Expansion of Business Activities in the Arctic: The Issue of Search and Rescue Services

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Introduction

Until recently, harsh year-long environmental conditions have significantly hindered or even completely blocked the necessary access and transport connections in the Arctic. Even in the case that weather did permit vessel passages, unreliable navigational aids and the lack of infrastructural support provided obstacles and inherent risks rather difficult to overcome. But, the scientifically proven decline of ice coverage can now positively influence business activities in the wider region (such as mining, tourism cruises and fishing) and boost the level of trans-Arctic maritime traffic.[1] Additionally, a significant number of private companies and government-related entities already operate within (or, at least have considered taking advantage of) the "High North," targeting high profits. A significant number of them are looking to exploit previously untapped resources such as precious minerals and vast quantities of energy resources (oil and gas), with the case of the Yamal Project standing out.[2] Maritime transport activities in this region have clearly intensified during the last

1 D. Dalaklis and E. Baxevani, "Maritime routes in the Arctic: Examining the level of traffic and port capabilities along the Northern Sea Route," *Ocean Yearbook* 31 (2017): 106–135. See also D. Dalaklis, E. Baxevani and P. Siousiouras, "The Future of Arctic Shipping Business and the Positive Influence of the Polar Code," (paper presented at International Association of Maritime Economists 2016 Conference, Hamburg, Germany, August 24, 2016).

2 Launched at end of 2013, this is one of the most complex liquefied natural gas (LNG) projects ever undertaken, located above the Arctic Circle and in a region that is ice-bound for seven to nine months during the year, Yamal is isolated from the necessary logistics infrastructure. LNG tankers with icebreaking capabilities, specially designed for the project, will ship LNG to international markets through the Northern Sea Route (NSR), see Total, "Yamal LNG: The Gas That Came in From the Cold," available online: <http://www.total.com/en/energy-expertise/projects/oil-gas/lng/yamal-lng-cold-environment-gas>.

Ocean Yearbook 32: 427–455
 | DOI:10.1163/22116001_03201017

decades,[3] with the discussion about the prospects of the so-called "Arctic routes" (Figure 16.1) still ongoing.[4] Lesser ice coverage is indeed positive news, but the Arctic remains a dangerous operating environment. It is indicative that ships are currently faced with long distances to cross (often without adequate support), adverse environmental conditions and unpredictable hurdles. More importantly, there are slow response times in case of an emergency. Therefore, as the maritime shipping sector hastens plans to exploit the region and its resources, emergency preparedness systems and response capabilities available to respond to human and environmental catastrophes must be further developed. For the time being, there are vulnerabilities in the capabilities of certain countries within the Arctic region to support safe and secure shipping operations and/or viable development opportunities. In fact, the current state of readiness to respond to incidents related to health emergencies, search and rescue (SAR) operations, and oil spill response is largely untested.

Before proceeding any further, it is necessary to note that for the purposes of this analysis, the "Arctic" is defined as the area containing the Arctic Ocean as well as the respective territories of the five States with latitude higher than the Arctic Circle (66° 33' 46.8" N)[5] that have Arctic coastlines and can therefore raise claims regarding the continental shelf, namely Canada, the United States (Alaska), Denmark (Greenland), Norway, and Russia—the so-called Arctic Five. There is a simple explanation: these five countries have the right to project their sovereignty seawards. In fact, Denmark, Canada, Norway, and Russia have already made submissions in relation to the Arctic seabed to the United Nations Commission on the Limits of the Continental Shelf (CLCS), which was established by the 1982 United Nations Convention on the Law of the Sea

3 Arctic Council, *Arctic Marine Shipping Assessment 2009 Report* (2009), pp. 04–07, available online: <http://www.pmel.noaa.gov/arctic-zone/detect/documents/AMSA_2009_Report_2nd_print.pdf> [AMSA Report]; see also Northern Sea Route Administration Transit Statistics, available online: <http://www.arctic-lio.com/nsr_transits>.

4 D. Dalaklis and E. Baxevani, "Arctic in the global warming phenomenon era: New maritime routes and geopolitical tensions," in *New Maritime Routes: Origins, Evolution and Prospects*, edl d'Odile Delfour-Samama, C. Leboeuf and de G. Proutière-Maulion (Paris: A. Pedone, 2016), pp. 169–188. See also D. Gritsenko and E. Efimova, "Policy environment analysis for Arctic seaport development: The case of Sabetta (Russia)," *Polar Geography* 40, no. 3 (2017): 186–207; F. Lasserre et al., "Polar seaways? Maritime transport in the Arctic: An analysis of ship-owners' intentions II," *Journal of Transport Geography* 57 (2016): 105–114.

5 The landmass within the Arctic Circle is divided among eight countries: Norway, Sweden, Finland, Russia, the United States (Alaska), Canada, Denmark (Greenland), and Iceland (through the small offshore island of Grímsey).

(UNCLOS).[6] Obviously, these initiatives are interrelated with the opportunity to access more resources, especially energy-related resources, located in the Arctic Ocean's seabed.

The year 2016 was nothing short of remarkable for the Arctic as new records for rising air and sea temperatures were noted, along with decreasing ice coverage. Air temperatures continued to rise. The average annual surface air

FIGURE 16.1 *Arctic routes.*
SOURCE: <HTTPS://PEOPLE.HOFSTRA.EDU/GEOTRANS/ENG/CH1EN/CONC1EN/POLARROUTES.HTML>.

6 See n. 1 above. For further information, see "Commission on the Limits of the Continental Shelf," United Nations Oceans and Law of the Sea, available online: <http://www.un.org/depts/los/clcs_new/clcs_home.htm>.

temperature anomaly (+ 2.0 °C relative to the 1981–2010 baselines) over land with latitude higher than 60° North between October 2015 and September 2016 was by far the highest in the observational record that began in 1900.[7] Five of the first six months of 2016 set records for the smallest respective monthly sea-ice extent since consistent satellite records began in 1979. Specifically, the pace of the Arctic sea-ice retreat is increasing, currently at 13.3 percent per decade compared to the averages of 1981–2010.[8] The projections for sea-ice retreat in 2017 are not looking more favorable. In fact, the Arctic sea-ice extent for January 2017 averaged 13.38 million square kilometers (5.17 million square miles), the lowest January extent in the 38-year satellite record.[9] This is 260,000 square kilometers (100,000 square miles) below January 2016, the previous lowest January extent, and 1.26 million square kilometers (487,000 square miles) below the January 1981 to 2010 long-term average.

This retreat of ice has made the Arctic more accessible, creating a renewed interest and confidence among those looking to extract major natural reserves of fossil fuels, navigate faster shipping routes, and engage in mining, fishing, and eco-tourism opportunities. Regions of high concentrations of Arctic marine activity occur along the coasts of northwest Russia and in the ice-free waters off Norway, Greenland, Iceland and in the U.S. Arctic.[10] Computer simulation models in the Proceedings of the National Academy of Science depict the fastest routes available between 2006 and 2015 for ships without a reinforced hull (non-ice strengthened) during the summer (depicted by the blue lines), while red lines depict routes available for Polar Class 6 ships with moderate icebreaking capacity (Figure 16.2a.) These simulation models predict that even with a moderate climate change impact, many more routes will be available around the 2040 time frame, including the possibility of Polar Class 6 ships ramming through the middle of the North Pole (Figure 16.2b).[11] Currently, the fastest available routes between North Atlantic and Asian Pacific ports for non-ice strengthened vessels are along the Northern Sea Route (NSR) and the Northwest Passage (NWP). Voyage statistics for the NSR and NWP

7 J. Richter-Menge, J.E. Overland and J.T. Mathis, eds., 2016: Arctic Report Card 2016, available online: <http://www.arctic.noaa.gov/Report-Card>.

8 Id.

9 National Snow and Ice Data Center (NSIDC) "Low sea ice extent continues in both poles," Arctic Sea Ice News & Analysis (January 5, 2017), available online: <http://nsidc.org/arcticseaicenews/2017/01/>.

10 AMSA Report, n. 3 above, pp. 04–07.

11 L.C. Smith and S.R. Stephenson, "New trans-Arctic shipping routes navigable by mid-century," *PNAS Plus* (January 2013), available online: <http://www.pnas.org/content/110/13/E1191.full.pdf>.

clearly demonstrate increasing traffic,[12] although trans-Arctic voyage numbers are rather modest.[13]

It is also important to consider that various Arctic States heavily rely on fishing activities as a tool to support local economies. There are approximately 214 fishing vessels registered in Northwest Russia and 3,500 registered in the Northern Norway region, with 150 being large trawlers and pelagic fishing vessels. Additionally, the Icelandic fishing fleet has remained fairly constant over the last decade and consists of approximately 1,700 vessels (50 large vessels). Fishing in Greenlandic waters is conducted by a limited number of shrimp trawlers and numerous small-sized boats, ranging between 1,500 and 2,000 in total number.[14] With ice retreating, it is plausible that commercial fishing activities will increase in specific regions of the Arctic. The Russian government has already acknowledged the vast importance of the fishing industry to the nation's

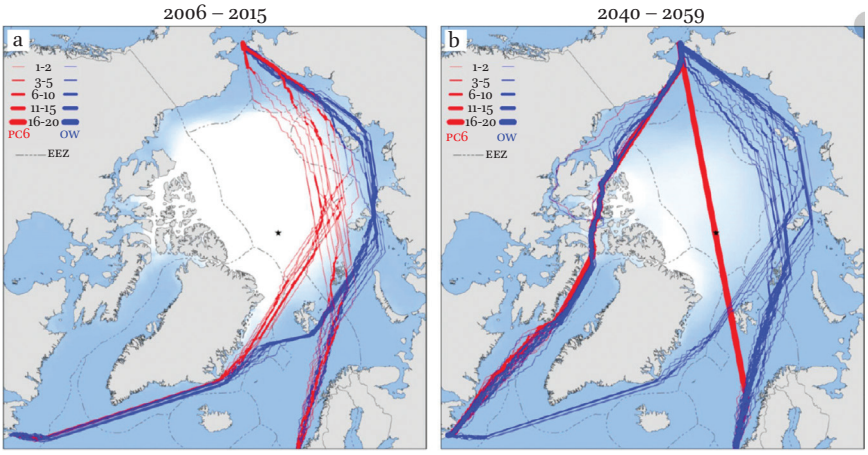

FIGURE 16.2 *Fastest routes available for ships without a reinforced hull versus Polar Class 6 ships in the period 2006–2015 and projected routes in the timeframe of 2040–2059.* SOURCE: SMITH AND STEPHENSON, N. 11 ABOVE.

12 V.M. Eguíluz et al., "A quantitative assessment of Arctic shipping in 2010–2014," *Scientific Reports* 6, no. 30682 (2016): 1–6, available online: <http://www.nature.com/articles/srep30682>.

13 A. Moe, "The Northern Sea Route: Smooth sailing ahead?" *Strategic Analysis* 38, no. 6,(2014): 784–802, available online: <http://www.tandfonline.com/doi/abs/10.1080/09700161.2014.952940>.

14 O.J. Borsch et al., "Maritime Activity in the High North: Current and Estimated Level up to 2025," MARPART Project Report 1 (Bodø: Nord Universitet, 2016).

economy. There was an official statement in relation to the construction of a new fleet as a matter of key importance, given that close to 90 percent of the existing vessels are economically inefficient and unsafe for fishermen.[15] For now, fishing activities in Russia appear to remain stable despite more access to fishing areas that would have been obstructed in the past by heavy sea-ice. Interestingly enough, the fishing vessel (F/V) *Araho*, the first U.S.-flagged factory freezer processor built at a U.S. shipyard in twenty-five years, was recently completed and delivered to O'Hara Corporation for service in the Bering Sea off Alaska. This vessel was built to withstand medium ice conditions with anticipated ice floe thickness of 0.6 meters.[16] Therefore, it is only a matter of time before local fishermen expand their activities towards the newly opened, but still dangerous, areas of the Arctic, or international investors forge ahead with intensive commercial fishing. The Arctic Ocean is vast; it will be extremely difficult if not impossible to effectively monitor this type of activity there.[17]

Apart from a certain focus on Arctic shipping lanes as international transport corridors,[18] some attention has also been devoted lately to the upward trend of the Arctic cruise ship industry.[19] The main reason for this is that over the last few decades, a significant increase in the number of passengers aboard Arctic cruise ships has been recorded. This was especially evident between 2003 and 2007, where the annual number of passengers traveling to the Arctic with cruise ships more than doubled, although the number of passengers has stabilized in recent years.[20] In the past, Arctic cruise ships that navigated the region were generally small in size and carried relative few passengers, but this

15 S. Orlov, "Rocking the boat of the Russian fishing fleet," April 19, 2016, Khodorkovsky, available online: <https://www.khodorkovsky.com/rocking-the-boat-of-the-russian-fishing-fleet/>.

16 Marine Log, "First new U.S. flag factory processor in 25 years delivered," *Marine Log* (February 7, 2015), available online: <http://www.marinelog.com/index.php?option=com_k2&view=item&id=25003:first-new-us-flag-factory-processor-in-25-years-delivered&Itemid=231>.

17 J. Thompson and H. Hoag, "The Arctic year in review," *News Deeply* (December 27, 2016), available online: <https://www.newsdeeply.com/arctic/articles/2016/12/27/the-arctic-year-in-review>.

18 See the interesting report by C.Ø. Hansen et al., *Arctic Shipping—Commercial Opportunities and Challenges* (Frederiksberg: CBS Maritime, 2016), available online: <https://services-webdav.cbs.dk/doc/CBS.dk/Arctic%20Shipping%20-%20Commercial%20Opportunities%20and%20Challenges.pdf>.

19 F. Lasserre and P-L. Têtu, "The cruise tourism industry in the Canadian Arctic: Analysis of activities and perceptions of cruise ship operators," *Polar Record* 51, no. 1 (2017): 24–38.

20 See n. 3 above.

trend has changed lately. For example, in August of 2016, the NWP became a mass tourism destination after the *Crystal Serenity*, a luxury cruise liner, successfully sailed through the NWP from Seward, Alaska to New York City, with a crew of over 650 and a guest capacity of 1,070 passengers.[21] This journey would not have been possible without the diminishing sea-ice conditions; it set a new record of the largest commercial cruise ship, weighing nearly 69,000 tons, to transit the NWP. Of significant concern, is that while there is an increase in the number and size of cruise ships, the bulk of them are not specifically designed to operate in Arctic waters. In addition to the potential major environmental disaster a ship of this magnitude presents, the Arctic region is not equipped to handle a mass rescue operation, should a disaster occur, requiring the evacuation of over 1,700 people.

In summary, the Arctic region is undergoing vast changes and at an unprecedented rate; this could dramatically affect both the fragile ecosystem and people that live and/or operate in the Arctic landscape. The main objective of this analysis will be to present the current status of SAR services in the Arctic, a prerequisite for safe maritime activities. Following a very linear structure, a brief overview of advantages and disadvantages in relation to the use of the two main Arctic routes (NSR and NWP) for maritime transport endeavors is provided. An examination of the current state of rescue coordination centers, SAR assets, icebreaker capabilities, spill response equipment and associated infrastructure for both these routes is then provided, along with related future resource allocation and planning. It is crystal clear that, for the time being, traffic varies from year-to-year and hindrances persist; the availability of icebreakers to keep the maritime corridors open and escort transiting vessels stands out as a main concern. By the end of this century, the majority of the Arctic Ocean is expected to be available for commercial shipping for roughly half of the year.[22] Given the anticipated transition to an increasingly ice-free Arctic, an integral part of the current analysis is to highlight resource gaps concerning emergency management coordination and response in the Arctic region that may be used to assess the need to regulate or intervene to assure safety and sustainability in the region.

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21 S. Goldenberg, "Now you can take a $120,000 cruise through the Northwest Passage," *Mother Jones* (March 29, 2016), available online: <http://www.motherjones.com/environment/2016/03/northwest-passage-cruis-ship-arctic>.

22 K.R. Barnhart et al., "Mapping the future expansion of Arctic open water," *Nature Climate Change* 6 (2015): 280–285, doi: 10.1038/nclimate2848.

Main Maritime Routes in Relation to the Arctic

The extraordinary transformation of the Arctic landscape opens up numerous opportunities for economic exploitation and profit. As of the late 1990s, navigation throughout the Arctic region was restricted solely to the summer months given the previously icy and harsh environment; vessels traditionally traveled to local destinations (small-sized ports) to meet the needs for basic goods. However, previously inaccessible areas covered by icepacks are now becoming increasingly navigable for shipping and remain ice-free for an extended period of time. It is indicative that the September 2016 sea-ice extent tied with 2007 for the second lowest Arctic sea-ice minimum in the 37-year satellite record.[23] More specifically, the days when navigation is possible are expected to follow an increasing trend, currently from around 70 days up to 125 days in 2050 and as many as 160 days in 2100.[24] In addition, previously isolated major natural resources will be more accessible and thus present another opportunity for maritime transport. It is for this reason, coupled with the prospect of shorter journey times and lower fuel costs, that the respective industry and scientific communities are occupied with assessing and determining the likely profitability of these emergent routes.

As the decline of ice coverage continues to open up areas of the Arctic for possible trans-Arctic shipping, efforts to predict the viability of routes such as the NWP or the NSR (Figure 16.1) are taking place. Even navigation at the central portion of the Arctic Ocean is now a consideration. As a result, the idea of using Arctic shipping routes as viable alternatives for the traditional routes through the Suez or Panama Canals is emerging. Exploration and possible exploitation of Arctic resources is also part of that equation. The attractiveness of these routes is heightened by the substantially shorter distance offered. For instance, the NSR is a substantially shorter passage (35 to 60 percent savings in distance) for shipping between northern European ports and those of the Far East and Alaska, when compared with the routes through the Suez or Panama Canals. The NWP has the potential to function as an alternative to both canals, with an estimated reduction in distance between northwestern Europe and Asia of 30 percent, as well as up to 20 percent between New York (representing North American ports) and Yokohama (representing East Asian ports). The benefit of shorter navigation distances, thus lowering transit costs, comes with a fair share of risks and uncertainty, particularly along the NWP.

23 See n. 9 above.

24 P. Cariou and O. Faury, "Relevance of the Northern Sea Route (NSR) for bulk shipping," *Transportation Research* Part A, 78 (2015): 337–346.

The ice conditions in the Canadian Arctic are generally more severe than those along the NSR.[25] Harsh conditions due to seasonality and shifting ice conditions even in the summer months, coupled with complex archipelago geography, draft restrictions, numerous chokepoints, and lack of reliable navigation aids and charts do not make this global trade route as attractive as originally envisioned.[26] In current conditions, the NSR is the most open route, followed by the NWP, while the Transpolar (TSR) route is inaccessible until the 2030s at the earliest.[27] The NSR and NWP are only tentatively open August through October in the early part of this century, but computer modeling under current environmental conditions indicates these routes may also be open in November by mid-century.[28]

The Northern Sea Route

The NSR is a well-established commercial seaway that was used for domestic transportation and played an important economic role for the Soviet Union around World War II.[29] This shipping route connects Europe and Asia north of the Eurasia landmass (Figure 16.3). According to political perception and legal regulations in Russia,[30] the NSR stretches from Novaya Zemlya in the west (168° 37' W) to the Bering Strait in the east (66° N).[31] The establishment of the NSR 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.[32] The NSR is not a specific route, but a multitude of passageways along the Russian Arctic coastline and

25 See n. 18 above.

26 K.J. Wilson et al., "Shipping in the Canadian Arctic: Other possible climate change scenarios," (Ottawa and Victoria: Canadian Ice Service and the Institute of Ocean Sciences, 2004), available online: <http://www.pmel.noaa.gov/arctic-zone/detect/human-access-canada.shtml>.

27 N. Melia, K. Haines and E. Hawkins, "Sea ice decline and 21st century trans-Arctic shipping routes," *Geophysical Research Letters* 43 (2016): 9720–9728, available online: <http://onlinelibrary.wiley.com/doi/10.1002/2016GL069315/full>.

28 See n. 18 above.

29 Arctic Portal, The Arctic Getaway, (2011), available online: <http://arcticportal.org/ap-library/news/344-northeast-passage>.

30 Regulations for Marine Operations Headquarters on the Seaways of the NSR of 1976; Regulations for Navigation of the Seaways of the NSR of 1991; Guide to Navigation through the NSR of 1996; Regulations for Icebreaker-Assisted Pilotage of Vessels on the NSR.

31 W. Østreng, "The Northeast Passage and Northern Sea Route" (2010), available online: <http://www.arctis-search.com/The+Northeast+Passage+and+Northern+Sea+Route+2>.

32 V. Peresypkin and A. Yakovlev, 2008. "The Northern Sea Route's role in the system of international transport corridors," *Focus North* 2 (2008), p. 1.

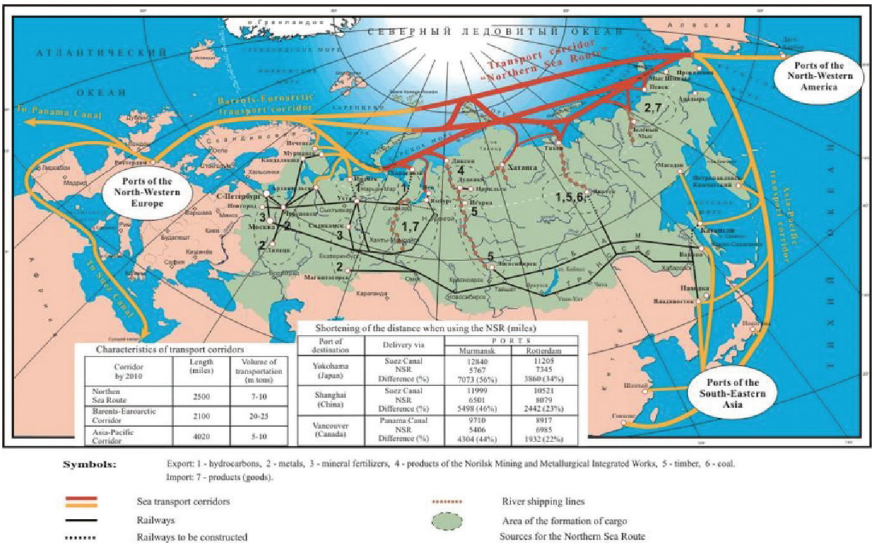

FIGURE 16.3 *Northern Sea route.*
SOURCE: NORTHERN SEA ROUTE INFORMATION OFFICE, AVAILABLE ONLINE: <HTTP://WWW.ARCTIC-LIO.COM>.

therefore covers a vast segment of the Arctic Ocean.[33] Recent interest in the form of "traffic facilitated by climate change" started in 2009 when a complete transit was made possible for the first time, spurring the debate regarding the viability of the so-called Arctic Routes.[34] The NSR has the potential to reduce the distance between Europe and Asia by up to 40 percent, compared to the Suez Canal, and bypasses bottlenecks and waters often swarming with piracy. Interest has been expressed, although restrained for now, by Asian States to use the NSR. The economic partnership between Russia and China, highlighted by the Yamal Project, is expected to generate additional maritime traffic.

The NSR is seen as the most viable route for maritime traffic running along the Russian Arctic coast. Discussions are mainly focused on the further development of this route, as it is the connection point for the shipment of goods between Europe and East Asia. Vast quantities of proven oil, gas, and

33 J. Kronbak and M. Liu, "The potential economic viability of using the Northern Sea Route (NSR) as an alternative route between Asia and Europe," *Journal of Transport Geography* 18, no. 3 (2010): 434–444.

34 Dalaklis and Baxevani, n. 4 above, p. 180.

mineral reserves are also situated along this corridor.[35] While the possibility of resource extraction and transport along the NSR captured the keen interest of investors, vessel transit numbers have dwindled in recent years. According to the NSR Information Office, just four ships navigated this route in 2010, increasing to 41 in 2011 and 46 in 2012. By 2013, the number rose to 71, followed by a significant drop to 31 in 2014 and 18 in 2015. Despite record low minimum ice coverage in 2016, just 19 vessels transited this route moving a total of 214,513 metric tons (MT) of cargo and 246 passengers.[36] Russian investments are ongoing to enhance logistics and internal connections, and establish a land network between Asian and European markets. However, there is still a large gap in properly trained crews for Arctic conditions, and a reliable marine traffic system to improve monitoring and tracking of marine activity, as well as vessel management services to reduce the risk of incidents, to facilitate response, and to provide awareness of potential user conflict.[37] The infrastructure deficit includes a lack of navigational charts, ice navigation training, places of refuge, and robust centers with port services capable of providing reception facilities for ship-generated waste. Furthermore, with the majority of transits along the NSR comprised of tanker vessels[38] (Figure 16.4), the prospect of inadequate emergency management resources to respond to oil or chemical discharges is an additional deterrent. Therefore this route should not be considered as a compelling alternative to the proven routes of the Indian Ocean and the Suez Canal. It is important to note that in order to increase the attractiveness of the NSR, the Russian authorities have committed to provide the required icebreaker support and SAR response year-round through the Marine Rescue Coordination Center in Dikson, Northern Russia, with additional support during the months of July through October from the two allocated marine rescue subcenters of Tiksi and Pevek (see discussion below).[39] Russia currently advertises the support of five icebreakers, two of which possess diving equipment and oil spill response equipment along the NSR.

35 See n. 18 above.

36 Northern Sea Route Information Office, 2017, available online: <http://www.arctic-lio.com/nsr_transits>.

37 See n. 3 above.

38 See Northern Sea Route Information Office, n. 36 above.

39 Northern Sea Route Information Office, Search and Rescue, 2017, available online: <http://www.arctic-lio.com/nsr_searchandrescue>.

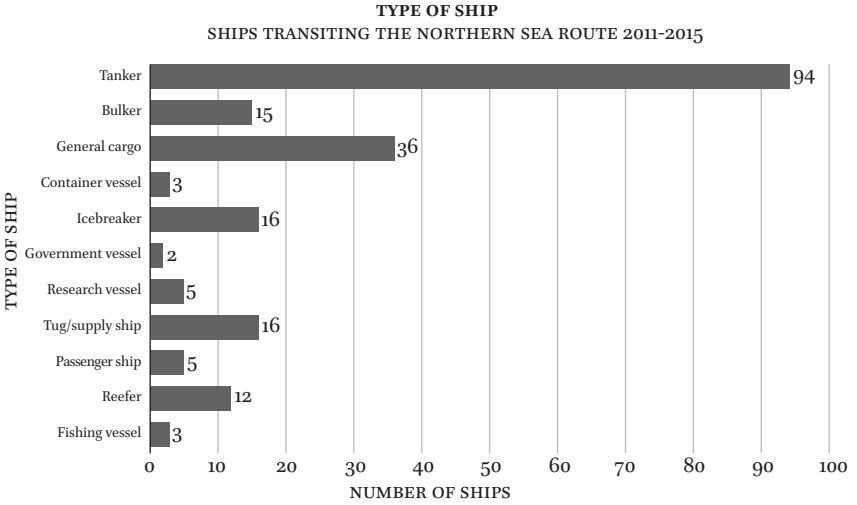

FIGURE 16.4 *Types of ships transiting the Northern Sea Route from 2011–2015.* SOURCE: NORTHERN SEA ROUTE INFORMATION OFFICE, 2017, AVAILABLE ONLINE: <HTTP://WWW.ARCTIC-LIO.COM/NSR_TRANSITS>.

The Northwest Passage

On the western edge of the Arctic Ocean, the NWP links the Atlantic and Pacific Oceans through the Canadian Arctic archipelago (Figure 16.1). The number of vessels navigating these waters is significantly lower compared to the NSR. This is due to a variety of reasons, including the complex geography (many narrow and shallow corridors), as well as ocean currents and drifting ice packs that block many entrance and exit sites. Also, there is a dispute between Canada and the United States regarding the legal regime of the passage (these waters fall under Canada's jurisdiction, but the United States maintains their high seas status respectively).[40] Transport connection on land is another setback. Venturing transport through the northern territories of Canada and Alaska has been characterized as the logistical equivalent of a lunar landing.[41] The NWP is mainly regarded as an alternative to the Panama Canal, though

40 See F. Griffiths, R. Huebert, and P. Whitney, *Canada and the Changing Arctic: Sovereignty, Security, and Stewardship* (Waterloo, ON: Wilfrid Laurier University Press, 2011), p. 130; W. Østreng et al., *Shipping in Arctic Waters: A Comparison of the Northeast, Northwest and Trans Polar Passages* (Berlin: Springer Science and Business Media, 2013), p. 335.

41 It was stated that "Shell was trying the logistical equivalent of a mission to the moon." See M. Funkdec, "The Wreck of the Kulluk," *The New York Times* (December 30, 2014),

the investments on the latter to increase its size and crossing speed will help maintain its competitiveness in the near future. Additionally, as inferred by comparison of maritime capacities, icebreaker services in this area are extremely low both in quantity and quality compared to those offered by Russia for the NSR.

It is also necessary to note that despite the single term used, there are several potential routes a vessel can follow as much within the NWP as in the NSR. Most vessels enter the western portion of the NWP from the east through a southern route along the main coast—the Amundsen Gulf—or through two northern routes, either north or south of Banks Island.[42] Vessels have to steer around numerous natural configurations, shallow water, or floes, therefore the total number of nautical miles (and time) per journey can vary. Both of these main routes are open for a few months each year, in summer and early autumn. Even during this period, icebreaker escort may be required to support crossing traffic.[43] A record number of 30 vessels transited the NWP in 2012, while the first large bulk carrier transit was in 2013. This was followed by a decline to only 17 vessels in 2014 due to a short and cold summer. The number of transits has increased in the last 20 years due to an increase in shipping activity by tug-supply vessels (half of them with icebreaking capacity) involved in the oil and gas industry in Beaufort Sea. However, other types of ships, such as passenger ships offering Arctic tourism opportunities, oil/fuel tankers, drill ships, seismic vessels, and many others are taking advantage of the specific route. It is interesting to note that small-sized crafts dominate the maritime traffic. These are the most difficult types of vessel to deal with in SAR operations because of their limited associated equipment. In any case, even with the increase in shipping traffic in the NWP and the Beaufort Sea, conditions remain difficult to navigate and the Canadian Ice Service warns that promoting increased shipping in the NWP should be done with caution and requires a high degree of preparedness for potential environmental incidents due to unmarked shallow areas, shifting topology of the seabed, fog, and dangerous weather.[44]

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available online: <http://www.nytimes.com/2015/01/04/magazine/the-wreck-of-the-kulluk.html?emc=edit_tnt_20141230&nlid=64813105&tntemailo=y&_r=0>.

42 Government of Northwest Territories, "Trends in Shipping in the Northwest Passage and the Beaufort Sea," *NWT State of the Environment Report* (Updated June 1, 2015), c. 7.3, available online: <http://www.enr.gov.nt.ca/state-environment/73-trends-shipping-northwest-passage-and-beaufort-sea>.

43 J.E. Overland and M. Wang, "When will the summer Arctic be nearly sea ice free?" *Geophysical Research Letters* 40, no. 10 (2013): 2097–2101, doi: 10.1002/grl.50316.

44 Funkdec, n. 41 above.

Search and Rescue Infrustructure along the Main Arctic Routes

In addition to the navigation challenges and lack of infrastructure/response capabilities that are coupled with the potential for unforeseen maritime accidents and environmental disasters, there is a need to factor in the geopolitical ambitions among many countries with a vested interest in the Arctic region. Projections for increased shipping traffic along the NSR and NWP are encouraged by substantial reductions in distance compared with Suez and Panama Canal routes resulting in large cost savings due to reduced fuel consumption and increased trip frequency.[45] Maritime shippers attracted by these large cost savings and countries fueled by political ambitions to carve out a place for themselves in the Arctic have not fully analyzed the impacts of human activity in the Arctic and how the limited rescue resources, challenging weather conditions, and remoteness of the area will impact their ability to render SAR assistance adequately. The epicenter of this discussion will focus on emergency management capabilities in the Arctic, including the current state of rescue coordination centers, search and rescue assets, oil spill response equipment, and icebreaker availability along the NSR and NWP.

Thick multi-year ice, complex straits, and pingos (underwater ice formations protruding from the seabed) make navigation especially arduous in the NWP.[46] While mainly limited to summer, navigation along the NSR is relatively easier owing to lower overall ice extent and open water in the Barents Sea.[47] Even though research supports downward trends of ice coverage in the Arctic, it is of importance to understand that despite a trend of rapidly declining ice coverage, sea ice can still grow in thickness.[48] When gauging how severe the conditions are for sea travel, ice thickness is the most important criteria. Even if ice coverage is retreating, it can be nearly impossible for ships to make their way through the remaining ice if it is too thick. As the northern waters of the Arctic are more approachable in the near future, shipping traffic will increase and be put at risk. Therefore, while the reduction of ice coverage in the

45 F. Lasserre, "Case studies of shipping along Arctic routes. Analysis and profitability perspectives for the container sector," *Transportation Research Part A* 66 (2014): 144–161.

46 W. Østreng et al., *Shipping in Arctic Waters: A Comparison of the Northeast, Northwest and Trans Polar Passages* (Berlin: Springer, 2013), p. 25; K. Yoshikawa et al., "Comparison of geophysical investigations for detection of massive ground ice (pingo ice)," *Journal of Geophysical Research: Planets* 111, no. E6 (2006), doi:10.1029/2005JE002573.

47 Østreng et al., n. 46 above.

48 P. Hodges, "Study: Arctic Sea Ice Too Thick for Icebreakers," *Last Resistance* (October 2, 2015), available online: <http://lastresistance.com/study-arctic-sea-ice-too-thick-for-icebreakers/>.

Arctic may signal the need for fewer icebreakers, the growth in shipping traffic and unpredictable environment require nations to bolster their icebreaking fleet. Icebreakers are the foundation of any capability in the Arctic and serve as excellent multi-functional platforms for purposes such as search and rescue, resupplying remote Arctic communities and ensuring shipping traffic channels remain ice-free, research, as well as support for mining and drilling endeavors, if needed. It is true that there is currently a ban for resource extraction in the Canadian and U.S. Arctic waters. However, there is no ban in place in the Russian side and there are certain speculations that the Trump administration will change the current limitations on the Arctic with the aim to bolster the country's economy. Therefore, it is imperative that additional investments are made in icebreakers to facilitate both shipping and other business activities along the NSR and NWP. For the United States and Canada there is a limited and aged fleet. On the positive side, at this point of time, the Russian capabilities with respect to icebreaking far exceed those of other Western nations.

In any case, actions taken by the Arctic Council in recent years to allocate SAR resources on an international level have streamlined new policies and bipartisan agreements to improve maritime safety and environmental protection in the Arctic region. In 2011, eight member States of the Arctic Council signed the Agreement on Cooperation on Aeronautical and Maritime SAR in the Arctic (2011 SAR Agreement). Specifically, it coordinates life-saving international maritime and aeronautical SAR coverage (Figure 16.5) and response among the Arctic States across an area of approximately 13 million square miles.[49] Furthermore, the agreement established competent authorities for each of the eight member States and agencies responsible for carrying out SAR activities, and lists the rescue coordination centers (RCC) by name and location for each State. This agreement is not prescriptive in the manner by which Member States must physically implement a response posture, and is therefore, a bit lacking. To provide some direction of the response to potential oil spills in the Arctic region, the Arctic Council facilitated the signed Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic in 2013. The objective of this agreement is to strengthen cooperation, coordination, and mutual assistance among the parties on oil pollution preparedness and response in the Arctic in order to protect the marine environment from pollution by oil. However, Arctic nations such as Russia, Norway, the United States, and Canada must build up infrastructure and port capabilities to attract maritime

49 See n. 36 above. See also International Security Advisory Board, *Report on Arctic Policy*, U.S. Department of State (September 21, 2016), available online: <https://state.gov/documents/organization/262585.pdf>.

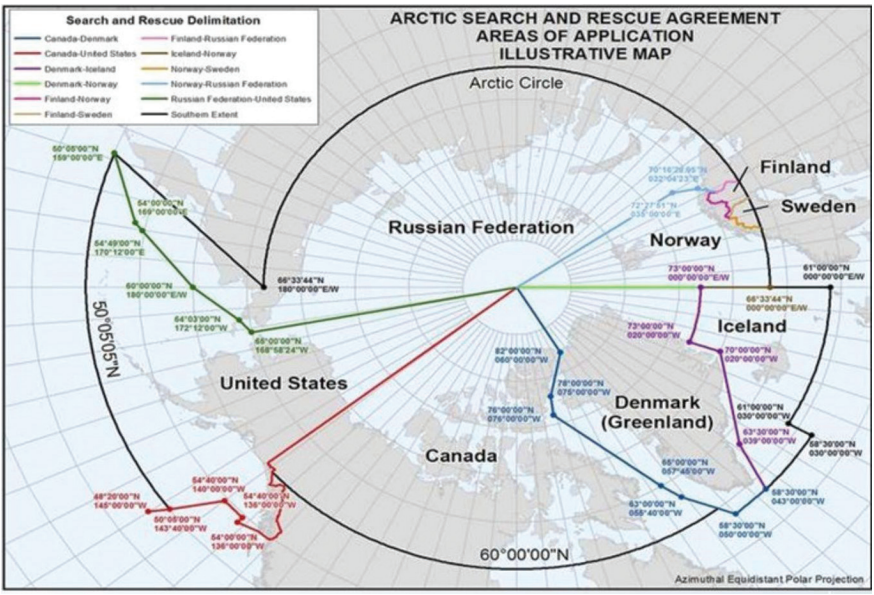

FIGURE 16.5 *Arctic Search and Rescue Agreement areas of application illustrative map.* SOURCE: NORTHERN SEA ROUTE INFORMATION OFFICE, 2017, AVAILABLE ONLINE: <HTTP://WWW.ARCTIC-LIO.COM/NSR_SEARCHANDRESCUE>.

shippers along the NSR and NWP and develop international contingency plans to prepare for increased shipping traffic and the possibility of large-scale maritime accidents that require SAR and oil spill response.

The NSR Capabilities

In accordance with the Arctic Council's 2011 SAR Agreement, the Russian Federation is responsible for the SAR mission along the NSR. To address concerns associated with the safe transit of vessels along this portion of the Northeast Passage (NEP), Russia invested 910M rubles (US$30.1 million) into the creation of 10 SAR centers along the this route (Murmansk, Dikson, Arkhangelsk, Naryan-Mar, Vorkuta, Nadym, Tiksi, Pevek, Provideniya, and Anadyr).[50] Oversight of SAR and oil spill response along the NSR is coordinated by a marine rescue coordination center (MRCC) and two marine rescue sub-centers (MRSC). The MRCC is located in Dikson, while the MRSCs are located in Tiksi

50 A.B. Farré et al., "Commercial Arctic shipping through the Northeast Passage: Routes, resources, governance, technology, and infrastructure," *Polar Geography* 37, no. 4 (2014): 298–324, available online: <http://www.tandfonline.com/doi/abs/10.1080/1088937X.2014.965769>.

and Pevek. Points of forward basing (PFB) offer additional support between the months of July and October and are located in Tiksy, Pevek, and Provideniya (Figure 16.6). The NSR Information Office also lists five icebreakers (NS *Yaygach*, NS *Yamal*, NS *50 Let Pobedy*, NS T*aimyr*, and *Admiral Makarov*), two of which also have on-board dive equipment and oil spill response equipment, capable of providing support for vessels in the NSR.[51] Despite proactive measures to lessen the risk associated with traveling this route with an increased SAR posture, the centers and sub-centers are still separated by rather vast distances and the response time may easily be inadequate to prevent fatalities in an emergency.[52] However, Russia continues to make a significant investment in icebreaking capabilities along the NSR, including ambitious plans to commission three new nuclear-powered icebreakers (*Arktika, Sibir,* and *Ural*) of the Project 22220 (LK-60Ya class). Traffic in the NSR will also increase by Arc7

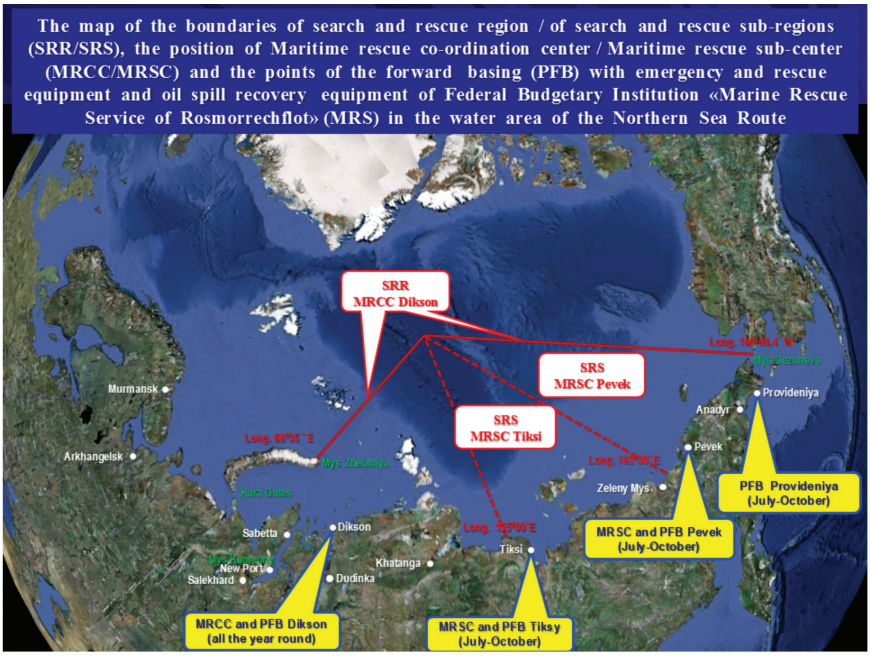

FIGURE 16.6 *Marine rescue coordination center and sub-centers along the NSR.*
SOURCE: NORTHERN SEA ROUTE INFORMATION OFFICE, 2017, AVAILABLE ONLINE: <HTTP://WWW.NSRA.RU/EN/PSO.HTML>.

51 See Northern Sea Route Information Office, n. 36 above.

52 See n. 18 above.

ice-classed LNG carriers capable of breaking through 2.1 meters of ice that will serve the Yamal project.

During the implementation of the Federal Target Program, Development of Transport System of Russia (2010–2015), the construction of six modern response vessels was planned. Specifically, these multi-functional rescue vessels are part of projects MPSV06 and MPSV07. The MPSV06 class averages 86 meters in length (282 feet) by 19.1 meters (63 feet). The first of its class, *Spasatel Petr Gruzinskiy*, is currently being built at a Russian facility on the Amur River, while a German yard has already completed two sister ships, *Beringov Proliv* and *Murman*. These two vessels each weigh 1,370 deadweight tons (dwt) and are furnished with two large cranes for salvage capabilities as well as a forward-mounted landing platform for helicopters. Additionally, they possess the capability of maneuvering a remotely operated underwater vehicle and possess decompression facilities for deep-water diver use.[53] The Russians have also produced four vessels in the slightly smaller MPSV07 class that have all entered into use following their completion in 2015 (*Spasatel Karev, Spasatel Kavdeykin*, *Spasatel Zaborschikov*, and *Spasatel Demidov*). The characteristics of this class are approximately 1,171 dwt vessels measuring 73 meters by 16.6 meters. Their capabilities include the ability to stay at sea for roughly 20 days and support for underwater diving operations down to depths of 300 meters.

The intensification of SAR capabilities along the NSR increases operational awareness and supports Arctic petroleum development[54] in the face of declining production in mature west Siberian oilfields.[55] Furthermore, new Arctic Council observer States like China, Korea, and Japan are supporting development of the NSR through shipbuilding and scientific research in an effort to secure alternative sources and supply lines of energy.[56] Therefore, the current Russian icebreaking capabilities, coupled with the future outlook of expanding the already robust fleet, make the NSR a favorable route. However, there

53 J. Shaw, "Icebreakers—Expanding the World's Fleet," *Pacific Maritime Magazine* (February 1, 2016), available online: <http://www.pacmar.com/story/2016/02/01/features/icebreakers-expanding-the-worlds-fleet/408.html>.

54 S.R. Stephenson and L.C. Smith, "Influence of climate model variability on projected Arctic shipping futures," *Earth's Future* 3 (2015): 331–343, doi: 10.1002/2015EF000317.

55 J. Henderson and E. Grushevenko, "Russian Oil Production Outlook to 2020," Energy Insight 3 (Oxford Institute for Energy Studies, University of Oxford, February 2017), available online: <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/02/Russian-Oil-Production-Outlook-to-2020-OIES-Energy-Insight.pdf>.

56 M.M. Bennett, "North by northeast: Toward an Asian-Arctic region," *Eurasian Geography and Economics* 55, no. 1 (2014): 71–93, available online: <http://www.tandfonline.com/doi/abs/10.1080/15387216.2014.936480>.

are significant monetary hindrances to discourage shippers from using the NSR. These include an obligatory paid escort by Rosatomflot, the owner of the nuclear-powered icebreaker fleet, which may limit the size of the vessel or require the shipper to acquire a two-icebreaker escort to open up the corridor for wider vessels. Nevertheless, Russian Federation authorities always put forward the argument that the NSR holds a tremendous potential as a major international shipping lane and continues to invest a tremendous amount of capital to further improve upon the current infrastructure and port facilities.[57]

Westward from Russia, the Joint Rescue Coordination Center of Northern Norway (NRCC NN) is a rescue coordination center located in Bodø that has the responsibility for coordinating SAR operations in Norway north of the 65th parallel north.[58] However, resources are lacking to support the NSR and therefore, Norway and the Russian Federation have a bilateral search and rescue agreement for the Barents Sea of which the content pertaining to this agreement is renewed and practiced annually. In Norway there are also various informal search and rescue arrangements with local governments and private entities. It is also important to note that the coastal areas of Norway and its ports remain relatively ice-free as a result of the Gulf Stream, leaving northern Norway ports ice-free year-round.[59] Therefore, Norway does not have a compelling reason to build up a large fleet of icebreaking vessels. As such, Norway maintains only one active offshore patrol icebreaking vessel, the *Svalbard*, commissioned on 17 February 2001. *Svalbard* is the largest ship in Norway's military armed forces (by tonnage) and was designed to supplement the three other helicopter-carrying ships of the Norwegian Coast Guard. The vessel is equipped with nuclear, biological, and chemical (NBC) protection and is capable of icebreaking and emergency towing of vessels up to 100,000 tons.[60] Norway has plans for a new icebreaker research vessel, *Kronprins Haakon*, which is scheduled for delivery in autumn of 2017. This new state-of-the-art vessel will be formally owned by the Norwegian Polar Institute, while the Institute of Marine Research will have operational responsibility, and the University of Tromsø will be the primary user. In addition to possessing state of the art scientific

57 See n. 3 above.

58 Government of Norway, "Hovedredningssentralen Nord—Norge," available online: <https://www.hovedredningssentralen.no/>.

59 W.M. Marsh and M.M. Kaufman, *Physical Geography: Great Systems and Global Environments*, (Cambridge: Cambridge University Press, 2012).

60 "KV Svalbard (W 303) Icebreaker/Offshore Patrol Vessel (OPV), Norway," Homelandse curity-technology.com (2017), available online: <http://www.homelandsecurity-technol ogy.com/projects/kv-svalbard-w-303-icebreaker-opv/>.

instrumentation, the vessel will operate year-round in ice-covered waters with an endurance capacity of 65 days at normal cruising speed.[61]

It is important to point out that while the Russian Federation has invested a significant amount of money in SAR infrastructure, the Russian ports along the NSR are in disrepair, having been neglected since Soviet times. There are approximately eighteen marine ports in the Russian Arctic according to the register of the seaports of the Russian Federation, eleven of which are regarded to be in poor condition and located in regions with sparse land transportation infrastructure.[62] Many shipping companies and Protection and Indemnity (P&I) Clubs are apprehensive to endorse the use of the NEP as an alternative route to the Suez Canal given the lack of available response resources, including repair and maintenance facilities and marine salvage resources in the case of a maritime accident. Specifically, the biggest financial risk in the Arctic, as perceived by P&I Clubs, is the cost of mobilizing a salvage operation, including wreck removal, and possible pollution clean-up from distances of 1,000 to 2,000 kilometers.[63]

The Northwest Passage Capabilities

Compared to the NSR, the NWP is extremely underdeveloped, especially around the waterways of the Canadian Arctic. There are no adequate deep-water ports along the northern slope of Alaska or throughout the NWP.[64] Port facilities along the North American Arctic coast west of the passages are equally negligible, and the closest well-developed infrastructure is the west coast of Greenland, Nuuk, being the largest and most significant port.[65] Therefore, the lack of adequate ports and associated SAR infrastructure do not make the NWP a compelling alternative to the Suez or Panama Canals. While trends indicate Arctic shipping will increase in the coming years, the NWP will require significant infrastructure upgrades to ports and associated SAR infrastructure. In any case, the analysis herein will examine both the Canadian and American capabilities with respect to the NWP.

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61 "Fincantieri: 'Kronprins Haakon' launched in Muggiano," *Your Subsea News* (February 28, 2017), available online: <http://www.yoursubseanews.com/fincantieri%3A+%E2%80%9Ckronprins+haakon%E2%80%9D+launched+in+muggiano_140421.html>.

62 See Northern Sea Route Information Office, n. 36 above.

63 B. Gunnarsson, "Practical Information for Operating on the Northern Sea Route," Centre for High North Logistics (CHNL) (n.d.), available online: <http://www.chnl.no/publish_files/Practical_Information_for_Operating_on_the_NSR.pdf>.

64 K.M. Eger, "Canadian Ports on the Northwest Passage," CHNL (2010), available online: <http://www.arctis-search.com/Canadian+Ports+on+the+Northwest+Passage>.

65 See n. 18 above.

Shipping in the Canadian Arctic is governed by Transport Canada in accordance with the *Canada Shipping Act, 2001*.[66] This act established a framework for SAR and communication operations in Canadian Arctic waters and includes provisions relating to the following services in the Arctic: monitoring international marine radio distress frequencies, broadcasting ice and marine weather information and notices concerning hazards to navigation, and screening ships entering Arctic waters to enhance safety and prevent pollution.[67] A party to the 2011 SAR Agreement, the Canadian Minister of National Defence is designated as the competent authority under the Agreement and both the Canadian Coast Guard (CCG) and Canadian Forces are designated as SAR agencies. The designated rescue coordination center for Canada is located in Trenton, Ontario and the SAR area of responsibility is illustrated in Figure 16.5.

Canada lacks a single port along the NWP in which a vessel could seek refuge in the event of mechanical problems or a serious storm.[68] The largest and only well-developed port in the Canadian Arctic is Churchill, Manitoba, located in Hudson Bay close to the interior of the North American continent. However, the Port of Churchill is not a viable transportation link and there are not many economic activities in the community.[69] The port's fate is uncertain as the owner, Denver-based OmniTrax, ceased all operations for the 2016 season without any warning.[70] For now it is unclear if Canada will have a deep-water link to the Arctic in the future.

Transport Canada has divided the Canadian Arctic into various zones, where navigation is allowed depending on sufficient ice-strengthening capabilities of a vessel.[71] Important ice and weather information is provided for

66 *Canada Shipping Act, 2001*, S.C. 2001, c. 26.

67 K.M. Eger, "Communication and Support to Navigation on the NWP," CHNL (2010), available online: <http://www.arctis-search.com/Communication+and+Support+to+Navigation+on+the+NWP>.

68 M. Byers, "Canada's Arctic Nightmare Just Came True: The Northwest Passage is Commercial," *The Globe and Mail* (September 30, 2013), available online: <http://www.theglobeandmail.com/opinion/canadas-arctic-nightmare-just-came-true-the-northwest-passage-is-commercial/article14432440/>.

69 The Mariport Group Ltd., *Canadian Arctic Shipping Assessment*, Report prepared for Transport Canada (June 2007).

70 S. Gilmore, "How Ottawa abandoned our only Arctic port," *Maclean's* (August 18, 2016), available online: <http://www.macleans.ca/news/canada/abondoned-churchill/>.

71 Canadian Coast Guard, *Ice Navigation in Canadian Waters*, (Ottawa: Fisheries and Oceans Canada, 2012), available online: <http://www.ccg-gcc.gc.ca/Ice_home/Ice_Publications/Ice-Navigation-in-Canadian-Waters>.

vessels utilizing the NWP through the Northern Canada Vessel Traffic Services Zone (NORDREG). NORDREG is a vessel traffic zone where ships of 300 tons or more, those involved in towing or pushing operations with a combined gross tonnage of 500 or more, and all vessels that carry, tow, or push cargoes of pollutants or dangerous goods must comply with the regulatory requirements.[72] The CCG operates a Marine Communication and Traffic Services (MCTS) center in Iqaluit to provide marine safety communications and oversight of the movement of vessel traffic in the Arctic.[73]

In 2016, the MCTS opened in May for the western Arctic operations and in June for the eastern Arctic operations, and operated until the end of December. Outside of these times, NORDREG services are provided by the Prescott MCTS, which provides year-round satellite safety information broadcast service for high Arctic waters.[74] The CCG responds to air and maritime SAR incidents on the NWP. The Joint Rescue Coordination Center (JRCC) in Trenton services the Central and Arctic Canada region. The JRCC in Trenton, Ontario, is staffed by SAR coordinators on a year-round basis. For most of the NWP, the Canadian Forces provide fixed- and rotary-wing SAR aircraft from Trenton while the CCG relies primarily on its helicopters and icebreakers.[75] Regardless, there is a long distance from Trenton to the NWP, which means it would take a long time to provide any rescue operation by air transport. During the navigation season, the CCG states it has an average response time along the NWP of 10 hours, under average ice conditions.[76]

Interestingly, Canada is experiencing a crisis in relation to current and projected future icebreaking capabilities. The government is plagued by a looming shortage of vessels and a growing threat of mechanical failures as a result of aging icebreakers that are well past their shelf life. Canada possesses a total of 17 icebreakers, although one icebreaker was taken out of service in November 2016

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72 *Northern Canada Vessel Traffic Services Zone Regulations*, SOR/2010-127; see also C.P. Knight, "NORDREG now Mandatory Within the Northwest Passage," *Mondaq* (November 8, 2010), available online: <http://www.mondaq.com/canada/x/114788/Marine+Shipping/NORDREG+now+Mandatory+Within+the+Northwest+Passage>.

73 See n. 64 above.

74 Canadian Coast Guard, "Canadian Coast Guard Arctic Operations 2016," News Release (July 29, 2016), available online: <https://www.canada.ca/en/fisheries-oceans/news/2016/07/canadian-coast-guard-arctic-operations-2016.html>.

75 W. Rompkey, *Canada's Arctic Waters: Role of the Canadian Coast Guard. Report of the Standing Senate Committee on Fisheries and Oceans* (Ottawa: Senate of Canada, December 2009), available online: <https://sencanada.ca/Content/SEN/Committee/402/fish/rep/rep07dec09-e.pdf>.

76 See n. 18 above.

for what was determined to be an undisclosed engine casualty. Furthermore, only two are heavy icebreakers and four are medium-endurance icebreakers. The CCG's most capable icebreaker, the *Louis S. St-Laurent*, was credited with the escort of the first bulk carrier to transit the NWP, the Danish-owned *Nordic Orion* in September 2013. This transit highlighted the importance of escort ships to take advantage of Arctic opportunities for maritime transport. However, the *Louis S. St-Laurent* is a 45-year old vessel and one of only two Canadian icebreakers capable of making this journey.[77] Each summer, the CCG positions icebreakers in the Arctic and NWP waters in preparation for Arctic operations (CCG positioned eight vessels in 2016).[78]

The CCG plans to construct a new icebreaker, *John G. Diefenbaker*, to replace the aging *Louis S. St-Laurent*, which was originally slated to be decommissioned in 2010. A refit of the vessel 17 years ago extended its service life, but the vessel has well exceeded its intended operational capabilities. The original plan was to begin construction on the *John G. Diefenbaker* in 2013, but government funding was reprioritized to build naval offshore patrol ships and this was coupled with apparent scheduling conflicts at the shipyard. Currently, preconstruction engineering is slated to begin at Seaspan's Vancouver Shipyards in 2017, with a construction contract to follow in 2019.[79] Until construction of the *John G. Diefenbaker* is completed in the early 2020s, the Coast Guard says it may need as many as five extra icebreakers at various times as the current fleet goes through repairs and upgrades. However, it is crucial to highlight the fact that beyond the initial plan to replace one icebreaker, Canada does not appear to have a long-term plan to replace its remaining icebreakers, most of which are 30 to 40 years old. In reaction to this looming shortage, the Canadian government is exploring the possibility of leasing icebreaking services from private companies. According to the Coast Guard's Director General of National Strategies, Canada may "face potential gaps in icebreaking services over the next five years." To deal with this issue, a formal request from the Canadian federal government was released to industry on 18 November 2016 seeking the potential cost and availability of icebreakers should the need become necessary.[80]

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77 L. Berthiaume, "Canadian Coast Guard may be Forced to Lease Icebreakers as Aging Fleet Increasingly at Risk of Breakdowns," *National Post* (November 16, 2016), available online: <http://news.nationalpost.com/news/canada/canadian-coast-guard-may-be-forced-to-lease-icebreakers-as-aging-fleet-increasingly-at-risk-of-breakdowns>.

78 See n. 71 above.

79 B. Pehora, "Coast Guard: New $1.3 billion Arctic Icebreaker to be Ready by 2022," *Nunatsiaq Online* (January 28, 2016), available online: <http://www.nunatsiaqonline.ca/stories/article/65674coast_guard_new_1.3_billion_arctic_icebreaker_to_be_ready_by_2022/>.

80 See n. 77 above.

To supplement the Canadian presence in the Arctic, the Canadian Armed Forces has procured six ice-capable ships, designated as the Harry DeWolf Class, for use by the Royal Canadian Navy (RCN). The official RCN designation for these ice-capable ships is the Arctic and Offshore Patrol Ship (AOPS). The first of six vessels, the HMCS *Harry DeWolf*, is scheduled for delivery in 2018.[81] These vessels will support the RCN and their ability to operate in the Northwest Passage. They can operate safely in first-year ice and support the Royal Canadian Mounted Police (RCMP) in policing maritime traffic in the Northwest Passage while providing a platform for Transport Canada, Fisheries and Oceans Canada, and other departments with mandates in the Arctic region. Furthermore, they can be used as general use platforms and provide response capabilities in the event of a disaster or emergency.[82]

In waters under U.S. jurisdiction, including the Arctic and the Antarctic, the United States Coast Guard (USCG) is fundamentally responsible for maritime safety, national defense, maritime security, maritime mobility, protection of natural resources, and ice operations. As the lead agency for maritime SAR, the USCG maintains a coastal network of boat stations, aircraft, communication systems, and a command-and-control network to respond to those in peril at sea. The USCG is designated as the competent authority in the 2011 SAR Agreement and both the USCG and U.S. Department of Defense are designated as SAR agencies. The designated JRCC for the United States is located in Juneau, Alaska, and an Aviation Rescue Coordination Center is located in Elmendorf, outside Anchorage, Alaska. Figure 16.5 outlines the SAR area of responsibility for the United States. Given the instrumental role the USCG plays in maritime operations within Arctic waters, there are multiple capital investment needs in infrastructure including icebreaking capabilities and the shore-based infrastructure to support both SAR and icebreaker operations. Specifically, the USCG has inadequate force structure to meet SAR contingencies and investment in constructing ice-strengthened patrol ships and aircraft for extreme climates is needed.[83] Furthermore, as vessel traffic continues to increase in the Arctic region, the United States needs to invest in pollution

81 "Arctic and Offshore Patrol Ship Project," Royal Canadian Navy (2017), available online: <http://www.navy-marine.forces.gc.ca/en/fleet-units/aops-home.page>.

82 A. Lajeunesse, "The Canadian Armed Forces in the Arctic: Purpose, Capabilities and Requirements" Policy Paper (Canadian Defence & Foreign Affairs Institute, University of Calgary, 2015), available online: <https://d3n8a8pro7vhmx.cloudfront.net/cdfai/pages/544/attachments/original/1432260016/Canadian_Armed_Forces_in_the_Arctic.pdf?1432260016>.

83 S. Deboer, "Arctic Security and Legal Issues in the 21st Century: An Interview with CDR Fahey," Center for International Maritime Security (March 1, 207), available online: <http://cimsec.org/arctic-security-legal-issues-21st-century-interview-cdr-sean-fahey/31016>.

response capabilities and sufficient infrastructure to support safe and secure maritime commerce.

The Arctic waters, specifically the NWP, are of strategic, economic, and environmental importance to the United States. Enhanced icebreaking capabilities are vital to properly carry out the SAR mission in the Arctic, while supporting U.S. security interests. The United States cannot be present in Arctic waters if they do not possess adequate means to get there. "Virtual" presence in the form of rescue coordination centers is in reality (actual) absence. The current condition of U.S. icebreakers and the country's ability to protect, regulate activity, and respond to crises is surprisingly very limited.[84] During loftier times, the U.S. fleet possessed eight icebreakers, but that number has dwindled to just three icebreakers after years of neglect and lack of attention. Currently, the United States has only three polar icebreakers: two heavy (the *Polar Sea* and the *Polar Star*) and one medium (the *Healy*).[85] The two heavy icebreakers are more than 40 years old, with the *Polar Sea* currently sitting idle in a dry dock pending a decision on refurbishment after experiencing an engine failure in 2010. The medium icebreaker does not possess the capabilities required for deep ice penetration and is not capable of handling the needs of the warming Arctic. To make matters worse, the only heavy icebreaker, the *Polar Star*, cannot take on Arctic missions according to USCG Commandant, Admiral Paul Zukunft, because it is obligated to support Antarctica's McMurdo Sound for the National Science Foundation for four more years. This apparent crisis is long in the making as the U.S. icebreaking fleet has been neglected and the program has been routinely placed on the back-burner by Congress. The U.S. icebreaker fleet is operated by the USCG, but the exorbitant cost of funding the new generation of icebreakers falls way outside of an already limited Coast Guard budget. Making matters worse, not only is an icebreaker expensive, costing at least US$1 billion each, but it would take the U.S. shipbuilding industry, which has long ceased to build icebreakers, at least ten years to build a brand new one.[86] Given the bleak U.S. fleet of polar icebreakers, the respective

84 M. McGrath-Horn, "U.S. Must Invest in a New Generation of Polar Icebreakers," *The Seattle Times* (April 13, 2016), available online: <http://www.seattletimes.com/opinion/us-must-invest-in-a-new-generation-of-polar-icebreakers/>.

85 U.S. Coast Guard Acquisition Directorate, "Polar Icebreaker," (n.d.), available online: <http://www.dcms.uscg.mil/Our-Organization/Assistant-Commandant-for-Acquisitions-CG-9/Programs/Surface-Programs/Polar-Icebreaker/>.

86 J. Hudson, "The Icebreaker Gap," *Politico* (September 1, 2015), available online: <http://www.politico.com/agenda/story/2015/09/the-icebreaker-gap-000213>.

American capabilities for the time-being remain rather limited and this is a significant disadvantage for the NWP.

Conclusion

The Arctic is seen as a place defined by constant change and uncertainty, but one factor that is undisputable is that the Arctic landscape is at the forefront of international attention. As humanity enters a new age of exploration, propelled by human-induced climate change, many other environmental changes are taking place as well, alongside social and economic developments. A climax of Arctic shipping occurred during the 1980s when the Soviet Union made large investments in infrastructure and icebreakers along the NSR. However, the continuous decline in summer Arctic sea-ice has reinvigorated interest in Arctic liner shipping. Using the Arctic Ocean as a means of travel between Pacific and Atlantic destinations, the region has been transformed into a promising field for economic activities. In contrast to large-scale shipping between the Atlantic and Pacific, cargo transportation to and from ports on the NSR is still mostly regional. However, it is vital to assess how this unprecedented rate of change will affect resource demands, transportation needs, infrastructure (both existing and lacking), existing geopolitical tensions, and response capabilities (search and rescue and icebreaking). It is also important to note that the sanctions against Russia following the crisis in Ukraine will not impact on the Yamal Project, which is proceeding on schedule. More traffic is expected in the Arctic region and the need for a sound SAR framework is essential.

Perhaps the most significant challenge for the United States and Canada is the lack of existing SAR infrastructure along the NWP. This is particularly troublesome given the increase in marine tourism and passenger vessels operating in the NWP in recent years. Much like Canada, there are no U.S. ports along the NWP where a vessel could seek refuge in the event of mechanical problems or a serious storm. It is conceivable that a vessel experiencing difficulties may even have trouble relaying problems to response resources as communications in the Arctic are extremely challenging. Furthermore, if an actual mass rescue operation was required in frigid Arctic waters, it is conceivable that resources available in the Arctic region could not handle an event of this magnitude. For example, even the town of Nome, Alaska, along the NWP, has a sizeable population, but only possesses 18 hospital beds. Evacuation of a vessel the size of the *Crystal Serenity* certainly poses a challenge. As large passenger vessels continue to operate more frequently and farther north in the Arctic, the prospect of having to conduct mass rescue operations with limited

SAR resources increases and the possibility for a major environmental disaster rises. Recent growth in Arctic marine tourism is outpacing infrastructure investment, development and support throughout the region.[87] For example, the success of the sold-out 2016 voyage of the *Crystal Serenity*, and the recently completed 2017 voyage through the NWP from Seward, Alaska to New York City, further speaks to the increasing popularity of Arctic marine tourism. There are a plethora of anticipated problems associated with responding to an incident aboard a cruise ship. The potential number of people that would have to be rescued far exceeds the capacity of most SAR response vessels and aircraft available in the Arctic. U.S. and Canadian Coast Guards and government officials met ahead of the 2016 voyage of the *Crystal Serenity* to prepare Crystal operators and rescue officials as best as possible to respond to the nightmarish scenario of rescuing over 1,000 passengers in Arctic waters. However, given the current lack of adequate SAR resources and associated infrastructure, nothing can adequately reduce the inherent danger of rescuing passengers up to 1,000 miles from the nearest Coast Guard base.

While it appears that some routes may be far off from future shipping traffic, we are running out of time to put systems in place to deal effectively with the enormous changes remaking the Arctic before there is a human and environmental catastrophe. The current SAR infrastructure varies between the NSR and the NWP, but as a whole is very limited. A 2009 Arctic Council survey of SAR resources among Arctic States indicated limited availability of fixed-wing aircraft and helicopters and a shortage of critical SAR response assets, such as long distance, heavy-lift capacity helicopters in most of the Arctic region.[88] The aforementioned survey response included icebreakers and seasonal patrol vessels that could be used for SAR when near enough to an incident, but the location and availability of SAR assets are often problematic given the vast distances and frequent harsh operating conditions typical in this region. Insufficient shore-side infrastructure, particularly along the NWP, needed to provide basic logistics and support functions for SAR missions further hampers emergency response efforts. In some instances, such as in connection with oil and gas activities, private industry addresses these gaps and shortfalls by providing its own supplemental SAR capacity as part of its ongoing Arctic operations, but this remains the exception rather than the rule. To address these shortfalls

87 See n. 3 above. See also D. Dalaklis, A. Olcer, F. Balini and J. DeWitz, "Protecting the Arctic Environment: Challenges and Opportunities for Liquefied Natural Gas," (paper presented at the 5th International Human Sea—Marisk Symposium, "Economic Challenge and New Maritime Risks Management: What Blue Growth?" Nantes, France, 4 October 2016).

88 AMSA Report, n. 3 above, p. 171.

and increase collaboration, the eight Arctic countries established the Arctic Coast Guard Forum (ACGF) in 2015. Its goal is to examine tasks, including joint operations, assets sharing, and an increased focus on exercises, with the aim of developing a common situational awareness (starting with search and rescue) between the eight member States, while referencing the work conducted by the Emergency Prevention, Preparedness and Response (EPPR) Working Group of the Arctic Council.[89]

The U.S. and Canadian Coast Guards report a spike in response calls from thrill-seeking adventurers that find themselves overcome by the weather and harsh climate of the Arctic. The Arctic planner for the USCG falls back on the phrase "tyranny of distance" (relating to the vast area to cover with limited means) to describe the epic challenges of assuring safe passage through the northern waterways for an increasing number of destination shipping and tourists.[90] In August 2017, the *Crystal Serenity* made a second voyage through the Northwest Passage, a once fabled place thought to be too dense in ice coverage to ever attempt passage even in the summer and with icebreaker support. Despite the still inherent dangers, this large cruise ship took over 1,700 passengers and crew through the NWP, once again creating a dangerous situation coupled with a possible overinflated sense of confidence due to past success. Of particular concern, is the prospect of rescuing these passengers, many of a more advanced age, from freezing cold waters of the Arctic. The logistical nightmare associated with this undertaking is overwhelming, terribly costly, and largely untested. The U.S. and Canadian response agencies nearest bases are hundreds of miles away and the ports that these vessels sail through are largely unequipped to handle victims of maritime casualties given the fact that the ports of call have populations half as numerous as the passengers onboard.

In addition to mass rescue scenarios, a frightening possibility is an accidental or intentional oil or hazardous material discharge in remote Arctic waters. Arctic governments have singled out the risk of a heavy fuel oil spill as the single largest threat to wildlife and the local economy.[91] Heavy fuel oil is banned in Antarctica as it is a very dirty, highly polluting and viscous fossil fuel, but it is still allowed in Arctic waters and is the default choice for many cargo ships.

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89 A. Østhagen, "The Arctic Coast Guard Forum: Big Tasks, Small Solutions," The Arctic Institute (November 2, 2015), available online: <https://www.thearcticinstitute.org/the-arctic-coast-guard-forum-big-tasks/>.

90 See n. 21 above.

91 S. Goldenberg, "Let's Not Turn the Arctic into an Adventure Playground," *The Guardian* (April 11, 2016), available online: <https://www.theguardian.com/commentisfree/2016/apr/11/arctic-adventure-playground-climate-change-polar-ice>.

If heavy fuel oil is spilled in cold Arctic waters, it will break down very slowly and will have devastating long-term impacts on Arctic communities, livelihoods, and ecosystems.[92]

In conclusion, the current state of the icebreaking fleet, maritime infrastructure, and available response capabilities in the Arctic region is not adequately prepared for the current sea-ice retreat and projected increase of maritime shipping and human activity in the North, especially for the United States and Canada along the NWP. It is important for Arctic countries to invest in shore-side infrastructure and oil and hazardous material response equipment to adequately respond to a maritime environmental disaster that could occur as the amount of ship traffic in the Arctic grows in the coming years. The right type of equipment and what exactly is needed could be the focus of additional research activities. It is imperative that investments are made by all Arctic countries to ensure that as shipping increases in the Arctic region, a timely and sufficient response to incidents is possible, and SAR facilities with an on-site presence in the High North are available to ensure safe and efficient Arctic marine shipping for the future.

92 See n. 90 above.