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Icebreaker Operations in the Arctic Ocean

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Russia's Icebreaker Capabilities - Arctic Ocean

Arktika class icebreakers are the bulk of the Russian nuclear icebreaker fleet, used primarily to aid shipping along the Northern Sea Route. Of the seven nuclear icebreakers, one is a containership with an ice-breaking bow, and two, the "Taymyr" and the "Vaygach" have been built for shallow waters in rivers transporting lumber, ore and other cargo.

Approximately 2,000 people work aboard the icebreakers, which are based at the Atomlot harbour in the Murmansk Fjord.

Arktika class icebreakers have a double hull and can operate in ice in 2.5 meters (8.2 ft) thick at speeds of up to 10 knots. In ice-free waters, the maximum speed of these ships is as much as 21 knots. There is water ballast between the inner and outer hulls which can be shifted to aid icebreaking operations. Icebreaking is also assisted by an air bubbling system which delivers air from jets below the surface.

The ships have two reactors, three propellers totaling 75,000 hp, and can operate for approximately 7 months at sea and 4 years between refuelling. The crew normally includes 130-200 personnel. The *50 Let Pobedy*, built in 2007, is the world's largest nuclear icebreaker, at 159 meters in length. It also carries two Ka-32 helicopters.

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In 2012, Russia's state-owned nuclear corporation, *Rosatom*, signed a contract to begin construction on the world's largest nuclear icebreaker, a "universal" vessel that could navigate both shallow waters and the Arctic Ocean.[1] The first of this massive new class of nuclear icebreakers was called the *Arktika* (the Arctic) and was floated out in 2016 and is set to be completed in 2019. The second of the three new icebreakers is the *Sibir* (Siberia), with a launching ceremony in September 2017; which should be commissioned in 2020.

These new icebreakers measure 173 meters in length with two reactors having the propulsion power of 60 megawatts. The *Arktika*, at 33,500 tonnes reportedly cost $1.74 billion. The construction of these vessels takes approximately eight years. According to the Russian Transport Ministry, Russia needs six new icebreakers for future operational regiments. [2]

Russia in the past decade has expanded its yearly operation in the Northern Sea Route, particularly now that sea ice has been receding as a result of climate change. Russia stands as the foremost military and commercial shipping leader in the Arctic region - with over 40 icebreakers, six military bases, 16 deepwater ports, and 13 air bases.[3] Protecting these bases are S-400 long-range surface to air missiles.

In 2014, Russia shipped offshore oil from the Arctic. After loading her cargo at the *Snøhvit LNG* export terminal in Norway, the Russian-owned tanker *Christophe de Margerie* in August 2017 shattered the speed record for transversing an ice-bound section of the Northern Sea Route.[4] Without an icebreaker escort, the ship travelled from Norway to Korea in 15 days - half the time required for a ship through the Suez Canal. The state-owned Russian company *Sovcomflot*, has commissioned 14 more tankers, on the basis of the Russian government forecasts that tanker traffic will increase tenfold by the year 2020.

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[1] E.Conant, "Breaking the Ice," *Scientific American* and *Pulitzer Centre in Crisis Reporting*, 2017.

[2] "Nuclear-Powered Icebreaker," Wikipedia, 5 October 2007. http://en.wiokipedia.org/w/index.php?title=Nuclear-powered_icebreaker&oldid=803891135.

[3] T.J. Starr, "Russia's Icebreakers Make It King of the Arctic and America is Just a Pauper," January 26, 2017.

[4] "The Arctic-time to Lead," *The Globe and Mail,* August 29, 2017, p. A-11.

Russia is designing and building LNG icebreaking tankers as a result of exporting gas from the giant project on the Yamal Peninsula, led by the Russian firm Novatek. The project will have the capacity of about 16.5 million tonnes of LNG per year. The project included Chinese investment of $12 billion dollars which offset the fundraising difficulties created by American sanctions.[5] The $27 billion facility on Friday December 8, 2017 started loading its first tanker of LNG for export to Asian markets.

US Icebreaker Capabilities - Arctic Ocean

The United States Coast Guard (UCSG) has only one serviceable heavy duty icebreaker in service, the *Polar Star*, built in 1976. The *Healy*, commissioned in 1999, is also in service but the *Polar Sea*, was removed from service in 2011 after a major engine casualty. It is likely the useful life left for the *Polar Sea* is three to seven years.[6]

In May 2017, President Trump pledged to build new icebreaker ships for the USCG.[7] The plan calls for the construction of three heavy icebreakers which can crush ice to 21 feet thick and three medium icebreakers which can crush ice up to 8 feet thick.

The Commandant of the Coast Guard, Admiral Paul Zukunft, is confident that US shipyards can build a heavy icebreaker for less than $1 billion.[8] Compounding the problem, however, is that the two shipbuilding companies that built the icebreakers in America, Lockheed Shipbuilding in Seattle and Avondale Industries in New Orleans are closed. Building an icebreaker stateside could take 10 years.[9]

The USCG has often been criticized for its rigid requirements of what it wants the icebreakers to do. Coast Guard officials are also reluctant to purchase or lease icebreakers from other nations, especially if they are non-military vessels. Another

[5] "Northern Sea Route Through The Arctic," *The Maritime Executive,* 8 January 2017.
[6] News of the National Academies of Sciences, Engineering and Medicine, 11 July 2017.
[7] D. Lamothe "Trump Pledges to Build Coast Guard Icebreakers but it's Unclear How Different His Plan is From Obama's", *Washington Post,* 17 May 2017.
[8] S. J. Freedberg, "US Yards Can Build Icebreaker for Under $1B: Zukunft", *Standing Watch-Flir,* 1 August 2017.
[9] Starr, "Russia's Icebreakers," Footnote 3, p. 5.

problem is that U.S law requires the Coast Guard vessel to be built in America, unless the president for a compelling reason allows them to be built overseas. In addition, several critics would argue that the US has no national security strategy in the Arctic to begin with.[10]

In February 2017, the USCG awarded $20 million worth of contracts for heavy polar icebreaker design studies and analysis.[11] Five companies will be working on the design studies which are expected to take 12 months to complete. The Coast Guard plans to award a single contract for design and construction by 2019; with building to commence by 2020, and in the water by 2023.

It was reported by CBC News that the USCG is using the National Research Council (NRC) facility in St. Johns Newfoundland for the design of the heavy icebreaker.[12] At the research facility, model boats go through simulations in an ice tank to work out the best design for the new vessels.

China's Icebreaker Capabilities - Arctic Ocean

On 6 September 2017, the Chinese Xinhua News Agency lauded the completion of the first ever Chinese voyage through Canada's Northwest Passage. The *Xue Long* or *Snow Dragon* commenced its transit through Lancaster Sound to the Beaufort Sea on the grounds of obtaining "scientific information" from the voyage of the icebreaker. The Chinese reported the ship "accumulated a wealth of experience for Chinese ships going through the Northwest Passage in the future."[13]

The Chinese News Agency reported "from Shanghai to New York, the traditional route that passes through the Panama Canal is 10,500 nautical miles, while

[10] Ibid., p. 4.
[11] "US Coast Guard Awards Heavy Polar Icebreaker Design Studies Contracts," *Naval Today*, *23* February 2017.
[12] G. Bartlett, "Coast Guard Testing New Icebreaker Designs at St. Johns Research Facility," *CBC News*, 26 July 2017.
[13] R. Fife and S. Chase. "China tests Shipping Waters in Northwest Passage," *The Globe and Mail*, 11 September 2017, p. A-3.

the route that passes through the Northwest Passage is 8,600 nautical miles; saving 7 days of time."[14]

Although the Canadian government granted the approval on the basis that China was conducting "scientific research", it seems clear that China is anticipating to increase shipping through these waters in the very near future. Chinese state media have called the Northwest Passage a "golden waterway." For the Canadian authorities, are they prepared to enforce our legislation if the Chinese substantially increase the amount of shipping through Canadian Arctic waters? It is clear that the Chinese are very interested in Canada's Arctic Ocean and are attempting to seek a larger role in the region after gaining observer status on the Arctic Council in 2013.

Despite concerns about the effect of increased Chinese shipping traffic on the fragile Arctic environment, Professor Michael Byers maintains that there is little to prevent countries such as China from using the Northwest Passage, assuming they still seek consent from the Canadian Government before entering such waters.[15]

The Chinese News Agency also reported that China sent six merchant ships through Russia's Northwest Passage in the summer of 2017, to take advantage of melting Arctic sea ice to speed the delivery of goods to North America and European markets.[16]

As the world's largest exporter state, China has an interest in securing unobstructed and expeditious movements globally. For this reason, it is unclear whether China will abide by Canadian legislation in controlling ship movements in the Northwest Passage, similar to the protocol worked out with the US. [17]

[14] N. Vander Klippe, "China Casts its Net: The Northwest Passage in Search of a Shortcut," Globe and Mail, 15 November, 2017, p. A11.
[15] M. Byers, "The Dragons New Lair," *Globe and Mail*, 15 November 2017, p. A-11.
[16] Fife and Chase "China tests shipping waters ," footnote 13,
[17] A. P. MacDonald, "China looking North: Compromising Canada's Arctic Sovereignty and Security", *Canadian Military Journal* 18, no. 1 (Winter 2017): p. 7.

An Historical Overview of Canada's Icebreaking Operations in the Arctic

An article by Captain Tom Pullen (Ret'd) of the Royal Canadian Navy gives an excellent overview of the building of various Canadian icebreakers for use in the Arctic.[18]

Pullen notes:

> The construction of the port of Churchill, Manitoba generated a requirement in 1931 for icebreaking assistance to ships, in Hudson Strait particularly, hauling grain from that port during the three month navigation season…[19] Likely the ship most associated with this task was the 4,800 tonne "N.B. Mclean." Built in 1930, with 6,500 hp, she patrolled these, and other waters for nearly 50 years.[20]

Pullen goes on to state:

> In 1952 the Department of Transport, at long last recognizing its need for a big icebreaker capable of handling winter commitments in the St. Lawrence, and the expanding requirement to resupply a growing assortment of northern weather stations and settlements each summer, produced the *d'lberville*, displacing 10,000 tonnes and developing 10,800 shaft horsepower." The *d'lberville*, like her bigger and newer consort, the *St. Laurent*, suffered from poor endurance. For years, these two have comprised the main icebreaking fleet.[21]

The other two ships referred to by Pullen were the *HMCS Labrador*, completed in 1954 and sailed for four years by the Royal Canadian Navy before it was released to the Canadian Coast Guard. Captain Pullen was the C.O of this ship that carried out extensive scientific and innovative work in the High Arctic. The ship had 10,000 shaft horsepower and a cruising range of 25,000 nautical miles.

The other ship referenced by Pullen was the Coast Guard ship, *John A. MacDonald*, which was best known for escorting the *Manhattan* in 1969, through the

[18] T.C Pullen, "The Development of the Arctic Ships", in *A Century of Canada's Arctic Islands-1880-1980* (The Royal Society of Canada, 1981), p.153.
[19] Ibid., p.157.
[20] Ibid.
[21] Ibid.

Northwest Passage. This ship was built in 1961, had 15,000 shaft horsepower, and had a cruising range of 20,000 nautical miles.

The next group of Coast Guard icebreakers fleet built were the "R" class; consisting of the *Pierre Radisson* and the *Franklin*. The *Radisson* was built in 1978 and had a 13,600 shaft horsepower with a cruising range of 15,000 nautical miles. Pullen emphatically notes in his article "all of our icebreakers at the time are capable only of summer Arctic operations. None of our icebreakers for that matter can contribute anything to our environmental, climatological, or operational knowledge of the Arctic between freeze-up and break-up. To repeat- they are summer visitors only."[22]

Pullen then referred to the company, Dome Petroleum, which operated drilling rigs for oil, in the Beaufort Sea building its own 6,500 tonne icebreaker *Canmar Kigoriak* in 1979, at Saint John, New Brunswick. The ship developed 16,400 shaft horsepower through a single centreline propeller instead of dividing between three. Dome Petroleum also in the late 1970s, designed a double hulled twin screw, icebreaking Very Large Crude Carrier (VLCC) Class X vessel using high- quality steel and with segregated water ballast tanks.[23] The company estimated that each tanker filled with oil could complete 16 deliveries per year and that 15 ships could handle a throughput of 750,000 barrels per day. Each ship was designed with 150,000 shaft horsepower and two propellers. Unfortunately, Dome ceased its operations in the Beaufort later that decade.

The other marine project referred to by other authors is the Arctic Pilot Project (APP), which was designed to test the feasibility of transporting natural gas in liquified form from Melville Island in the High Arctic to markets in eastern North America.[24]

In the early 1980s, the project, led by PetroCanada, contemplated using two 140,000 m^3 icebreaking LNG double-hulled icebreaking tankers as class VII ships (capable of continuous headway through seven feet of fast ice). The liquification facilities would be located at Bridgeport Inlet on the south coast of the island. The ships were designed for 180,000 shaft horsepower, had a length of 374 meters, and relied on three propellers. Due to economic conditions, the project was later discontinued.

[22] Ibid., p. 158-159. The third "R" class icebreaker was the *Des Groseilliers*, built in 1982.
[23] Ibid., p. 161.
[24] J. Lewington, "Lessons of the Arctic Pilot Project", in *Politics of the Northwest Passage*, ed. F. Griffiths (Kingston: McGill-Queens University Press and Montreal, 1987), p. 163.

Another company interested in Arctic marine operations was Panarctic Oils. It joined APP as an opportunity to generate income from its Drake Point field on Melville Island, which held about 5 trillion cubic feet of gas.[25] The company also hoped to use tankers to market small quantities of oil from the Bent Horn project reserves in the High Arctic, using the route similar to that of APP.[26] Early in 1974, Panarctic discovered the Bent Horn oil field on Cameron Island. In 1985, the first shipment of 100,000 barrels was made by an icebreaking tanker to a refinery in Montreal. These shipments continued until the late 1990s.

A ship also operating in the High Arctic was the 28,000 deadweight tonne Arctic Class II *M.V. Arctic*. This ship, which began operations in 1978 with substantial government assistance, was meant to supply communities in the Eastern Arctic, as well as supplying and supporting the Nanisivik mine near Strathcona Island and Cominco's Polaris mine on Little Cornwallis Island. Such mining operations have since ceased in these regions of Nunavut.

Canadian Government Decision Making- Acquiring New Icebreakers for the Arctic - Or Not?

The Canadian government first began considering that the country needed a new heavy icebreaker after the voyage of the "Manhattan" through the Northwest Passage in 1969. On the 2nd of August 1972, the *Arctic Waters Pollution Prevention Act* of 1970 was proclaimed. The *Arctic Shipping Pollution Regulations* (ASPPR) was then enacted to provide a comprehensive regime to regulate access of marine transportation to Arctic waters. ASPPR divides Canada's archipelago into 16 shipping critical zones with the severity of ice conditions in each zone based on a year-round basis with zone 1 being the most severe and zone 16 the least severe.

In the ASPPR schedules VI and VII outline mechanical and hull specifications for nine Arctic classes. Schedule VIII indicates what class of ship may enter the 16 zones at what times of year. For example, an Arctic 10 vessel may enter all 16 zones at any time

[25] Ibid., p. 167.
[26] Ibid., p. 170.

of the year; whereas an Arctic class 1 vessel is very restricted at what zones and the time of year it is allowed to transit such waters.

Professor K.M Nossal in his informative article describes the limitations of the ASPPR:[27]

> it outlines not a vessel's icebreaking capabilities, but the structural prerequisites of ships wishing to navigate the archipelago; whether an Arctic class vessel can actually navigate those zones that it is entitled to is another matter altogether.[28]

In 2010, Canada initiated the *Northern Canada Vessel Service for Zone Regulation* (NORDREG) under the *Canada Shipping Act*. When a vessel of 300 gross tonnage or vessels carrying a cargo of a pollutant or dangerous goods approaches the NORDREG Zone, they must file a Sailing Plan Report. There are three different categories of reporting procedures:

1. General, NORDREG (Arctic Canada traffic zone);
2. Coast Guard Icebreaker escort and;
3. Arctic Ice Regime shipping system messages. Whenever the Ice Regime System is used for voyages outside of the existing Zone/ date system, ships are required to submit the following two messages:
   a) Ice Regime Routing Message, and
   b) After Action Report.

In 2017, Canada in co-operation with the International Maritime Organization (IMO) assisted in the development of a new polar code, which came into effect in the same year. The *Polar Code* addresses the various hazards encountered by certain vessels that operate in the Arctic. In addition, Canada recently unveiled the new *Arctic*

[27] Kim Nossal, "Polar Icebreakers: The Politics of inertia," in *Politics of the Northwest Passage*, ed. F.Griffiths (Kingston: McGill-Queens University Press, 1987), p. 216.
[28] Ibid.

Shipping Safety Regulations.[29] The *Polar Code* and the new regulations include a variety of safety and pollution prevention measures related to vessel design and equipment, vessel operations and crew training.

Under the *Oceans Protection Plan* announced by Ottawa in August 2017, Transport Canada is supposed to take action to support safe and responsible shipping in our Arctic waters. As part of such a Plan, the Federal Government is committed to reviewing the *Pilotage Act* including governance, safety, labour models, tariffs and pilotage in the North. The Minister of Transport promised $175 million in funding to protect Arctic waters. It will be interesting to follow how and when such monies will be dispersed by the Department.

The Canadian Coast Guard also has another important commitment as a result of Canada being a part of the Arctic Council. On 30 October 2015 Canada signed an agreement to establish the Arctic Coast Guard Forum (ACGF). This agreement focuses on the establishment of areas of responsibility and co-operation for search and rescue operations and icebreaking collaboration in Arctic waters. Canada, as a result of this international agreement, is obliged to provide heavy icebreakers in such SAR operations to fulfill its obligations under this agreement. The Coast Guard would also be very involved in the mediation of shipping oil spills as a result of accidents in these waters.

Canada currently has only two heavy icebreakers; the *Louis S. St. Laurent* and the *Terry Fox*. The *Louis S. St. Laurent* came into service in 1969. It is the most powerful icebreaker in the CCG fleet but it is almost 50 years old and should have been replaced years ago. The ship displaces 14,500 tonnes and develops 17,900 kw in shaft power and is rated between a 3 and 4 Arctic Class.

As noted by Nossal: "Such a rating restricts the ship to south of 60 N from the end of March to the beginning of June. It may enter less severe zones (6-16) for six to ten months of the year."[30]

[29] A. Lakshmi, "Canada Unveils New Arctic Shipping Safety Regulations," *Marine Link*, 14 January 2018.
[30] Ibid., p. 227.

T. C. Pullen in his article mentioned the ability of the "Manhattan", at 155,000 tonnes in operating in heavy multiyear ice in Viscount Melville Sound, followed by two Coast Guard icebreakers in support:

> In general terms, the bigger the ship, the more cargo it can carry at less cost. In Arctic waters, the size-profit ratio pays another dividend: massive ships make super icebreakers. The prescription for success in breaking Arctic ice is as much a matter of mass as it is of power. The more massive the vessel the better the icebreaker, and if the requirement is year-round navigation through the Northwest Passage then only icebreaking commercial behemoths are capable of doing the job.[31]

Professor Nossal highlights the prolonged attempts to make a decision to build a new heavy icebreaker for the CCG. Such events can be summarized as follows:[32]

- On June 1921, the House of Commons Standing Committee on Indian Affairs and Northern Development urged the construction of an icebreaker with the capability of navigating Arctic waters for 10 to 12 months of the year;
- In the early 1970's, the Coast Guard proposed a two- track acquisition strategy: an Arctic class 7 for the medium term and a class 10 for the long term; nuclear powered;
- By 1976, the Federal Cabinet was persuaded that Canada's polar icebreaker should be a "hybrid"; with gas turbine engines powered by nuclear reactors;
- In March 1978, a $6 million design was announced for the project and in July 1979 a request for proposal was issued by the Department of Supply and Services, inviting contractors to submit their proposals for the nuclear propulsion system. Only the French submitted a proposal by 1980;
- In April 1981, Cabinet decided to abandon all further work on the hybrid 10, but approved a "design phase" for a Polar 8 vessel[33];

[31] Pullen, "The Development of Arctic ships," footnote 17, p. 154.
[32] Nossal, "Polar Icebreakers," p. 228.
[33] Ibid., p. 229.

- In 1983 a "funded bid" phase for the Polar 8 was planned and a total of $1.3 million was allocated for payment to three shipyards with the capacity to build such a ship. It was assumed that Cabinet would consider the "construction phase" by August 1985.

- Cabinet approves the "construction phase" of the Polar 8, in September 1985.

As noted by Nossal, the 1970s and 1980s:

> "suggested a marked lack of rational policy direction. In the space of a decade, Cabinet tentatively embraced three very different conceptions of polar icebreaking capability; each having very different implications - for Arctic navigation, for sovereignty, for Arctic ecology, for expenditures, and for the Canadian shipbuilding industry. Cabinet was not convinced of the need to expend substantial funds on a polar icebreaker."[34]

In addition, by 1981 much of the initial optimism around the Cabinet table about Arctic resource exploitation had evaporated.[35]

What is the Prognosis in Building New Icebreakers for the Canadian Coast Guard For Use in the Arctic?

After five decades when the Canadian government first considered building a new heavy icebreaker for use in our Arctic Ocean, how much further have we progressed in reaching this goal? Twenty years ago, Professor Nossal noted "the politics of inertia by Cabinet decision makers on this subject."[36] Has any progress been made by Ottawa in addressing the issue of replacing the Coast Guard's aging icebreaker fleet? The prospects in addressing this important issue does not look promising, based on the past history of attempting to rejuvenate this fleet of ships.

[34] Ibid., p. 231.
[35] Ibid., p. 233.
[36] Ibid.

As a result of Canada's National Shipbuilding Strategy (NSS) in 2011, Seaspan Shipyards in Vancouver was given the contract to build the polar icebreaker the *John G. Diefenbaker* which was originally due to be completed by 2017. The cost for building this vessel was estimated at $1.3 billion.[37] The shipyard is currently building three Offshore Fishery Patrol Vessels (OFPV's) for the CCG. On 8 December 2017, Seaspan launched the first of these vessels for the CCG. Because of the limited capacity at the yard, two joint support ships (JSS) are scheduled to be built for the Royal Canadian Navy; ahead of the *Diefenbaker*. Since construction of these two ships has not begun to date, although it was recently reported that work will not begin to start until at least 2019.[38] It is difficult to project when the polar icebreaker project will be completed. As reported in the National Post on 1 December 2017: "The Liberals have said they can't provide parliament with a schedule for the delivery of the supply ships or the icebreaker because they deem such information secret."[39] What is so secret in the Department of Public Services and Procurement Canada releasing such information? Similar to the procurement of capital equipment for the Department of National Defence, obtaining the timing and costs of various projected programs is shrouded in mystery.

In a report conducted by Transport Canada in 2016 on the Canadian Coast Guard, they remarked:

> The Canadian Coast Guard fleet is ageing, which has implications for maintenance as well as procurement. Given that 29 percent of the larger vessels are more than 35 years old and close to 60 percent of small vessels are older than the design life of 20 years; it is not surprising that the number of major systems repairs required is increasing, vessel days are decreasing, and the number of ships out of service is increasing over time…. The Canadian Coast Guard is not receiving the political attention, or the administrative and financial resources it requires. [40]

On 17 November 2016, the federal government asked industry to begin drawing up various options for providing icebreaking services, including the potential cost and

[37] D. Publiese, "European Warship Bid could Save $32 B," National Post, 1 December 2017, p. NP-1.
[38] D. Pugliese, "No Start on Supply Ships till 2019," *National Post*, 16 January 2018, p. N-3.
[39] D. Pugliese, "Liberals Won't Give Delivery Schedule For Supply Ships," *National Post,* 1 December 2017, p. NP-1.
[40] "Canada Transport Act Review Report," *Transport Canada* 1 (25 February 2016): pp. 220-223.

availability of possibly leasing from private companies after a CCG ship is taken out of service as a result of an "engineering challenge."[41]

It seems clear that the shipping season in the Northwest Passage will be extended due to the receding of ice in these waters due to climate change. As a result, foreign ships will be transiting the Passage much earlier than in the past and at times relying on Canadian Coast Guard icebreakers to assist them on these voyages. In addition, in concert with the new R.C.N Arctic Offshore Patrol Ships (AOPS) they will assist in ensuring that foreign ships will comply with our Arctic marine laws and regulations. The 19th of December 2017 marked the beginning of construction at the shipyard in Halifax for the third AOPS vessel.

Unlike Russia and its Northern Sea Route, Canada is not promoting the North West Passage (NWP) as an international shipping route, with the result it may be adverse to creating an improved shipping corridor scheme in these waters which would enable and encourage further usage in the Passage. [42] Foreign vessels will still have to comply with the United Nations *Convention on the Law of the Sea* (UNCLOS) and Canadian legislation and regulations before entering the NWP. A significant issue for Canada will be to effectively monitor and prosecute any foreign ships who do not comply with our marine laws on a year round basis in entering the waters of our Arctic Ocean.

The problem which still exists for over four decades is the fact that our CCG still needs to construct a number of heavy icebreakers for the Arctic; sooner than later. As described earlier, Canada's largest heavy icebreaker is close to 50 years old; well beyond its serviceable due date. An additional problem for the CCG is the lack of deep water ports in the High Arctic. Unlike Russia, there has been little political will in Ottawa to build such infrastructure in the Arctic. D.N.D was attempting to rebuild the docks at the old Nanisivik mine site in Nunavut. To date the costs have exceeded the estimates for repairing the jetty with the result such facilities have been unusable for either DND or the Coast Guard.

[41] L. Berthiaume. "Icebreaker Shortage has Coast Guard Looking to Lease," *Calgary Herald*, 18 November 2016, p. NP3.
[42] MacDonald, "China Looking North," footnote 16, p. 7.

With Canadian shipyards limited in building such ships in the short term, will the Canadian government lease such ships from elsewhere or have them built outside of Canada, such as Finland. Recognizing it takes approximately eight years to build such a ship, Ottawa must determine soon to develop a substantive procurement plan to build these icebreakers, before the existing ships become unserviceable because of age. This situation is not unique. In 2014, *HMCS Protecteur* was the first Joint Support Ship (JSS) of the RCN, which was removed from service as a result of a major fire followed by "HMCS Preserver" which became physically unsafe after 40 years of service. The result was that the naval fleets on both coasts became reliant on contracts for providing such support services from Chile and Spain. Unless action is taken soon to replace our existing icebreakers, the Coast Guard can be left in a similar situation as the R.C.N - with no heavy icebreakers operational to augment the possible increased number of foreign ships transiting the Northwest Passage.

As noted by Professor Nossal, "Acquiring icebreaking capability has been marked by a tendency for both Ministers and bureaucrats to wait until the state is presented with clean and unambiguous demands for icebreaking services by readily identifiable clients before contracting with indigenous shipyards for icebreaker construction."[43] Nossal argued that such inertial factors explain why the Canadian government is not much closer to acquiring new polar icebreakers close to fifty years after the voyage of the *Manhatten*. Many critics would still maintain there are valid reasons today for justifying a new Canadian icebreaker fleet for operations in the Northwest Passage, as foreign shipping is bound to increase in these Arctic waters in the very near future.

[43] Nossal, "Polar Icebreakers," footnote 24, p. 238.