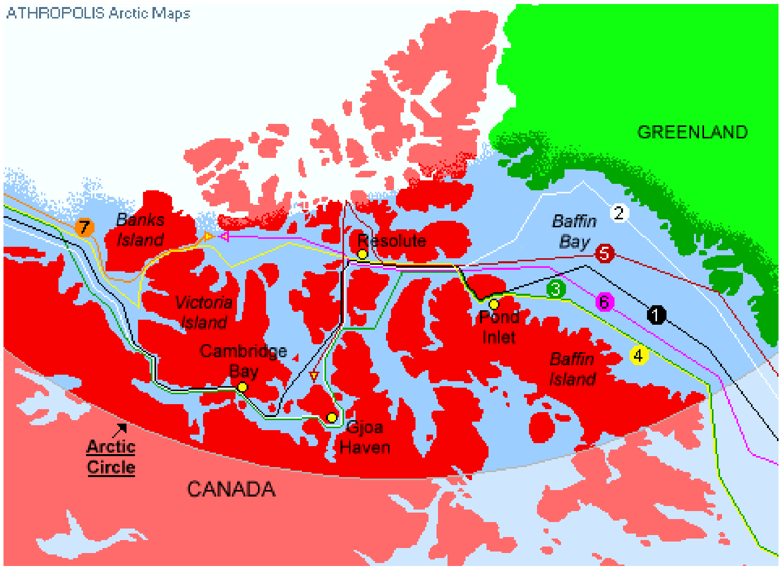

Figure 3: The Northwest Passage
Source: articmap-newpass3.gif/atropolis.com

Sea ice conditions within the archipelago vary dramatically from year to year, presenting unpredictability to any surface operation. There is mounting evidence that sea ice reduction will continue, although there is great uncertainty over the rate at which sea ice will continue to diminish. In summers 2007 and 2008, most of the archipelago was so-called ice free, promising to open the NWP to high volumes of intercontinental commercial shipping. This warrants a comment on the concept of *ice-free*.

Most Arctic shipping experts view this term as meaning ice-infested with icebergs, bergy bits and growlers present, even in the summer period. In fact, some believe shipping operations in this environment can be even more dangerous than in ice-covered areas. From a mariner's point of view, it has been assumed that with less ice, more icebreaking capacity will be needed. The reasoning goes as follows:

> Initially, as first year ice weakens and/or disappears; its ability to keep multi-year ice out of shipping areas will be adversely affected. This will mean that, even if there is less ice overall, it will be much harder, pose more of a damage risk and be more difficult to break the passage through. I have rammed multi-year ice with a heavy icebreaker, been stopped and when the icebreaker was reversed, was not able to see any evidence of the impact of ice. The same lack of first year ice will also allow for much more freedom of movement of the multi-year ice pack which will then likely compact in chokepoints, thereby compounding the problem. In the future then, as the climate changes, we can look forward to standard ice deviations in coverage, thickness and movement that will continue to increase dramatically, giving shipping some of the best "ice" years yet, but potentially some of the worst as well (Marr 2001: 1).

Ice-free does not necessarily mean problem-free, or for that matter preclude icebreaker assistance.

The inter-annual variability in sea ice conditions of the Canadian Archipelago will continue to be extreme. According to the Canadian Ice Service,

> It is quite likely that the latter half of this century will still experience occasional summers with ice conditions as severe as those witnessed in the 1980s. Multi-year ice, particular in low concentrations, will present the major hazard to shipping…. Since the oldest and thickest ice in the Arctic Ocean is that which is driven against the western flank of the Canadian Archipelago, this will likely be the last multi-year ice to remain. As long as there is a source of multi-year ice in the Arctic Ocean, it will continue to drift through the Canadian Archipelago (Falkingham, 2004).

M'Clure Strait between Melville and Banks Island is one of the straits that have a fairly long history of being blocked with multi-year ice drifting in from the Central Arctic Ocean. In addition comes shallow waters and draft restrictions, narrow straits acting like choke points and the combination of the two, making navigation a regular and punctual activity hard to achieve. The AMSA study concludes that even during the most recent periods of reduced ice, the location of the ice, its thickness from year to year and the variability of ice-free areas makes it nearly impossible to schedule transits with any degree of certainty of reaching the desired port on schedule. In addition come the obstructions stemming from seabed pingoes (AMSA, 2009: 19).

In 1969, the ice-strengthened American super tanker *Manhattan* transited the Canadian archipelago from the East Coast of the USA to Prudhoe Bay in Alaska. The next year it returned the same way back. During the first voyage, *Manhattan* was accompanied by the Canadian icebreaker *Macdonald* which at one point registered an unexpected "shoal" in the vicinity of the sailing route. The shoal turned out to be a seabed pingo, which is old ice shaped like a cone extending like a "knife" from the seabed upwards towards the surface of the ocean. At the base, the biggest can measure more than 300 m, and may raise more than 60 m above seabed. The assumption is that seabed pingoes, which are often covered and strengthened with frozen clay and mud, are relics from the time when the seabed was above sea level. More than 100 pingoes were registered scattered around on the continental shelf of the Beaufort Sea and within the shallow channels of the Canadian Archipelago (Information Canada, 1972).

Seabed pingoes undoubtedly represent a danger to ships with deep draughts. *Manhattan* had a draught of 56 feet whereas the peak of pingoes are often no more than 40 feet beneath the surface of the ocean. The semi-official journal, *Canada Today,* claimed in 1974 that:

> The discovery meant that the long-sought passage around the top of North America was at the time a dead end for super tankers and that the *Manhattan*, which had pioneered the route less than a year before, could be the last as well as the first to make the run….One tanker ripped open by a pingo…could disrupt the fragile ecological balance of much of the Arctic (Canada Today, 1974: 4).

Canada claims full and unlimited jurisdiction over the archipelagic section of the route which was declared part of Canadian internal waters, effective January 1986. The United States and later on the EU have protested against this claim which they find illegal. According to the US government, the NWP is an *international strait* open to international shipping on the basis of the principle of *transit passage* without any interferences from the coastal state. Thus, when it comes to the legal status of their respective passages, Canada and Russia are faced with the same legal and political opposition (Østreng et al., 2012: Ch. 6). This disagreement surfaced in 1970 when Canada enacted the *Arctic Waters Pollution Prevention Act* (AWPPA) establishing a 100 nautical miles environmental zone north of the Archipelago as a precautionary step to prevent ship-based pollution. At the time of enactment, the Act was not part of accepted international ocean law. Thus, the U.S. government immediately declared the Canadian move a violation of international law and a threat to the status of the NWP as a strait open to international shipping. Diplomatic notes were exchanged and protests issued in both directions. In the 1980s, the two parties calmed the disagreement and agreed to disagree. However, in 2009 the USA restated her long-term opposition against the Canadian position, indicating that the question of freedom of navigation is high on her political agenda and that national interests are at stake if that freedom is curbed (US Presidential Directive, 2009).

Transit Sailings

Between 1903 and 2004 there have been 94 single transit passages by larger ships, 30 round trips and 27 recreational small boat passages (from Atlantic to Pacific waters or vice versa). Thus, counting round trips as two passages, there have been 181 transits during the 101-year period and most of these have been through the southern coastal route. On average, 1.7 transits have been conducted per year in the course of 101 years. These voyages were undertaken by 67 vessels carrying 15 different flags. In the same period, 175 partial transits were recorded through the waters of the archipelago (not going through the whole of the NWP, including the Beaufort Sea (AMTW, 2004: A-20-A-21). A further brief examination of available data shows that transits of the passage remained a fairly sporadic affair until the 1970s, up to which point only nine complete transits had been made. In terms of flag activity, 63 per cent of transits between 1903-2004 were Canadian flag, mainly

Canadian Coast Guard icebreakers (AMSA, 2009: 32-42). The last 34 years have seen the most transit sailings. From 1969 to the end of the 1980s, more than 30 complete transits of the passage were undertaken by a variety of vessels. The bulk of these voyages were Canadian, of which most were involved in the search for hydrocarbon resources in the Canadian offshore area of the Beaufort Sea. Between 1984 and 2004, a total of 23 commercial cruise ships and 15 recreational yachts accomplished transits of the NWP. Cruise ships operating in these waters doubled in 2006, from 11 to 22. 2010 saw 26 transits, out of which only three were commercial (Lasserre and Pelletier, 2011: 1470). Several navigation accidents took place in the summer of 2010. In most instances ships ran aground due to poor accuracy of nautical maps. None were reported to collide with pingoes.

The modern history of Arctic marine transport indicates that despite the historical attempt to make the NWP a viable transit route, it is unlikely these waters will become the passage it was originally intended. Thus, destination shipping is anticipated to increase in the years ahead mostly driven by the search for resources, in particular oil and gas.

Destination Routes

Re-supply of commodities has been and still is the most stable element of shipping in the Canadian Arctic. Nearly all the voyages are destination, coming from the Atlantic to support the sealift of cargo to local communities.

Current shipping demand in the Eastern Arctic involves up to 22 seasonal trips and occurs during the 100 day navigation season that span from mid-July to the end of October (most communities receive at most two re-supply calls a year). Each voyage can include deliveries to 8-9 communities. Recently, marine operations averaged 100 voyages by large ships in summer. Churchill is a prime trading port in the east. In 2004, 14 out of 18 foreign voyages to the Canadian Arctic called the port of Churchill, shipping wheat and grain to international markets.

In the western Canadian Arctic, cargo is handled by tugs and barges, with most cargo shipped down the Mackenzie River to Tuktoyaktuk for transfer to ships with deeper ocean drafts. Current shipping demand involves 14-15 seasonal tug-barge trips. These operations take place in what has been labelled the *Mackenzie River Route* – a route of some regional significance. The western Arctic sailing season is typically 60 days between mid-July and mid-September. It is anticipated that by 2020, annual re-supply demand will require up to 30 ship trips.

Canada's Arctic region is rich in oil and gas development opportunities. As much as 1.7 billion barrels of oil and 880 billion m³ of gas have been discovered of potential resources of 8.4 billion barrels of oil (discovered plus undiscovered) and 4.3 trillion m³ of gas. This represents about 25 per cent and 33 per cent respectively of Canada's remaining resources of conventional crude oil and natural gas. Some exploration activity is now underway. In 2008 six companies received permits to explore the Beaufort Sea and the Mackenzie delta for oil and gas, but it will take a fairly long time before new finds reach the stage of production (Østreng et al., 2012: Ch. 3).

As far as other minerals are concerned, the most promising cargo potential is to be found in the development of an iron ore project at Mary River on Baffin Island. This is expected to be operational by 2020 and to generate shipment levels of about 12 million tonnes per year. Assuming 200 000 dwt vessels, there would be about 60 loads in destination shipment per year through the eastern part of the NWP. Other mining developments could require shipping services but the quantities are likely to be relatively small due to the nature of the minerals that are being exploited. In some cases no more than 6-12 vessel transits are expected during an extended season. Some, like the output of gold, diamonds, and uranium in some places, are more readily flown out by aircraft that are already a part of the supply chain (CASA, 2007).

The North Slope of Alaska holds about 4.2 billion barrels of US proved oil reserves or about 20 per cent of US total proved reserves. This oil is transported southward by pipeline to Valdez on the Pacific from where it is transported southward on keel. The same mode of transportation is planned for the petroleum resources off the Alaskan Arctic coast, which is supposed to hold at least 27 billion barrels of oil and 1 trillion m³ of natural gas (Østreng et al., 2012: Ch. 3). Thus, Alaskan petroleum does not add much to destination sailings in the western section of the NWP.

In terms of logistics, the NWP has no adequate ports with the necessary facilities to support the growing amount of commercial traffic along the northern slope of Alaska and throughout the Canadian Archipelago. Several ports have been proposed, but it is unclear if these ports will have the necessary facilities to meet the demand of increased shipping along the NWP. Currently, there is also a lack of adequate communication systems in the area. The United States have made few contributions to the development of adequate communication systems and services, while Canada operates with seasonal systems. The Canadian Coast Guard (CCG) is the primary agency along the NWP relative to rescue, safety and environmental response. Since the CCG icebreakers leave the Arctic in the end of October there is a lack of emergency response along the NWP on a year-round basis. Longer active shipping seasons along the NWP raise a number of service level issues for the governments of both Canada, the United States and even Denmark/Greenland (Østreng et al., 2012: Ch. 5).

The AMSA report makes three important conclusions when it comes to the future economic attraction of the NWP: (1) despite climate changes, the NWP will continue to be controlled by ice conditions at multiple choke points; (2) it may be years before the Canadian Arctic matches the resources extracted when compared with Alaska or the Russian Arctic; (3) other transit routes are more attractive compared with the NWP. A fourth point may be added: ice conditions are widely expected to improve more rapidly in Russia's NSR than in the Canadian Archipelago. Eight out of 15 ship owners favour the NEP and the NSR to the NWP because the former "has better infrastructures, more local ports to service and more mining and oil and gas operations" (Lasserre and Pelletier, 2011: 1469). In fact, this is one reason why most of the "pioneer commercial transit" to date have been through the NEP rather than the NWP.

The Transpolar Passage

Transpolar routes outside of national jurisdiction in the Arctic Ocean cover all waters that are part of the High Seas and where the freedom of navigation applies. This definition includes two sections of water expanses: the first is the Central Arctic Basin, which is 4.7 million sq km in area. Here, coastal states have no jurisdiction at all apart from the flag state jurisdiction they exercise over their own ships and crews. The second section includes all ocean areas beyond the territorial seas of 12 nautical miles and within the outer limits of the 200 nautical miles exclusive economic zones (EEZ). This belt is 188 nautical miles in extension measured outwards from the outer limits of the territorial sea. Here, coastal state rights and obligations mix with the rights and obligations of all other states. In this belt the coastal states have sovereign rights over certain issue areas, among them over the exploration and exploitation, conservation and management of natural resources – living and non-living – on and in the seabed and in the water column above. The coastal states also exercise rights to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in those areas that are ice-covered within the limits of the EEZ. In the ice-covered areas of these stretches, Article 234 of UNCLOS provides coastal states with some additional powers to apply pollution regulations. At the same time, Article 87 of the same Convention claims these waters to be part of the High Sea, guaranteeing the freedom of navigation to coastal and land-locked countries alike. This belt is where coastal state jurisdiction meets with the freedoms of the High Seas and where all parties shall have due regard to the rights and duties of other states and where all are obligated to act in a manner compatible with the spirit and letter of the Convention. Thus, the biggest chunk of Arctic water is that which is designated the High Seas. The direct distance across the Central Arctic Ocean from the Bering Strait across the North Pole to the Fram Strait is 2100 nautical miles.

Contrary to popular belief, the ice cover of the Central Arctic Ocean is not a static unbroken surface. It is constantly in motion, breaking into pieces, and building up pressure ridges above and below the surface where floes grind together. Because of the cleavage of the sea-ice canopy, leads and areas of open water (called polynyas) and thin ice (called skylights) are present all year round. As early as in the 1960s (before the global warming of the present was recorded) these open water areas constituted from 5 to 8 per cent of the total area of the Arctic Ocean during the winter season, and approximately 15 per cent during summer (Molloy, 1969). The distribution and frequency of polynyas and skylights are random, but they appear even in the vicinity of and at the very North Pole throughout the year. Some of the leads and skylights in the vicinity of the Pole were assessed to be nearly half a mile in diameter (Calvert, 1960; Dyson, 1963).

The sea ice varies in shapes, thicknesses, ages and hardness, presenting different challenges to navigation. Expert opinion is that the present thawing is long-term and that the ice-edge will steadily migrate northward along with a further thinning and weakening of sea ice. The northern movement of the ice edge will gradually make the southern margins of the Arctic High Seas (within the 188 n.m belt) available for navigation, i.e. along the *high latitude-route* claimed to be part of the NSR (see section "The Official Russian Definition of the NSR", above). Over the last 30 years, sea ice thickness in the Central Arctic Ocean has decreased by 42%, a decrease of 1.3 m – from 3.1 to 1.8 m (Weller, 2000: 40), with an accompanying reduction of some 73% in the frequency of deep pressure ridges in certain places (Wadhams, 2004). As a consequence, the influx of multi-year ice from the Central Arctic Ocean to the coastal areas, in particular to the NSR, has decreased by 14 per cent from 1978 to 1998 (Wadhams, 2004).

On the basis of these and other scientific observations, model experiments suggest a further decrease in sea ice thickness of some 30 per cent, and an ice volume decrease between 15 and 40 per cent by 2050 (NOIFA, 2001: 3). If this trend continues, one postulate is that summertime disappearance of the ice cap is possible in the course of this century and that significant areas of the Arctic Ocean may become permanently free of sea ice in summer (NOIFA, 2001). One of the models simulates an ice-free Arctic Ocean in summer by 2050. This scenario implies that the physical occurrence of multi-year ice can possibly disappear from these waters in the future improving further the conditions of economic activities in the Central Arctic Basin as well as along the NEP and NWP.

This is not to say that the Arctic Ocean will be ice-free in winter. As concluded in the AMSA study: "Even after the first ice-free summer is recorded, there will almost certainly be subsequent years when all of the ice does not melt in summer but survives to become 'old' ice the following year. It is...generally agreed that the Arctic waters will continue to freeze over in winter" (AMSA, 2009: 26). Let us illustrate the point: in mid-September 2007, the Arctic Ocean reached its absolute sea ice minimum so far covering only 4.1 million sq km. One year later – in September 2008 – the extent of sea ice was about 1 million sq km bigger than at the same time the year before, covering 5.2 million sq kilometres (Doyle, 2008). In March 2008, the ice extent rebounded rapidly to a winter maximum that was actually higher than in the previous four years. On these grounds, sea ice-experts expect strong natural variability events in the future, causing both decreases and increases of the Arctic sea-ice cover on seasonal and decadal time scales (Johannessen, 2008: 52). Thus, different sources assume sea ice to be a lasting characteristic of the Arctic Ocean, although still very different from the conditions 30 years back.

Ever since 1978 the sea ice extent has been declining. This trend is most pronounced at the end of September, but all months show a declining trend. However, the retreat introduces the dangerous *polar lows* to new areas of the Arctic Ocean. *Polar lows* are high latitude, maritime small-scale cyclones caused by cold air interacting with relatively warm open oceans. These cyclones, which are difficult to forecast, appear suddenly and unexpectedly and are often associated with strong surface winds and heavy snowfall. They usually originate north of 70°N and practically all move in a southward direction. *Polar lows* are not found solely in the Arctic as they also appear in southern waters, such as near Japan (Mauritzen and Kolstad, 2011: 25-36). Recent studies suggest, however, that the likelihood of *polar lows* to occur in open waters for various reasons will decrease over time, whereas "…the retreat of sea ice will expose large new ocean regions to the atmosphere. In these regions, where *polar lows* and related weather have been non-existent so far (because *polar lows* need energy from the oceans), *polar lows* will make their first appearances in the future. These are the same regions that have been proposed as tomorrow's shipping lanes and oil/gas exploration areas" (Mauritzen and Kolstad, 2011: 34). Here, improvement in one operational condition for ships and oil rigs – retreat of sea ice – is counteracted by the introduction of a new challenge – *polar lows*. Among the passages, the Transpolar passage (TPP) will be the least affected by the newcomer.

Destination and Transit Routes in the TPP

Transpolar routes can serve both destination Arctic and transit purposes. The former implies that vessels can use international waters for parts of their voyage, entering the NEP and NWP from the north to unload their cargo. On such occasions, ships using TPP do not get away from the legal controversies of the NSR and NWP, but becomes part of it. For transit voyages, this involvement can be avoided by using the high sea sections of the Arctic Ocean, accessing or exiting through the Fram and Bering Straits.

No commercial ship has ever conducted a voyage across the Central Arctic Ocean. The first TPP transect was undertaken by the Canadian Icebreaker *Louis S. St-Laurent* and the *Polar Sea* of the United States in July-August 2004 (Brigham, 2005). All together, seven trans-Arctic voyages – all taking place in summer – have been conducted by icebreakers, nuclear as well as diesel powered.

The first surface ship ever to reach the North Pole was the Soviet nuclear icebreaker *Arktika* on 17 August 1977. *Arktika* departed from Murmansk on 9 August and sailed eastbound through the Vilkitskii Strait to the ice edge of the Laptev Sea, then turned northward and sailed along longitude 125°E, reaching the North Pole 8 days later. The ship arrived back in Murmansk on 23 August after having sailed 3852 nautical miles in 14 days with an average speed of 11.5 knots. Parts of the voyage took place in heavy ice. This trip unleashed several more voyages from several more countries. Between 1977 and 2008, ship access to the North Pole in summer has been attained from all regions of the Arctic Basin. Data shows that 77 voyages have been made to the Geographic North Pole by icebreakers from Russia (65), Sweden (5). USA (3), Germany (2), Canada (1) and Norway (1). Of all the visits, 85 per cent has been undertaken by Soviet/Russian icebreakers. Nineteen of these trips were in support of scientific exploration and the remaining 58 were for the entertainment of tourists. Eight icebreakers reached the Pole in summer 2004, and during the four consecutive summer seasons, 33 ships reached the North Pole mainly for tourist and scientific purposes. Of the 76 icebreaker trips that have been to the Pole in summer, the earliest date of arrival has been 2 July 2007 and the latest 12 September 2005. This indicates that the navigation season has been restricted to about 10 weeks for highly capable icebreaking ships. The only voyage of the 77 not conducted in summer was that of the Soviet nuclear icebreaker *Sibir*, which supported scientific operations during the period from 8 May to 19 June 1987, reaching the North Pole on 25 May (AMSA, 2009).

Eleven of the 77 voyages were conducted by diesel-powered icebreakers, the rest had nuclear propulsion (AMTW, 2004: A-26). The fact that conventionally-powered icebreakers have conducted successful operations to high-latitudes in all regions of the Central Arctic Ocean implies that such voyages are not entirely dependent on nuclear propulsion. New icebreaking technology may enhance the capabilities of diesel-powered ships to operate in the waters around the North Pole.

The dwindling sea ice cover has given some extra impetus and nourishment to the old idea that commercial ships shall one day be able to operate in ice-infested waters without icebreaker escort or in convoy. Norilsk Nickel will soon have a fleet of six operational icebreaking carriers, all highly capable of operating independently of icebreakers through the winter season to serve the port of Dudinka along the NEP (AMSA, 2009). The rapid development of ice-classed vessels and icebreaking technologies "…can make shipping in Arctic Waters feasible even in 'winter' months like April/May or November/December (Tupolev, 2011: 12)."

Apart from sea ice conditions, regular shipping operations in the High Seas of the Arctic Ocean are up against multiple challenges. Among the more obvious is the lack of governmental or commercial salvage response to support shipping in far-away waters, there is also a lack of communications and there are no routinely produced ice information products at navigation scale for the High Seas beyond coastal state waters. Although all Arctic states provide marine weather information for their coastal waters, none has as yet been assigned the responsibility to do so for the High Seas regions – although an initiative seems to be underway in this respect (Østreng et al., 2012: Ch. 5).

Connecting Corridors in Southern Waters

On the Atlantic side of the Arctic Ocean there are three possible corridors: the "Northern Maritime Corridor" (NMC) connecting the NEP to Europe and North America; the "Fram Corridor" (FC) connecting the TPP to the North Atlantic and ultimately to the NMC; and the "Davis Corridor" (DC) connecting the NWP to the western branch of the NMC and the east coast of North America. On the Pacific side, the three Arctic passages connect with one joint southern corridor: the "Northern Pacific Corridor" (NPC) going through the Bering Strait linking the west coast of North America and North East Asia to the "Great Circle Route" (GCR). These corridors are two-way corridors employed by transit and destination Arctic shipping.

The Northern Maritime Corridor

The "Northern Maritime Corridor" (NMC) stretches from the White Sea in the north, with partners in Murmansk, Nenets and Arkhangelsk regions, to multiple ports in the North Sea (Solheim et al., 2004: 70). This corridor was approved as an inter-regional project by the European Union (EU) in 2002, involving partners in 22 regions in 8 countries. The NMC is regarded by western analysts as a most important linkage to Northwest Russia, connecting "…the NMC to the …Northern Sea Route which connects Northwest Russia to the Pacific Ocean" (Solheim et al., 2004: 71). In our definition of the NEP, the NMC overlaps with the latter in the White and Barents Seas. In this definition, the NMC overlaps with the traditional geographical conception of the NEP, making the Barents Sea a definitional venue of four overlapping routes: the NEP, the NMC, the Kara Sea Route (KSR) and the functional extension of the NSR (see Figure 4).

Figure 4: The NMC – NEP Connection
Source: Ocean Futures (2006)

Marine transport of Russian oil through the NMC has been going on for some time already, but increased dramatically in 2002. The oil comes from production sites in Western Siberia. As the existing pipeline from Siberia to southern Russia was oversubscribed at the time, oil was instead shipped by train to the White Sea, transferred to tankers and shipped on to the European market through the NMC. Crude oil, bunker oil and refined products are shipped out on small ice strengthened tankers from different ports in the White Sea to Murmansk where it is transferred to large tankers for export. The transport capacity was originally about 5.4 million tonnes a year, but is expected to triple and quadruple over a short period of time (Østreng et al., 2012: Ch. 3).

In addition, the trans-Atlantic branch of the NMC, which connects the NEP to the East Coast of North America, has been activated for transport as the first load was delivered to the U.S. East Coast in February 2008. Since transport costs from Murmansk to North America are comparable to those from the Middle East, this trade is expected to increase rapidly (Fokus North, 2007: 2). By 2020 the estimate is that 20 million tonnes of LNG will be transported from Russian Arctic gas fields to North America (Lassere and Pelletier, 2011: 1469). In this geopolitical perspective, Siberia is linked to Washington via two or three Arctic routes and the transoceanic blue water branch of the NMC.

Due to Iceland's geographical location en route to the North American East Coast, Icelandic authorities and shipping companies have plans to service the trans-oceanic branch of the NMC by offering deep ocean ports, repair facilities, reloading of cargo from small to large tankers etc. The idea is to establish a transhipment port at Isafjordur in northwest Iceland. Previously, the harbours at Reykjavik and Reydarfjordur in East Iceland have been suggested. The government points out that the deep fjords in west Iceland, like Hvalfjordur offer good natural conditions for ports for big ships and even "better than other options in the northern part of the Atlantic" (MFA, 2006: 39). The Icelandic government not only suggests that Iceland could be a transhipment country for the east coast of North America, but also for Northern Europe. The geopolitics of this scheme is that Iceland can facilitate international trade "…as a transhipment hub…between the continents of Europe, North America and Asia across the Central Arctic Ocean through trans-arctic sea routes" (Heininen, 2011: 32). The reference to Asia has among other things to do with the close cooperation that has developed between Iceland and China in the course of the three last years on Arctic shipping (Barentsobserver, 2010).

The Northern Pacific Corridor

The "Northern Pacific Corridor" (NPC) on the Pacific has not yet been formally established or for that matter got an official name. For the purpose of this article it is named the NPC, which starts out in the Bering Strait, overlapping with the functional definition of the NSR on the Pacific.

The Bering Strait is a narrow international strait that connects the Arctic Ocean to the North Pacific Ocean. It is the geographical venue of the NWP, NEP, TPP and NPC – a choke point through which all vessels have to pass to exit or access the Arctic Ocean on the Pacific. At the strait's narrowest point, the continents of North America and Asia are just 90 km apart. The biggest depth is 60 meters. Seasonally, dynamic sea-conditions found in this natural bottleneck are labelled by some as the "navigators nightmare" (Synhorst, 1973: 110-111) clogged as it is with first year sea ice more than 4 feet thick. Multi-year sea ice is known to move through the strait at speeds approaching 27 nautical miles per day. The closest U.S. harbour with deep water is Dutch Harbour at the Aleutians in the Southern Bering Sea. On the Russian side, the nearest deep water port is Providenija. Thus, the regional shortage of suitable and effective infrastructure is striking and in need of cost-intensive improvements. Current shipping activity in the area is based on community re-supply and destination traffic. In recent years, Asian countries have expressed interest in Arctic shipping and resources. As has been observed "…the ports of the Far East, south of the Bering Strait, are not related to the Arctic, but of course this cannot lessen their role in the Arctic transport supply" (Tamvakis et al., 1999: 264).

The prospects of the Arctic being navigable during more months of the year, leading to both shorter shipping routes and access to untapped energy resources, has moved observers to assume that China's large shipping companies can be expected to avail themselves of Arctic routes, even though those routes will be open only on a summer season basis (Chircop, 2011: 11). Chinese Vice Premier Li Keqiang, in a public speech in 2009, urged Chinese scientists to continue to push forward in polar and oceanic exploration to serve the county's modernization drive because the ocean has become an important source of natural resources (see www.xinhuanet.com website). China has also engaged in formal bilateral dialogues on Arctic issues with Canada, Iceland and Norway. From a Chinese viewpoint, an ice-free Arctic will increase the value of strong ties and broader cooperation with the Nordic countries (Jacobson, 2010; Chircop, 2011) not least because China's quest to become a permanent observer to the Arctic Council has failed twice.

Japanese institutions have for the last 20 years given the NSR much attention. The Japanese Ministry of Transport was actively involved in organizing the *International Northern Sea Route Programme* (INSROP) together with the *Ship and Ocean Foundation* (SOF) in the early 1990s. SOF, which was one of three principal partners in the implementation of INSROP lasting for six years (Østreng, 1999: xxxv-xlii), also organized the INSROP Symposium in Tokyo in 1995. Then she initiated the follow up research program – JANSROP – which focused attention on the establishment of a transportation system to bring energy resources from Far East Russia to international markets (Kitagawa, 2006).

South Korea being the fourth largest oil importing and the tenth largest oil consuming country in the world is dependent on oil deliveries from the Middle East. From a logistical point of view, the security of marine transportation routes for oil between Northeast Asia and the Middle East has been seriously threatened by piracy and conflicts among Asian countries. Due to piracy, the cost of insurance for ships travelling via the Gulf of Aden towards the Suez Canal increased more than tenfold between September 2008 and March 2009 (Jacobson, 2010: 5). In response to the threat to these southern supply routes, it is necessary to exploit various other transportation routes and modes for natural resources. For this reason, Russia has been identified as strategically important to South Korea as a new alternative energy source in accordance with Korea's strategy of diversifying the countries she imports from. In line with this, South Korea is building an icebreaker to be launched in late 2012, primarily intended for scientific research in the Arctic Ocean and to develop Arctic transportation routes (Yeong-Seok Ha, 2006: 106). The South Korean government in 2008 restated her interest in involving herself in the development of Arctic sea routes (Digital Chosunilbo, 2008).

Despite this expressed interest, no regional action has been taken to link up to Arctic resources and waterways. The reason being that there "…are a host of structural and cultural obstacles to overcome before the RFE [Russian Far East] and its Asian neighbours can…reach a level of mutual trust high enough to ensure dynamic cooperative development in the region" (Simonsen, 1996: 4-5). For all these stumbling blocks and hindrances "…to be overcome many mutual perceptions and not least realities have to change both in Russia and in Japan, China and the Koreas" (Simonsen, 1996: 5). It is widely known that to keep up the economy of northern regions like Magadan, Kamchatka, Sakhalin Oblast and the northern areas of the Republic of Sakha and Khabarovsky Krai, "sea transport is practically the only means of cargo haulage (Otsuka, 2006: 74). Therefore, the waters of the Bering Strait have been used in summertime by U.S,. Russian and Canadian vessels servicing communities and industry in northern Alaska and ports along the NWP and NSR in both directions through the Bering Strait and the Aleutian islands. Overall, approximately 159 large commercial vessels pass through the Bering Strait every year during the open-water period from July to October. These estimates exclude fishing vessels and fuel barges serving coastal communities, in particular in Alaska. The volumes of cargo taken through the Strait are by any yardstick small. In recent decades proposals have been put forward to change the state of affairs and to put the region on political and economic maps through the establishment of interconnecting transportation corridors.

In 1992, the State Advisor to the Russian Federation, professor Alexander Granberg suggested that it would be attractive "…to set up a system of food supply to the eastern sector of the Arctic (i.e. the Russian Far East) through regular deliveries from the US Pacific coast and south-East Asia…This system assumes particular relevance since many of the former food suppliers to the (Russian) Arctic are now far 'abroad' (Ukraine, Belarus, Central Asia)" (Granberg, 1992: 13). Granberg also recommended delivery of oil from the Russian Arctic to the West Coast of the U.S. in exchange for American food supplies to the Russian Far East through a trans-oceanic sea lane across the Pacific, connecting with the NSR. In this scheme, the NSR would be used to distribute large portions of U.S. supplies to the Arctic regions through connecting rivers. This suggestion has not yet materialized.

According to Japanese experts,

> …progress in international specialization and economic globalization has accelerated and broadened the interrelationship between the two regions [Russian Far East and Northeast Asia] both socially and economically. It is widely known that oil and natural gas development off the coast of Sakhalin Island provides a wide range of multiplier effects in these areas. And in this way, the globalized face of the economy and industry will play an important role in the sustainable development of the Russian Far East and East Asia for many years to come…The abundant natural resources in the extreme north area of the Russian Far East will draw [the]…attention of the international market (Otsuka, 2006: 71).

Chinese researchers claim that the opening of the Arctic routes "will advance the development of China's north-east region and eastern coastal area, [and]…it is of importance to East-Asian cooperation as well" (Jacobson, 2010: 7). As has been pointed out, the "non-Arctic states, China, Japan, North Korea and South Korea are all in the same boat" (Jacobson, 2010: 13). When it comes to the prospects of an ice-free Arctic, each of these countries:

> …stands to benefit enormously from shorter commercial shipping routes and possible access to new fishing grounds and other natural resources. A unified Arctic strategy would be of their mutual interest. Finding ways to jointly use an ice-free Arctic has the potential to create a genuine win-win situation for both China and Japan, the two East-Asian powers which in so many other areas find it difficult to find common ground (ibid).

Arctic shipping could contribute to economic development in east and northeast China. "Known as the rust belt, China is actively promoting the economic and industrial revitalization of this region, which lags behind other major industrial and manufacturing centres" (Chircop, 2011: 12).

Thus, the countries bordering on the Northeast Pacific may in due time find common ground to formally establish a Northern Pacific Corridor connecting the Northeast Asian countries to the NEP (NSR), NWP and TPP with a trans-oceanic branch to the North American West Coast. In the meantime, and while waiting for regional cooperation to mature, these waters are freely available to increasing international shipping as High Seas servicing both transit and destination shipments.

Multiple transits through the NSR in 2009-2011 brought LNG, gas condensate, iron and frozen fish to Asian ports – Shanghai, Vladivostok, Thailand (Ta Put), South Korea (Ulsan) and China (Ningbo/Lianyungang), and one shipment went the other way from Korea through the Bering Strait to Arctic and European ports (Østreng et al., 2012: Ch. 5, see also Wergeland, 2011: 419-420). It is time to prepare politically and diplomatically for meeting "the strategic consequences of three continents growing together in the North" (Dagsavisen, 2009).

The Fram Corridor

The "Fram Corridor" (FC) has not been formally established and/or baptised with a name of public recognition. It is simply a label provided for the purpose of this article, borrowing its name from the Fram Strait which separates Svalbard and Greenland in the north with a minimum of 540 km and in the south with a maximum of 900 km. The Molly Deep provides the deepest point not only in the Strait but also in the whole of the Arctic Ocean with a depth of some 5607 m. In the centre of the Strait, depths in general are around 2000 m, with coastal depths ranging from 100 to 500 m. (Lysaker, 2009). The Fram corridor in our definition includes the Strait and the Greenland Sea connecting in the south with the transoceanic branch of the NMC north and/or south of Iceland.

90 per cent of all sea ice that leaves the Arctic Ocean goes through the Fram Strait at high speeds – in between 10 to 25 cm per second (Lysaker, 2009). Previously, this Strait was the outlet of thick multi-year ice extending down to the Denmark Strait between Jan Mayen, Iceland and Greenland. Parts of the Fram Corridor is what whalers and sealers for centuries have called the *West Ice* (Vestisen) outside the east coast of Greenland – a hostile sea ice area of many tragic ship losses.

Today, the Fram Strait is mostly the outlet of young and first-year ice with a thickness of up to 1.5 m. Only on rare occasions has multi-year ice been recorded going through the Strait in recent years. This is due to the rise of the air temperature in the area of 2-3 degrees Celsius in the course of the last decades (see www.npweb.npolar.no). Thus, climate change has made the FC more accessible to surface shipping than before.

Unlike the NPC, the FC is not being used on a regular basis for shipping purposes, neither destination nor transit. It is known that it has been used by a small number of submarines exiting or accessing the Arctic Ocean (Østreng, 1979: 70-132), and as an exit area for the Canadian icebreaker *Louis S. St-Laurent* and the USCGC *Polar Sea* in August 2004. In addition, a few research ships and even drifting ice stations (Althoff, 2007) have been operating in the area for research purposes, but the volume of this traffic has been limited and is fairly recent. As a connecting corridor of active seasonal use, the FC belongs at best to the long-term future, but ice and navigation conditions are in steady improvements for more active use.

Both Denmark and Norway have established 200 nautical miles zones in the Svalbard/Greenland area. Those zones overlapped with some 150 000 sq km. In 2006, the two countries reached an agreement to delimit the disputed area on the basis of the median line principle (Overenskomst, 2006). The shelf area outside of 200 nautical miles north of the Fram Strait has not yet been delimited between the two countries.

The Davis Corridor

The "Davis Corridor" (DC) is not a formal name depicting an established transport route between adjacent countries. It is used as a label for the purpose of this article, borrowing its name from the Davis Strait which separates Greenland and Baffin Island with depths varying between 350 m and 3600 m. The Strait is known for its fierce tides ranging from 30 to 60 feet, which discouraged many early explorers. A cold ocean current of heavy ice runs southward along the banks of Baffin Island emptying itself into the Labrador Sea in the North Atlantic at speeds of 8 to 20 km a day. This makes the northern part of the Labrador Sea ice-infested and similar to the waters of the FC. The DC includes the Davis Strait and the Labrador Sea and extends southward connecting to the western branch of the NMC. It includes the whole of the North American East Coast and passes four national territories – Greenland, Canada, Iceland and the United States.

Shipping through the Corridor is modest, counting between 100 to 200 vessels a year. It is seasonal and mostly conducted by Danish, Greenlandic and Canadian vessels. Since 2002 the amount of sea ice in the Strait has decreased, and today there is open water available all year round making commercial activities possible (Danmarks miljøundersøkelse, 2012). The Strait has a fairly long history of large-scale commercial fisheries (trawling for scallops, pollock and cod) and has also been subjected to petroleum prospecting.

There have not been any serious political attempts to establish a cooperative corridor in these waters. The present level of shipping activity is most likely handled sufficiently effective by the informal cooperation that already takes place between the bordering countries.

Conclusions

Four overall conclusions of geopolitical and economic significance to shipping in these waters can be drawn from the above discussion:

1. In terms of resources, manoeuvrable sea ice and logistics, the NEP is by far the most attractive of the three Arctic Passages, both in the short and medium term, and even, under certain conditions, in the long term. This implies that Russia, claiming national jurisdiction over the NSR, has a key role in controlling the most important part of Arctic shipping. Three developments can change/mitigate this situation; (a) *the parties agree to disagree,* i.e. none of the opposing interests are publicly compromised in management. The parties keep a straight face and look the other way when need be. This is a short term "solution," which has worked for the NWP; (b) *the disagreement is resolved through negotiations between the parties involved*. Given the long history and complexity of the matter, this solution may be time consuming, although preferable. At best, it is a resolution in the medium term. Third, *nature provides a solution* in that the sea ice disappears from the Arctic Ocean as indicated by climate models. In such an event, the TPP may get a new role in transit shipments on the premise that they do not involve parts of the coastal waters of the NSR and NWP. If, however, the claim of jurisdiction to the High-latitude and Near-North Pole routes of the NSR is made official Russian policy, the freedom of the High Seas is violated, and a fresh legal controversy may be added to issue of Arctic shipping.

2. Driven by the search for resources, destination shipping is likely to increase along both the NEP and NWP throughout the 21st century. However, indications are that the harvesting of these resources may not happen as fast and on such a scale as many observers seem to take for granted, at least not in the immediate to medium term future. Developments of new production sites takes time, up to 30 years of completion. On grounds like this, the volume of destination shipping along the NEP most likely will increase in the *short term*, based on existing production sites, and also in the *long term*, based on new production sites to be developed in the *medium term*. In this perspective the medium term may be a period of relative stagnation and even decline in the transport volume for oil and gas along the NEP.

Transit shipments on the NEP saw a surprising increase in the 2011 season and is expected to be even more pronounced in the years ahead. Actually, transit shipments along the NEP may in the short term pick up some extra momentum and get a higher volume than usually expected due to its relatively favourable ice conditions and degree of logistical development. This is not the case for the logistically underdeveloped and ice clogged NWP, and even less so for the TPP, which at present is nothing but a theoretical sea route for the long term.

3. Among the blue water corridors connecting with Arctic passages, the NMC in the Atlantic is by far the most important, servicing both continental Europe and increasingly also the North American East coast. On the Pacific side, no such formal connection exists, but there are political indications that – despite the political hurdles to be overcome – Russia, Japan, China and South Korea may choose to pool resources for the establishment of such a corridor.

What can be envisaged for the medium and long term is that the northern, western and eastern flanks of Eurasia are circumscribed by formally established transport routes through a continuous stretch of blue and ice-infested waters. In this way, the two sets of passages and corridors will make up an integrated hemispheric transport system connecting the Arctic to the economic and political affairs of the southern part of the northern hemisphere and the northern part of the southern hemisphere. Such an outcome is the ultimate political test of the practical logic of the *pedagogic of the strategic atlas:* that decisions and actions of states are conditioned by their own geographical location and horizon, and that supply lines for energy and mineral resources tie regions together displaying their vulnerabilities as well as their interdependencies.

An American integrated hemispheric transport system circumscribing the northern, western and eastern coasts of North America is less likely to be developed on the same scale as the Eurasian one. This is because of the relatively low volume of destination and transit shipping envisaged for the NWP in the years to come. The volumes to be transported are simply too modest through the NWP and the DC. The NPC seems to be the only route that can serve the western coast of North America with sufficient volumes of resources. In this perspective the NMC serves both Asian and North American countries through the NEP rather than the NWP.

The FC is not likely to play any important part in this hemispheric transportation system. In comparison the DC is the more significant of the two.

4. For the above scenarios to materialise, the infrastructural shortcoming of the Arctic Passages has to be mended and the NMC has to be defined as a political cooperative project between Pacific states. That will take time, investments and political compromises. In the meantime, shipments along the NEP and NMC will increase gradually, more so for Russian waters than for North American

ones. In the long term, a potential exists for three continents – Asia, Europe and North America – to grow together in the North by a fully integrated Eurasian transport system.

Notes

1. This article is based on: Willy Østreng, Karl Magnus Eger, Arnfinn Jørgensen-Dahl, Brit Fløistad, Lars Lothe, Morten Mejlænder-Larsen & Tor Wergeland. (2012). *Shipping in Arctic Waters. A Comparison of the Northeast, Northwest and Transpolar Passages*. Berlin: Springer-Verlag.
2. The viewpoints expressed in this article are those of the author and do not necessarily reflect the stand of the Norwegian Scientific Academy for Polar Research.
3. Regulations for Marine Operations headquarters on the Seaways of the NSR of 1976, Regulations for Navigation of the Sea Ways of the NSR of 1991, Guide to Navigation through the NSR of 1996, Regulations for Icebreaker-Assisted Pilotage of Vessels on the NSR of 1996, Federal Law of Internal Sea Waters, Territorial Sea and Contiguous Zone of July 1998, no. 155-F3, and The Regulations for Navigation on the Sea Ways of the Northern Sea Route, Marine doctrine of the Russian federation for the Period 2020 of 2001 and Tariffs for Icebreaking Fleet Services on the Seaways of the NSR of 2005.

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