



Potential for a Whole-of-Government, Year-Round Presence in the High Arctic

Lieutenant-Commander Anonymous

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Exercise Solo Flight

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Reconsidering Nanisivik: Potential for a Whole-of-Government, Year-Round Presence in the High Arctic

INTRODUCTION

In 2019, Government of Canada (GofC) published “*Canada’s Arctic and Northern Policy Framework*,” (CANPF) with the vision of “strong, self-reliant people and communities working together for a vibrant, prosperous and sustainable Arctic and northern region at home and abroad, while expressing Canada's enduring Arctic sovereignty.”¹ One of the stated government priorities speaks to security and defence of Canada and the northern and Arctic residents through a whole-of-government approach.²

This meshes with the Canadian Armed Forces’ (CAF) “*Strong Secure Engaged: Canada’s Defence Policy*” (SSE), which has dedicated sections detailing the CAF’s Arctic priorities for each of the services and domains. The Royal Canadian Navy’s (RCN) Arctic focus includes the operation of the Arctic and Offshore Patrol Ships (AOPS) and the Nanisivik Naval Facility (Nanisivik).³

The RCN could leverage interdepartmental cooperation for developing Nanisivik to further the Government of Canada’s priority of “ensuring that Canada and our northern and Arctic residents are safe, secure and well-defended”⁴ by expanding the Naval facility to year-round operations, with a functional airfield, and offering to partner with the CCG to support an additional Vessel Traffic Management System (VTMS) site, and other government departments (OGD) to support a fourth Maritime Security Operations Centre (MSOC) location.

This essay will discuss background information on the Northwest Passage (NWP), Maritime Domain Awareness (MDA), and Nanisivik. It will then discuss how Nanisivik, modified from current intentions to include year-round operations and an airport, can be used as a maritime security and MDA hub near the NWP. This could include the potential partnering with the Canadian Coast Guard (CCG) and the possibility of a Marine Communications and Traffic Services (MCTS), and partnering with OGDs to form a fourth MSOC. It will then discuss the uses of the MCTS, MSOC, and whole-of-government approach to Nanisivik outside of military and criminal threats to include human and environmental security. And finally, it will cover some of the possible challenges to this concept, including funding, resource cost to the RCN, OGD buy in, and considering Nanisivik, Iqaluit, and Resolute.

¹ Global Affairs Canada, *Canada’s Arctic and Northern Policy Framework*. (Ottawa: Canada Communications Group, 2019), 8. [nth-arctic_northern_policy_framework_1662642171557_eng \(2\).pdf](#)

²*Ibid.*

³ Department of National Defence, *Strong, Secure, Engaged: Canada’s Defence Policy*. (Ottawa: Canada Communications Group, 2017), 34-35. Strong, Secure, Engaged. Canada's Defence Policy.

⁴ *CANPF*, 50-51.

BACKGROUND

Northwest Passage

Climate change is affecting the Arctic two to three times faster than the rest of Canada.⁵ Rising temperatures means there is less ice, and what is there is not as sturdy and does not last as long as before. There are “extensive sea ice-free periods projected by mid-century for the Canadian Arctic.”⁶ Not only does this greatly affect the Indigenous people who inhabit the Arctic and North, threatening their traditional hunting grounds and transportation, it is also making the Arctic Ocean navigable for more of the year.⁷

Once passable for short summer months, and only with the assistance of an icebreaker, the NWP is opening for longer periods of time, and allowing more tourist and commercial traffic to transit through Canada’s sovereign waters.⁸ There is increased international interest in the natural resources found in Canada’s Arctic, as well as the ability for commercial traffic to transit through the passage saving precious time moving cargo around the world.⁹

The region has become an important crossroad where issues of climate change, international trade and global security meet. As melting sea ice opens shipping routes, it is also putting the rich wealth of northern natural resources within reach. Increased commercial and tourism interests also bring increased safety and security challenges that include search and rescue and human-created disasters.¹⁰

There is potential for building a vibrant northern economy to better support the local population, “the Government of Canada and its partners will close the gaps that exist between this region, particularly in relation to its Indigenous peoples, and the rest of the country.”¹¹ As outlined in CANPF, “growing a diversified and sustainable economy is vital to cushioning the northern economy from boom and bust cycles.”¹²

However, this increased traffic also brings with it additional security risks including ease of foreign surveillance from potential adversaries, transportation of illicit cargo, additional routes into Canada for criminal entities, the risk of collision or requirement for a mass Search and Rescue (SAR) and Casualty operation, polluting the environment, stealing of resources including illegal fishing, and increased disruption of the Indigenous and Inuit traditions and culture, further stressing the delicate resources these communities rely on.

⁵*Ibid.*, 48.

⁶ *Ibid.*, 18.

⁷ *Ibid.*

⁸ Luke Copland, Jackie Dawson, Adrienne Tivy, Frances Delaney, and Alison Cook, “Changes in Shipping Navigability in the Canadian Arctic Between 1972 and 2016”. *FACETS*, no. 6(2021): 1069-1087. <https://doi.org/10.1139/facets-2020-0096>

⁹ *Ibid.*

¹⁰ *CANPF*, 4.

¹¹ *Ibid.*, 7.

¹² *Ibid.*, 6.

Higher levels of activity also increase the acute security risks associated with irregular movements of people and goods, the pursuit of foreign interests and human-induced disasters. As a whole, these changes highlight the importance of enhancing situational awareness across the region, and of promoting research and observation, including charting and mapping, that will provide the information necessary for sound decision-making.¹³

There is an evident need and responsibility for this increase in vessel traffic to be monitored, assessed, and responded to as required, as is done in the rest of Canada's waters. How that is achieved follows next.

Maritime Domain Awareness

MDA, or surveilling Canada's waters and monitoring vessels' locations and activities, involves multiple government departments working in tandem. The CCG runs Canada's MCTS programs through various communications and sensor equipment allowing information to be passed between vessels and shore-based units regarding safe navigation and protection of the marine environment.¹⁴ Participation in the traffic services is mandatory for vessels over 300 tonnes in accordance with the Northern Canada Vessel Traffic Services Zone Regulations (NORDREGS),¹⁵ and includes reports sent at specific points via VHF radio, as well as information received from Automatic Identification System (AIS), surveillance radar, and marine telephone.¹⁶

The CAF uses these systems as well as satellite information and aerial and maritime surveillance reports to contribute to the MDA and also uses this information for decision making on possible security threats.

Information is shared with OGDs through the MSOC, which involves the following partner organizations: Department of National Defence, Royal Canadian Mounted Police (RCMP), Department of Fisheries and Oceans (DFO), CCG, Canada Border Services Agency, and Transport Canada.¹⁷ These departments can share intelligence and information within the confines of their individual regulations to build a more complete picture, and can coordinate responses to avoid duplication of effort.¹⁸

Currently there are three MSOCs in Canada: Victoria for the West Coast, Halifax for the East Coast, and Niagara for the Great Lakes.¹⁹ The Arctic is under the responsibility of Halifax based on the quickest route to the Arctic.²⁰ Joint Task Force North (JTFN), headquartered in

¹³ *CANPF*, 19.

¹⁴ Canadian Coast Guard, "Canadian Coast Guard Vessel Traffic Services," last modified 08 December 2022, Canadian Coast Guard vessel traffic services (ccg-gcc.gc.ca)

¹⁵ *Ibid.*

¹⁶ *Ibid.*

¹⁷ Transport Canada, "Marine Security Operation Centres," last modified 23 September 2020, Marine Security Operation Centres (canada.ca)

¹⁸ *Ibid.*

¹⁹ *Ibid.*

²⁰ *Ibid.*

Yellowknife with satellite sites in Whitehorse and Iqaluit, also provides an essential Command and Control and Headquarters function to any CAF operations in their area of responsibility, as well as local knowledge and important relationships to the communities and the Canadian Rangers.²¹

Nanisivik

In 2007, the Canadian Government announced it would build a Naval Facility in Nanisivik, NU, shown on Figure 1.²² This former mining town was seen as an ideal spot based on having deep water port capabilities, existing airfield, and proximity to the eastern entrance to the NWP, shown on Figure 2.²³ It would be a spot for the RCN's new AOPS to refuel, resupply, and receive shore support in the Arctic.²⁴

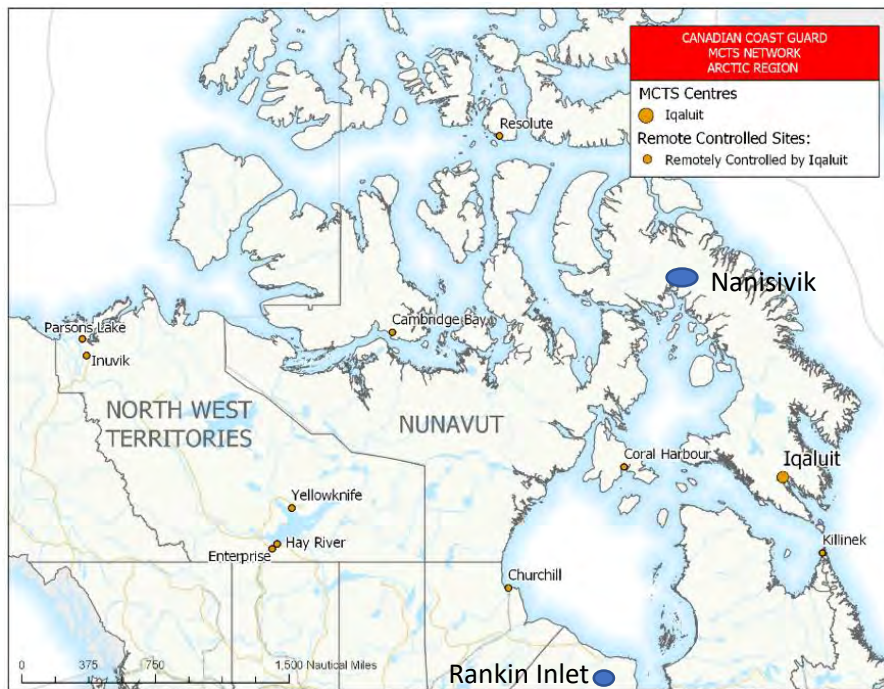


Figure 1 – CCG MCTS centres with Nanisivik and Rankin Inlet added by author
Source: CCG, Marine Communications and Traffic Services Program Information

²¹ Department of National Defence, “Joint Task Force North,” last modified 07 April 2018, Joint Task Force North - Canada.ca

²² Steven Chase, “Long-Delayed Naval Facility in the High Arctic Now Postponed to 2023,” *The Globe and Mail*, 30 March 2022, <https://www.theglobeandmail.com/politics/article-long-delayed-naval-facility-in-the-high-arctic-now-postponed-to-2023/>

²³ *Ibid.*

²⁴ *Ibid.*

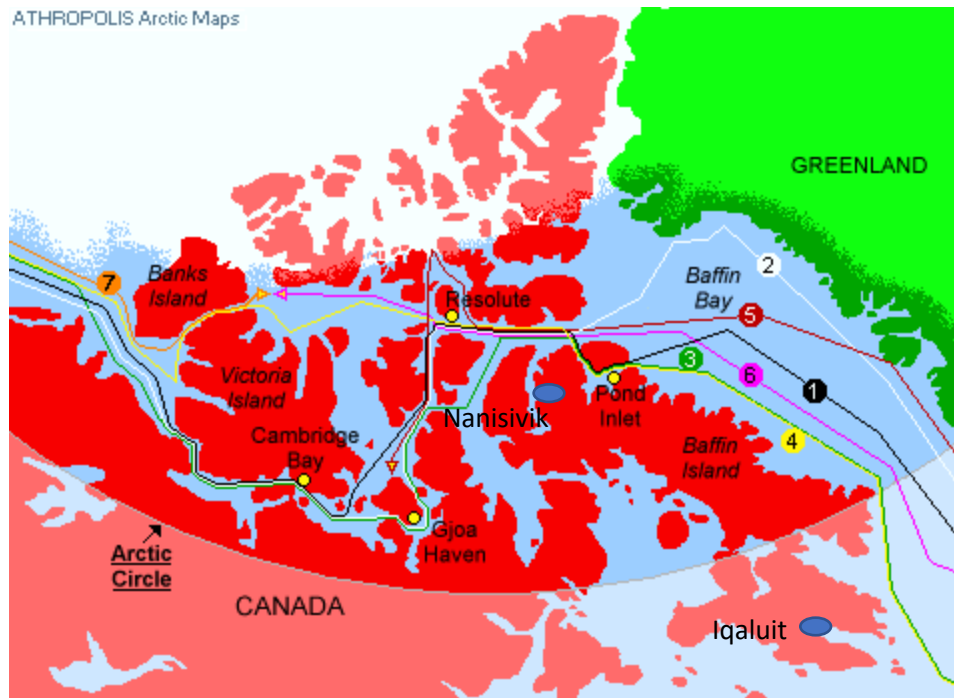


Figure 2 – Possible Routing through NWP with Nanisivik and Iqaluit added by author
Source: athropolis.com, Maps of the Northwest Passage

Challenges arose as costs became greater than anticipated and the project budget was reduced.²⁵ The airfield was no longer supported, and the storage areas were to be unheated.²⁶ Then the project was further reduced from a year-round facility to operating only during the warmer months.²⁷ Eventually the lack of heated fuel tanks meant that the station would only have people there for about a month each year, and fuel storage would not be possible.²⁸

Many delays in construction occurred because of the very short building season – only four months each year were warm enough for construction, and getting materials to the remote Arctic was difficult.²⁹ Adding on multiple lost years due to COVID and the road being washed out between the closest settlement of Arctic Bay and Nanisivik,³⁰ and the Facility is scheduled for completion and use in 2024-2025, 16 years after it was announced.³¹

Nanisivik is located approximately 2,610Km from Iqaluit, and approximately 440 Km from Resolute, by sea.³² At about 325 Km from the entrance to Lancaster Sound³³, it is roughly halfway between Resolute and the eastern edge of Lancaster Sound. While there are six to seven

²⁵ *Ibid.*

²⁶ *Ibid.*

²⁷ Office of the Auditor General of Canada, “2022 Report of the Auditor General of Canada, Report 6 – Arctic Waters Surveillance,” last accessed 08 May 2023, Report 6—Arctic Waters Surveillance (oag-bvg.gc.ca)

²⁸ *Ibid.*

²⁹ *Ibid.*

³⁰ *Ibid.*

³¹ *Ibid.*

³² Google Maps measurement tool used by author

³³ *Ibid.*

different routes through the western half of the NWP, all but one pass by Resolute via Lancaster Sound,³⁴ and Nanisivik is 100Km from Lancaster Sound down Admiralty Inlet.³⁵ Similarly, all also pass by Iqaluit while transiting Davis Strait.³⁶

Nanisivik's location, together with the capacity for a deep-water port, airport, and year-round operations are important aspects for the follow-on discussion. The location offers access to the NWP, while being located further east than Resolute means that in certain weather conditions, it may not be blocked in with ice to the same extent as Resolute. Its location in a fjord will protect it from some of the prevalent winds moving through Lancaster Sound. The Nanisivik jetty needs repairs, which the GofC has already approved funding for,³⁷ and it has deep water capability. The minimum depth at the existing jetty is approximately 15m, allowing access for many cargo vessels.³⁸ The airport requires infrastructure work and funding; however, it would be a boon to a year-round multi-departmental facility. There is an airport in Arctic Bay, about 35 Km away, however the road between Arctic Bay and Nanisivik is not reliable; a flood washing out the road made it impassable for the entire 2021 building season.³⁹ Enabling year-round operations would provide a location for potential whole-of-government operations and continuous presence in the high arctic.

ARGUMENT 1

Nanisivik Offers Increased Security Through Enhanced MDA Shared with OGDs

Nanisivik could be an additional site for continuous CAF presence in the Arctic. An ideal configuration would be closer to the original plans with some lodging facilities, storage areas, and heated fueling capabilities.⁴⁰ This would provide another CAF site for year-round operations and an Arctic RCN presence for an extended period of time during the year where ships could be supported. Adding an airport would further enable this capability with the possibilities of direct air resupply, crew and troop transport, and refueling of aircraft. Not only helicopters and fixed wing transport planes, but ideally fighter jets as well, extending the CAF's range of operations as well as NORAD response.⁴¹

Having a Naval facility near the NWP allows for quicker responses to maritime-based threats in the area. The Harry DeWolf Class AOPS would be the obvious primary Navy user of the facility, as the RCN's ice capable warships designed partly with this mission set in mind.⁴²

³⁴ Athropolis.com, "Maps of the Northwest Passage," last accessed 08 May 2023, Maps of the Northwest Passage (athropolis.com)

³⁵ Google Maps

³⁶ Athropolis.com

³⁷ Report 6 – Arctic Waters Surveillance

³⁸ GPS Nautical Charts, "Nanisivik Marine Chart: CA_CA573380), last accessed 08 May 23, i-Boating : Free Marine Navigation Charts & Fishing Maps (gpsnauticalcharts.com)

³⁹ Report 6 – Arctic Waters Surveillance

⁴⁰ *Ibid.*

⁴¹ Chase

⁴² Adam Lajeunesse, "Canada's Arctic Offshore and Patrol Ships (AOPS): Their History and Purpose," *Marine Policy*, Volume 124 (2021) , <https://doi.org/10.1016/j.marpol.2020.104323>.

Even though they are categorized as patrol warships with constabulary capabilities versus combat capable warships like the Halifax-Class Frigates,⁴³ they can still contribute in meaningful ways. They have Intelligence, Surveillance and Reconnaissance (ISR) capabilities, can conduct presence and escort operations, have multiple small boats including a landing craft for transportation, and have a helicopter landing pad and hangar. “AOPS will provide armed, sea-borne surveillance of Canadian waters, including in the Arctic. They will enforce sovereignty, cooperating with partners, at home and abroad, and will provide the Government of Canada with awareness of activities in Canada’s waters.”⁴⁴

It follows that other less ice-capable classes of warships can also use Nanisivik as a base of operations in warmer months as well. An RCN facility north of Halifax to offer fuel, resupply, a site for contractor repair and trials, crew change needs, etc. that has the additional layer of CAF and government security, which simplifies the processes for the ships. All of this serves to expedite a ship’s return to operations at sea, their main purpose and goal. This could extend as well to our allies – another NATO facility for joint operations. Indeed, SSE states:

Underpinning naval capability will be a continued emphasis on building and maintaining a picture of what is happening in our own waters and increasingly overseas – as a means to anticipate and respond to threats, in cooperation with other government departments and agencies as appropriate, as well as our allies.⁴⁵

Nanisivik’s location in the High Arctic allows for more real time situational awareness (SA) in the event that RCN presence is needed for an event, whether that is a military-related threat, or assistance to an OGD for SAR, environmental problem, support to law enforcement, etc. Having more warships in the Arctic for longer periods of time also gives JTFN and the Maritime Component Commander eyes and ears on location, providing additional information to facilitate Command SA and decision-making.

Canada's ability to respond to regional challenges, provide security and ensure compliance with our laws and regulations largely depends on our ability to build and maintain a comprehensive picture of what is happening across the region, as gaps can have life-threatening consequences.⁴⁶

If Nanisivik was developed for year-round operations, the CAF could offer to partner with OGDs. SSE has stated that the CAF will “increase presence in the Arctic over the long term and work cooperatively with Arctic partners.”⁴⁷ The CCG would be an obvious choice given their icebreaking and arctic operations expertise. They have a long history of operating in Canada’s North, and have built relationships with the communities there. The CCG “enables the summer re-supply of communities in Canada’s North, and provides key services, including

⁴³ Department of National Defence, Director General Naval Force Development, *Royal Canadian Navy Strategic Lexicon*, (Ottawa: Canada Communications Group, 2022), 77.

⁴⁴ SSE, 34-35.

⁴⁵ *Ibid.*

⁴⁶ CANPF, 41.

⁴⁷ SSE, 14.

search and rescue, icebreaking, support for scientific research, marine communications and traffic services, aids to navigation, and marine environmental response.”⁴⁸

An essential Government of Canada presence in the Arctic and North, the CCG maintains year-round operations in Iqaluit, Yellowknife, and Hay River.⁴⁹ However, year-round presence in Nanisivik would give them another location for SAR, scientific research, and MCTS.

In response to rapid regional changes, roundtable participants recognized the need for a whole-of-government approach to safety, security and defence. As part of this, increased presence in the region by the Canadian Armed Forces and the Canadian Coast Guard was highlighted as an important response.⁵⁰

There may not be as much of a requirement for SAR services in the middle of the winter period, however there are still flights and ice crossings made year-round. With rising temperature making the NWP transitable for longer each year, the need for SAR will increase. Additional SAR capability increases not only human security directly, but can also help avoid or minimize an environmental disaster stemming from cargo, fuel, and other substances that could harm the Arctic environment.

There is a scientific research station in Cambridge Bay,⁵¹ but Nanisivik is further north. While Nanisivik is south of Alert, adding an additional government location where research could take place would be valuable considering the overall lack of data sets and information from the Arctic.

The current lack of baseline data poses major challenges to evidence-based decision-making. The responsible use of data can help cultivate a better understanding of the 'big picture' of environmental issues, contributing to the development of informed, data-driven policy and decisions that can help Arctic and northern communities build resiliency in the face of climate change.⁵²

Increased availability of scientific data allows for a more well-informed decision-making process, including security decisions.

Arctic MCTS is currently controlled from Iqaluit May to December, and Les Escoumins, QC the rest of the year.⁵³ CCG uses VHF radio, AIS, surveillance radar, and vessel traffic management information systems to pass and receive information from vessels within their area of control.⁵⁴ Vessels will report in at specific locations and provide such information as their

⁴⁸ Canadian Coast Guard, “Canadian Coast Guard Completes 2022 Operational Season,” last modified 15 December 2022, Canadian Coast Guard Completes 2022 Arctic Operational Season - Canada.ca

⁴⁹ Canadian Coast Guard, “Marine Communications and Traffic Services Program Information,” last modified 11 July 2022, Marine Communications and Traffic Services program information (ccg-gcc.gc.ca)

⁵⁰ *CANPF*, 34.

⁵¹ CCG, “Marine Communications and Traffic Services Program Information.”

⁵² *CANPF*, 19.

⁵³ CCG, “Marine Communications and Traffic Services Program Information.”

⁵⁴ CCG, “CCG Vessel Traffic Services.”

name, tonnage, cargo, destination and estimated time when expected to arrive there, the time to the next calling in point if applicable based on their routing, and if they are taking actions such as coming to anchor or coming alongside in a port.⁵⁵ Vessels can also contact MCTS in case of an emergency to ask for assistance and to let other vessels in the area know what is happening.⁵⁶ What the vessel is reporting to MCTS should match with what the vessel has set to show in their AIS information, as well as what their actual movements end up being. All of this information contributes to MDA, and if something between the different sources of information does not match, it can be an indication of illegal activity.

If there was an MCTS in Nanisivik, along with the additional sensors and receivers as required, it could increase the MDA for the region and provide additional real time information to aid in the decision-making process. It would extend the range of the VTMS, providing more regulated and orderly vessel progression through the NWP. As opposed to, or in addition to, a vessel's required daily report to Iqaluit as per the NORDREGS,⁵⁷ additional calling in points could be created. This would give the MCTS more SA as to where a vessel is at a given point in time, as well as indication on their intended routing. If there was an information sharing agreement between the MCTS and CAF through the CCG, this real time SA could prove vital to any required responses from the CAF or OGDs depending on the situation. The RCN could have additional early warning and identification of vessels transiting through the NWP and thus a better ability to intercept vessels of interest. This can also be a building block to enhance the Arctic maritime capabilities that are part of the NORAD enhanced agreement.⁵⁸

In addition to the CCG, partnering with OGDs in Nanisivik would enhance the whole-of-government approach to Arctic security. The facilities could be used by the RCMP for law enforcement activities, either with their own vessels or partnered with the RCN and CCG for transportation. The RCMP already has a vast presence in the Arctic, often the only government presence in some of the more remote areas.⁵⁹ Nanisivik could be an additional resource for them not only for water-born law enforcement, but also another location for ISR, training, and airlift.

Transport Canada is the "lead federal department that regulates shipping"⁶⁰ working with the CCG, DFO, and Environment and Climate Change Canada.⁶¹ Their Marine Safety and Security teams enforce regulations and their Duty Officers monitor Canadian Arctic shipping daily and conduct monitoring, compliance, and enforcement with the CCG.⁶² Their National Aerial Surveillance Program is a key supplier of ISR for Canada's security,⁶³ and the Nanisivik

⁵⁵ Canadian Coast Guard, "Radio Aids to Marine Navigation 2023," last modified 13 April 2023, Radio Aids to Marine Navigation 2023 Part 3: Vessel Traffic Services (ccg-gcc.gc.ca)

⁵⁶ *Ibid.*

⁵⁷ Justice Laws Website, "Northern Canada Vessel Traffic Services Zone Regulations," last modified 27 April 2023, Northern Canada Vessel Traffic Services Zone Regulations (justice.gc.ca)

⁵⁸ Canadian Armed Forces, "NORAD Modernization Project Timelines," last modified 24 March 2023, NORAD modernization project timelines - Canada.ca

⁵⁹ Royal Canadian Mounted Police, "RCMP in the North," last modified 08 July 2016, RCMP in the North | Royal Canadian Mounted Police (rcmp-grc.gc.ca)

⁶⁰ Transport Canada, "Arctic Security," last modified 24 September 2020, Arctic Security (canada.ca)

⁶¹ *Ibid.*

⁶² *Ibid.*

⁶³ *CANPF*, 79.

airport could be a refueling stop, or an additional base of operations, extending their range and offering another government facility in the event of inclement weather or mechanical difficulties.

Fisheries and Oceans Canada has offices across the Arctic, and is responsible for management of and compliance monitoring and enforcement for northern fisheries, marine mammals, and Marine Protected Areas and Refuges.⁶⁴ They too could use Nanisivik as a base of operations for the NWP, a refueling and resupply area, exchange of ISR, and airlift and air access.

The whole-of-government approach and ISR interoperability and information sharing would make sense organized as a fourth MSOC. There are already three MSOCs in Canada, with these partner OGDs and the CAF involved, so the concept is proven. Copying an existing organizational and Command and Control structure would streamline the process. This is a natural extension of Nanisivik as a GofC maritime hub in the High Arctic adjacent to the NWP.

In addition to the presence and historical habitation Canada's Arctic and northern residents including the Inuit and First Nations, the presence of the GofC and its activities assist in "Canada's enduring sovereignty [being] continually expressed."⁶⁵ As well, the "established and permanent presence... of the CAF... demonstrates Canadian sovereignty,"⁶⁶ as does the "investing in regional infrastructure."⁶⁷ Through CANPF, the GofC has pledged that "Canada will continue to exercise the full extent of its rights and sovereignty over its land territory and its Arctic waters, including the Northwest Passage."⁶⁸ Here too, then, establishing Nanisivik as a continually operating base, supporting GofC partners in achieving their respective and joint Arctic mandates, supports CANPF goals. It adds another facet to Canadian sovereignty in the Arctic and north, shoring up the GofC aim of "firmly asserting its presence in the north."⁶⁹

Nanisivik as a GofC maritime security centre by the NWP would send a strong message reinforcing Canada's commitment to Arctic security within Canadian waters. The NWP is opening and becoming increasingly transitable without an icebreaker.⁷⁰ Saving days or weeks off of transit times makes business sense and maximizes profits.⁷¹ Arctic waters becoming easier to transit overall also creates more opportunities for destination shipping to and from the Arctic. If Canada is to control international shipping through the Arctic Archipelago, this proposed vision of a year-round whole-of-government presence in Nanisivik reinforces Canada's sovereignty and better enables enforcement of the various laws, rules, and regulations to preserve the rules-based international order. As per CANPF, "improved situational awareness, including through

⁶⁴ Fisheries and Oceans Canada, "Fisheries and Oceans Canada in the Arctic Region," last modified 23 March 2022, Fisheries and Oceans Canada in the Arctic Region (dfo-mpo.gc.ca)

⁶⁵ *CANPF*, 20.

⁶⁶ *Ibid.*

⁶⁷ *Ibid.*, 34.

⁶⁸ *Ibid.*, 60.

⁶⁹ *Ibid.*

⁷⁰ Jessica Murphy, "Is the Arctic Set to become a Main Shipping Route?", *BBC News*, 01 November 2018, <https://www.bbc.com/news/business-45527531>

⁷¹ *Ibid.*

NORAD and the Maritime Security Operations Centres, will also be key to protecting our north now and into the future.”⁷²

ARGUMENT 2

Nanisivik Improves Security of Arctic Residents Through Enhanced SA

A Nanisivik-based MSOC would do more than enable SA, decision-making, and maritime and air response to illicit or military security threats. The enhanced SA from the supported ISR capabilities and MSOC information sharing would benefit the Arctic and Northern residents as well. Better SA can bring earlier awareness and faster response to vessels and aircraft in distress, including those operated by Arctic and northern residents, supporting a faster response time to get on scene and aid. Having ships with helicopter landing capabilities also provides an additional method for air extraction to medical facilities. This is in line with CANPF:

Canada will also continue to ensure that the Canadian Arctic and North and its people are safe, secure and well defended. As part of achieving this goal, Canada has committed to increasing Search and Rescue reaction and responsiveness to emergencies for Arctic residents and visitors.⁷³

Greater SA, quicker response, and an additional place for vessel and air support for law enforcement from OGDs means increased compliance with rules and regulations protecting the Arctic environment. An increasingly ice-free and navigable NWP will bring more large commercial vessels through the Arctic.⁷⁴ The SA and support to OGDs that year-round Nanisivik would provide would help OGDs minimize the environmental impact of the increased number of ships. This in turn will help preserve the Arctic resources that the Indigenous and Inuit traditions, culture, and way of life rely on while supporting the socio-economic development that increased trade and tourism would bring to the region.⁷⁵ Additionally, enforcement of fishing regulations and natural resource development will help preserve economic and resource rights for the Indigenous people, and the Canadian developments that they support.⁷⁶

A Nanisivik MCTS supporting an NWP vessel traffic service, controlling and monitoring the passage of vessels, would ensure that their routing and actions were not only within regulations, but also in line with what the local population and territorial governments had agreed upon, enforcing the Northern Low-Impact Shipping Corridors.⁷⁷ This would help minimize the impact on the traditional and cultural way of life for the Indigenous population.

⁷² CANPF, 51.

⁷³ *Ibid.*, 5.

⁷⁴ *Ibid.*, 18.

⁷⁵ *Ibid.*, 60.

⁷⁶ *Ibid.*, 75.

⁷⁷ Arctic Council and Protection of the Arctic Marine Environment (PAME), “Overview of Low Impact Shipping Corridors & Other Shipping Management Schemes”, May 2021, <https://pame.is/document-library/pame-reports-new/pame-ministerial-deliverables/2021-12th-arctic-council-ministerial-meeting-reykjavik-iceland/788-overview-of-low-impact-shipping-corridors-other-shipping-management-schemes/file>

Unregulated vessel traffic and accidents could have a devastating impact on Arctic and northern people and the unique environment in which they live. As these waterways are Canada's internal waters, Canada will continue to manage vessel traffic within our national waters to ensure that navigation is conducted in accordance with our rigorous safety and environmental protection standards.⁷⁸

MCTS provides real-time information to vessels, including location and destination of other vessels they may meet, navigation hazards, weather warnings, etc.⁷⁹ This can help to avoid collisions or groundings of ships, and the resultant danger to humans and the environment. An additional MCTS in Nanisivik would also be a redundancy for Iqaluit in case of emergency or malfunction there. And it would help to control traffic in the event that there are a large number of ships, similar to other areas of Canada with busy vessel traffic and multiple MCTS along a waterway or route.⁸⁰

Any enhancement to Nanisivik would need to be in accordance with the Arctic and Northern Policy Framework, and include consultation with the Nunavut government as well as the Arctic Council and other Indigenous groups as appropriate.⁸¹ This would be an excellent opportunity to continue to build these important relationships between the GofC and the Arctic and Northern population. RCN could find ways to support the Arctic and northern residents with the Nanisivik development, perhaps through public access to amenities and working with the Nunavut government for emergency and disaster planning.

POTENTIAL BARRIERS

The proposed increase in scope would require additional funding approval, as well as concept and planning approval. The sunk cost fallacy would have to be investigated and avoided. However, the scope of Nanisivik originally had amenities to enable year-round operations, a longer time period when fueling would be offered, and an airport with a jet-capable runway.⁸² The approvals of concept were there, albeit a few governments ago.

The great importance of the Arctic has been realized, and planning efforts and ways forward have been found through the CANPF and the work of the Arctic Council.⁸³ Each of the GofC departments discussed here have policies, operations, and practices on Arctic operations. And the potential security threats are known and acknowledged, from finding Chinese buoys and balloons,⁸⁴ to increased Russian aggression and capabilities, and to commitments made for

⁷⁸ CANPF, 19-20.

⁷⁹ CCG, Maritime Communications and Traffics Services Program Information

⁸⁰ *Ibid.*

⁸¹ CANPF, 45.

⁸² *Report 6 – Arctic Waters Surveillance*

⁸³ CANPF

⁸⁴ Robert Fife and Steven Chase. "Canadian Military found Chinese Monitoring Buoys in the Arctic: Former Lieutenant-General Says Devices Likely used to Monitor U.S. Nuclear Submarine Traffic." *The Globe and Mail*. 21 February 2023.

NORAD enhanced warnings systems and reactions.⁸⁵ Given the importance and high priority the GofC has placed on the Arctic and Arctic security, perhaps additional funding may be secured.

The RCN, and the CAF writ large, are in a personnel crisis. The CAF is short over 10,000 people, with the RCN being almost 20% under crewed.⁸⁶ Expanding on the Nanisivik scope and mission places additional strain on the personnel in the RCN. As changes, approvals, and infrastructure take time, Nanisivik may be expanded in phases, and the RCN may be able to take a phased approach to crewing Nanisivik, increasing the number of personnel as each phase roles out, and anticipating that the personnel crisis will be adequately alleviated as each new crewing level is needed.

Issues with Command and Control, authorities, and processes of the MSOCs have been identified by the Auditor General in 2022's "*Report 6 – Arctic Waters Surveillance*".⁸⁷ Each department has agreed to the assessment and committed to fixing the issues,⁸⁸ and solutions could be applied to the Nanisivik MSOC.

This approach also works best with a whole-of-government approach. The OGDs could opt out even if the CAF and RCN buy in to an expanded Nanisivik. Given the potential maritime traffic in the NWP, additional government presence is likely called for. While most of these OGD partners have a significant presence already in the Arctic, the hubs are located in Rankin Inlet, Iqaluit, Yellowknife and Whitehorse.⁸⁹ While these make sense for intergovernmental cooperation and joint C2, having a working base of operations adjacent to the NWP makes sense from a response time and extended range capability into the High Arctic.

There are already government facilities and HQs in Iqaluit, at the eastern entrance to the NWP, and joint-government and CAF facilities in Resolute,⁹⁰ at the other end of the eastern part of the NWP, before the possible routing splits. An approach may be to increase either or both of these facilities to have the capabilities discussed above. However, based on the strategic importance of Arctic security to Canada and key allies such as the US, and the GofC commitment to the Northern and Arctic communities to actively support the development of the Arctic and close the socio-economic gap that has disproportionately disadvantaged the Indigenous and Inuit populations,⁹¹ perhaps it is not a question of "either or". Perhaps the solution is "and": developing Iqaluit, Resolute, and Nanisivik, to ensure the right security resources are in place to follow through with the commitment to "ensuring that Canada and our northern and Arctic residents are safe, secure and well-defended."⁹²

⁸⁵ NORAD

⁸⁶ Lee Berthiaume, "Canada's Navy Facing Personnel 'Crisis' as Vacancy Nearly 20%: Commander," *Global News*, 27 September 2022, <https://globalnews.ca/news/9159765/royal-canadian-navy-personnel-crisis>.

⁸⁷ *Report 6 – Arctic Waters Surveillance*

⁸⁸ *Ibid.*

⁸⁹ CCG Maritime Communications and Traffics Services Program Information

⁹⁰ Col (Ret'd) Pierre Leblanc, "Nanisivik versus Resolute Bay", *Vanguard Canada*, 25 August 2017, <https://vanguardcanada.com/nanisivik-versus-resolute-bay/>

⁹¹ *CANPF*, 37.

⁹² *Ibid.*, 50-51.

Finally, there is the possibility that the vessel traffic density in the NWP and Canadian Arctic will not reach the density that justifies the type of fiscal and resource commitment for an enhanced Nanisivik. It is possible that climate change will not continue to affect the Arctic ice, allowing more Arctic waters to be navigable for more of the year. However, even if the world manages to get global warming checked and climate change under control, that change will likely not take effect before the NWP opens to more traffic. In the past decade there has been an increase in vessel traffic in the Canadian Arctic.⁹³ “In 2017, more than 190 vessels undertook 385 reported voyages through the Canadian Arctic, a 22% increase over 2016.”⁹⁴ It is possible that ships will increasingly continue to use the Northern Passage in Russia’s Arctic, but not the NWP in the Canadian Arctic due to its more dangerous navigation and lack of infrastructure, specifically icebreakers and ports.⁹⁵ In contrast, ships that have made the transit have saved between four⁹⁶ and 15 transit days by using the NWP,⁹⁷ and some estimates are that the savings could amount to \$500 per tonne of cargo, based on a 50% cost of shipping being fuel.⁹⁸ It will be too late to increase GofC security presence in the Arctic once the shipping numbers have been proven, or a disaster happens with great loss of life and/or environmental damage occurs. Canada cannot afford for Arctic security measures to be reactionary; they need to be proactive, and appropriately resourced and funded to enable the commitments made in the Arctic and Northern Policy Framework.

CONCLUSION

Nanisivik offers potential benefits to the RCN and CAF, OGDs, as well as the Arctic and northern residents, particularly if operational capability is expanded to year-round crewing, and the functional airport is supported. A whole-of-government approach to Canadian Arctic maritime security would be supported by this version of Nanisivik, especially if the CCG opted in for the MCTS and supporting equipment and sensors. An additional base of operations, useable by GofC partners, allies, and the local residents would bring added security measures to the NWP while increasing local infrastructure and boosting the local economy. Climate change is allowing the NWP to open to increased vessel traffic, this appears inevitable. Actions can be taken now to increase Canada’s security and continue to enforce Canada’s well-established and long-running Arctic and northern sovereignty, and a first step can be Nanisivik.

⁹³ *Ibid.*

⁹⁴ *CANPF*, 73.

⁹⁵ Frederic Lasserre, “Maritime Trade: A Geopolitical Revolution?”, *Italian Institute for International Political Studies*, 20 October 2021, <https://www.ispionline.it/en/publication/future-arctic-route-maritime-trade-geopolitical-revolution-32054>

⁹⁶ Thomas Herrmann, “Shipping Through the Northwest Passage: A Policy Brief”, *The Henry M. Jackson School of International Studies*, 27 June 2019, <https://jsis.washington.edu/news/shipping-through-the-northwest-passage-a-policy-brief/>

⁹⁷ Murphy

⁹⁸ Laura Jurgeleviciute, “Northwest Passage: The Future of Shipping has Arrived,” *Inside Over*, 12 September 2019, <https://www.insideover.com/economy/northwest-passage-the-future-of-shipping-has-arrived.html>

BIBLIOGRAPHY

- Afenyo, Mawuli, Adolf K.Y. Ng , and Changmin Jiang. "A Multiperiod Model for Assessing the Socioeconomic Impacts of Oil Spills during Arctic Shipping." *Risk Analysis*, Vol. 42, No. 3, (01 March 2022) DOI: 10.1111/risa.13773
- Arctic Council. "Canada." Last accessed 08 May 2023. Canada | Arctic Council (arctic-council.org)
- Arctic Council and Protection of the Arctic Marine Environment (PAME). "Overview of Low Impact Shipping Corridors & Other Shipping Management Schemes." Last modified May 2021. <https://pame.is/document-library/pame-reports-new/pame-ministerial-deliverables/2021-12th-arctic-council-ministerial-meeting-reykjavik-iceland/788-overview-of-low-impact-shipping-corridors-other-shipping-management-schemes/file>
- Athropolis.com. "Maps of the Northwest Passage." Last accessed 08 May 2023. Maps of the Northwest Passage (athropolis.com)
- Berthiaume, Lee. "Canada's Navy Facing Personnel 'Crisis' as Vacancy Nearly 20%: Commander." *Global News*, 27 September 2022. <https://globalnews.ca/news/9159765/royal-canadian-navy-personnel-crisis>.
- Berthiaume, Lee. "Ottawa will pay for repairs to Navy's new Arctic ships due to expired warranty." *CTV News*. 06 March 2023. <https://www.ctvnews.ca/politics/ottawa-will-pay-for-repairs-to-navy-s-new-arctic-ships-due-to-expired-warranty-1.6301443>
- Blanchfield, Mike. "Pompeo Says Canadian Claim to Northwest Passage is 'Illegitimate'." *The Canadian Press*, 06 May 2019. [https://www.ctvnews.ca/canada/pompeo-says-canadian-claim-to-northwest-passage-is-illegitimate-1.4410426?.](https://www.ctvnews.ca/canada/pompeo-says-canadian-claim-to-northwest-passage-is-illegitimate-1.4410426?)
- Bognar-Lahr, Dorottya. "In the Same Boat? A Comparative Analysis of the Approaches of Russia and Canada in the Negotiation of the IMO's Mandatory Polar Code." *Ocean Development & International Law*, 51:2 (2020): 143-161. DOI: 10.1080/00908320.2019.1680491
- Cameron, Grant. "Nanisivik Naval Facility Hits Turbulent Waters on Its Voyage to Completion." *Daily Commercial News*, 16 February 2023. <https://canada.constructconnect.com/dcn/news/government/2023/02/nanisivik-naval-facility-hits-turbulent-waters-on-its-voyage-to-completion>
- Canada. Department of National Defence, Director General Naval Force Development. *Royal Canadian Navy Strategic Lexicon*. Ottawa: Canada Communications Group, 2022.
- Canada. Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. Ottawa: Canada Communications Group, 2017.
- Canada. Global Affairs Canada. *Canada's Arctic and Northern Policy Framework*. Ottawa: Canada Communications Group, 2019.

- Canadian Armed Forces. "NORAD Modernization Project Timelines." Last modified 24 March 2023. NORAD modernization project timelines - Canada.ca
- Canadian Coast Guard Auxiliary. "Central & Arctic, Volunteer Marine Search and Rescue." Last accessed 08 May 2023. <https://ccga-ca.com/about.php>
- Canadian Coast Guard. "Canadian Coast Guard Completes 2022 Arctic Operational Season", 15 December 2022. <https://www.canada.ca/en/canadian-coast-guard/news/2022/12/canadian-coast-guard-completes-2022-arctic-operational-season.html>
- Canadian Coast Guard. "Marine Communications and Traffic Services Program Information." Last modified 11 July 2022. Marine Communications and Traffic Services program information (ccg-gcc.gc.ca)
- Canadian Coast Guard. "Radio Aids to Marine Navigation, Part 3: Vessel Traffic Services." Last modified 13 April 2023. <https://www.ccg-gcc.gc.ca/publications/mcts-sctm/ramn-arnm/part3-eng.html>
- Canadian Coast Guard, "Canadian Coast Guard Vessel Traffic Services," last modified 08 December 2022, Canadian Coast Guard vessel traffic services (ccg-gcc.gc.ca)
- Charron, Dr. Andrea. "Ode to Canada's Maritime Security Operations Centres." *Canadian Naval Review*, 10 February 2020. <https://www.navalreview.ca/2020/02/ode-to-canadas-maritime-security-operation-centres/>
- Chase, Steven. "Long-Delayed Naval Facility in the High Arctic Now Postponed to 2023." *The Globe and Mail*, 30 March 2022. <https://www.theglobeandmail.com/politics/article-long-delayed-naval-facility-in-the-high-arctic-now-postponed-to-2023/>
- Copland, Luke, Jackie Dawson, Adrienne Tivy, Frances Delaney, and Alison Cook. "Changes in Shipping Navigability in the Canadian Arctic Between 1972 and 2016." *FACETS*. 6(2021): 1069-1087. <https://doi.org/10.1139/facets-2020-0096>
- Dawson, J., N.A. Carter, M.B. Reid, S. Lalonde, A. Orawiec, R. Pelot, and P. Schmitz. "Development and Management of Low-Impact Shipping Corridors in Nunavut: workshop discussion paper." Ottawa: University of Ottawa (2019).
- Leonard-Spitzer, Deanna. "The Northwest Passage." *CE Think Tank Newswire*, Jun 08, 2019. <https://www.proquest.com/docview/2438596218>.
- Department of National Defence. "Joint Task Force North." last modified 07 April 2018. Joint Task Force North - Canada.ca
- Fife, Robert and Steven Chase. "Canadian Military found Chinese Monitoring Buoys in the Arctic: Former Lieutenant-General Says Devices Likely used to Monitor U.S. Nuclear Submarine Traffic." *The Globe and Mail*. 21 February 2023.

- Fisheries and Oceans Canada. "Fisheries and Oceans Canada in the Arctic Region." Last modified 23 March 2022. Fisheries and Oceans Canada in the Arctic Region (dfo-mpo.gc.ca)
- Fisheries and Oceans Canada. "Northern Low-Impact Shipping Corridors." Last modified 08 September 2022. <https://www.dfo-mpo.gc.ca/about-notre-sujet/engagement/2021/shipping-corridors-navigation-eng.html>
- Fraser, David. "Canadian Military Says it has Tracked, Stopped China Surveillance in Arctic Waters." *The Canadian Press*, 22 February 2023. <https://www.cbc.ca/news/politics/dnd-china-surveillance-operations-airspace-waters-1.6756548>.
- Geddert, Jeremy Seth. "Right of (Northwest) Passage: Toward a Responsible Canadian Arctic Sovereignty." *Canadian Journal of Political Science* 52, no. 3 (09, 2019): 595-612. doi:<https://doi.org/10.1017/S0008423919000052>.
- Government of Canada Oceans Protection Plan. "Arctic Inshore Rescue Boat Station." Last modified January 2018. https://tc.canada.ca/sites/default/files/migrated/oppfactsheet_arcticinshorerescueboatstn_eng_jan2018.pdf
- GPS Nautical Charts, "Nanisivik Marine Chart: CA_CA573380), last accessed 08 May 2023, i-Boating : Free Marine Navigation Charts & Fishing Maps (gpsnauticalcharts.com)
- Herrmann, Thomas. "Shipping Through the Northwest Passage: A Policy Brief." *The Henry M. Jackson School of International Studies*, 27 June 2019. <https://jsis.washington.edu/news/shipping-through-the-northwest-passage-a-policy-brief/>
- Howell, Stephen E.L., David G. Babb, Jack C. Landy and Mike Brady. "Multi-Year Sea Ice Conditions in the Northwest Passage: 1968–2020." *Atmosphere-Ocean*, (2021). DOI: 10.1080/07055900.2022.2136061.
- IM. "Opening Up the Northwest Passage." *Industrial Minerals* (03 April 2019). <https://login.cfc.idm.oclc.org/login?url=https%3A%2F%2Fwww.proquest.com%2Ftrade-journals%2Fopening-up-northwest-passage%2Fdocview%2F2229068949%2Fse-2%3Faccountid%3D9867>.
- International Maritime Organization. "International Code for Ships Operating in Polar Waters (Polar Code)." Last accessed 08 May 2023. <https://www.imo.org/en/ourwork/safety/pages/polar-code.aspx>.
- Jurgeleviciute, Laura. "Northwest Passage: The Future of Shipping has Arrived." *Inside Over*, 12 September 2019. <https://www.insideover.com/economy/northwest-passage-the-future-of-shipping-has-arrived.html>
- Justice Laws Website, "Northern Canada Vessel Traffic Services Zone Regulations." SOR/2010-127, last amended 01 July 2010, regulations are current to 2023-04-20. <https://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-127/page-1.html>

- Lajeunesse, Adam. "Canada's Arctic Offshore and Patrol Ships (AOPS): Their History and Purpose." *Marine Policy*, Volume 124 (2021).
<https://doi.org/10.1016/j.marpol.2020.104323>.
- Lajeunesse, A., and R. Huebert. "Preparing for the Next Arctic Sovereignty Crisis: The Northwest Passage in the Age of Donald Trump." *International Journal*, 74(2) (2019): 225–239. <https://doi-org.cfc.idm.oclc.org/10.1177/0020702019849641>
- Lasserre, Frederic. "Maritime Trade: A Geopolitical Revolution?" *Italian Institute for International Political Studies*, 20 October 2021.
<https://www.ispionline.it/en/publication/future-arctic-route-maritime-trade-geopolitical-revolution-32054>
- Leblanc, Col (Ret'd) Pierre. "Nanisivik versus Resolute Bay." *Vanguard Canada*, 25 August 2017. <https://vanguardcanada.com/nanisivik-versus-resolute-bay/>
- Marinesthing. "All About Vessel Traffic Management Systems." Last modified 20 October 2020. <https://marinesthing.com/all-about-vessel-traffic-management-system-vtms/>
- Murphy, Jessica. "Is the Arctic Set to become a Main Shipping Route?" *BBC News*, 01 November 2018. <https://www.bbc.com/news/business-45527531>
- Office of the Auditor General of Canada. "Arctic Waters Surveillance", Independent Auditor's Report, Report 6 2022, Reports of the Auditor General of Canada, https://www.oag-bvg.gc.ca/internet/English/att__e_44160.html#hd5g
- Pictou, Cora. "Canada's Coastal Marine Security Operations Centre – East." 17 March 2021, RDIMS: 17351132, <https://rusi-ns.ca/wp-content/uploads/2021/03/MSOCE.pdf>
- Pryce, Paul. "Resolute Bay: A Chilly Response in Ottawa." *NATO Association of Canada*, 1 March 2016. <https://natoassociation.ca/resolute-bay-a-chilly-response-in-ottawa/>
- Public Safety Canada. "Marine Security Operations Centres." Last modified 11 May 2022. <https://www.publicsafety.gc.ca/cnt/brdr-strtrs/brdr-lw-nfrcmnt/mrn-scrty-prtns-cntrs-en.aspx>
- Royal Canadian Mounted Police. "RCMP in the North." Last modified 08 July 2016. RCMP in the North | Royal Canadian Mounted Police (rcmp-grc.gc.ca)
- Salter, Mark. "Sovereignty Served Cold." *Centre for International Policy Studies*, 05 September 2019. <https://www.cips-cepi.ca/2019/09/05/sovereignty-served-cold/>
- Sheehan, Rebecca, Dimitrios Dalaklis, Anastasia Christodoulou, Megan Drewniak, Peter Raneri, and Angelos Dalaklis. "The Northwest Passage in the Arctic: A Brief Assessment of the Relevant Marine Transportation System and Current Availability of Search and Rescue Services." *Logistics* 5, no. 2 (2021): 23. doi:<https://doi.org/10.3390/logistics5020023>
- Shen, Xin-Yi, Yu Zhang, Chang-Sheng Chen, Song Hu, Dan-Ya Xu, Wei-Zeng Shao, Liang Chang, and Gui-Ping Feng. "Arctic Sea Ice Variation in the Northwest Passage in 1979–

- 2017 and Its Response to Surface Thermodynamics Factors.” *Advances in Climate Change Research*, Volume 12, Issue 4 (2021): 563-580.
<https://doi.org/10.1016/j.accre.2021.08.004>.
- Sibert, Stewart. “Thinking Outside of the Icebox: Charting a New Course Through the Northwest Passage.” *Boston University International Law Journal*, (01 June 2018).
- Silber, Gregory K. and Jeffrey D. Adams. "Vessel Operations in the Arctic, 2015–2017." *Frontiers in Marine Science*, (18 September 2019).
[doi:https://doi.org/10.3389/fmars.2019.00573](https://doi.org/10.3389/fmars.2019.00573).
- Song, C., Y. Zhang, Z. Xu, Z. Hao and X. Wang. "Route Selection of the Arctic Northwest Passage Based on Hesitant Fuzzy Decision Field Theory." *IEEE Access*, vol. 7 (2019): 19979-19989. doi: 10.1109/ACCESS.2019.2897716.
- Strader, Olin. “A Bering Strait Vessel Traffic Service: Critical Infrastructure for an Opening Arctic.” *The Arctic Institute*, 08 February 2012. <https://www.thearcticinstitute.org/bering-strait-vessel-traffic-service-part2/>
- Transport Canada. “Arctic Security.” Last modified 24 September 2020. Arctic Security (canada.ca)
- Transport Canada. “Marine Security Operation Centres.” Last modified 23 September 2020.
<https://tc.canada.ca/en/marine-transportation/marine-security/marine-security-operation-centres>
- Wang, Chuya, Minghu Ding, Yuande Yang, Wei Ting, and Tingfeng Dou. "Risk Assessment of Ship Navigation in the Northwest Passage: Historical and Projection." *Sustainability* 14, no. 9 (2022): 5591. doi:<https://doi.org/10.3390/su14095591>.
- Wright, Trevor. “Arctic Infrastructure Lacking in Some Areas Say Former Army Colonel.” *Nunavut News*, 08 June 2021. <https://www.nunavutnews.com/news/arctic-infrastructure-lacking-in-some-areas-say-former-army-colonel/>