Both the Canada First Defence Strategy and the Northern Strategy commit the Canadian Forces (CF) to the robust defence of Arctic islands, seas and airspace. Consequently, the Royal Canadian Navy (RCN) has been directed to perform a larger role in asserting Canada’s sovereignty over its Arctic waters. This raises a number of challenges for RCN ships and personnel since the Arctic is a harsh and often unforgiving operating environment. Even small growlers and bergy bits – the types of ice that will become more prevalent as climate change breaks up first-year ice – can sink large warships. Uncharted straits, the huge distances between communities and fuel supplies, and Canada’s own stringent Arctic pollution laws all place limitations on RCN operations in the Arctic.

Contrary to popular perception, Arctic waters are not completely unknown to RCN sailors. Sovereignty patrols occurred throughout the Cold War, and the RCN has gained a significant amount of operating experience from joint sovereignty exercises such as Operation Nanook. However, until versatile and ice-strengthened Arctic Offshore Patrol Ships (AOPS) are built and integrated into the RCN fleet, the navy must continue to expand its Arctic operations with the fleet it has. Maintaining a viable presence in fluctuating weather and ice conditions will have to take logistical, environmental and engineering limitations into account. In this article I will explore the difficulties we face presently with Arctic operations and some of the solutions that the navy is implementing to overcome them.

The Halifax-class Frigates: An Interim Arctic Presence

Since 2007, the primary sovereignty exercise of the CF has been Operation Nanook, usually held in August and September. This is a whole-of-government exercise, incorporating various military and other government assets in a scenario-based approach to managing security and sovereignty threats in the Arctic. Exercises have involved the landing of Canadian Army troops on the shores of Baffin Island (2009), a multinational naval task group operating in Arctic waters (2010), and this past summer, an emergency response to a real-life air disaster just outside Resolute, Nunavut. The RCN’s role in Operation Nanook is extensive, and often includes port inspection divers, Kingston-class maritime coastal defence vessels (MCDVs) and Victoria-class submarine operations. The most visible and enduring of RCN contributions to Operation Nanook is the deployment of a Halifax-class frigate.

Although not the most specialized navy asset, the Halifax-class frigate is the best platform the RCN has to maintain a physical presence in Arctic waters until the AOPS join the fleet. As a general-purpose frigate, it possesses sophisticated sensors and communications capable of building and maintaining a recognized maritime picture in the Arctic, and its Sea King helicopter is useful for ice reconnaissance, search and rescue and local transport. Once on station, the frigate provides the most versatile navy response to immediate threats in Arctic waters. At least one frigate is kept available on the East Coast at all times as a Maritime Forces Atlantic (MARLANT) ‘ready duty ship’ for contingency response. This means that any security threat in the Arctic demanding immediate RCN attention would likely incorporate the despatch of a Halifax-class frigate to the region, provided certain logistical hurdles, primarily availability of fuel and ice density (time of year dependent) could be overcome.

This is certainly not what the original designers of the Halifax-class ships had in mind when the frigates were built in the late 1980s and early 1990s. Although the frigates were intended to be ‘multi-purpose’ platforms capable of fulfilling a range of combat missions, their overriding concept of operations embraced the Cold War threat of the time. Naval planners envisaged utilizing the frigates...
for anti-submarine warfare against Soviet submarines in the north Atlantic, as well as integrated anti-air and anti-surface operations as part of a combined Canadian or NATO fleet. There was little talk of sending surface vessels to the Arctic to exercise northern sovereignty — the Department of National Defence (DND) still intended to procure nuclear submarines for Arctic patrol as outlined by the 1987 White Paper.2 After the submarine acquisition was quietly dropped and the Cold War came to an end, the Halifax-class frigates were delivered and they have since been the workhorse of the navy, utilized for a range of missions from maritime interdiction operations in Mediterranean and Middle Eastern waters, to humanitarian assistance/disaster relief operations in the Caribbean, to littoral warfare operations in the coastal waters off Libya.

Once the frigates began exercising in the Arctic as part of Operation Nanook, the RCN discovered a catalogue of operating limitations that must be carefully managed. This is not to say that they cannot operate in the Arctic, or that it is dangerous to sail these frigates north of 60°N. Indeed, these workhorses of the fleet have proven year after year that they can sail at increasingly more northerly latitudes and in challenging weather and ice conditions. Every Commanding Officer, however, must recognize the risks and realities of conducting Arctic operations with a warship designed for combat in the open north Atlantic. Some of these factors are strategic in nature, and both the RCN and the federal government are moving to rectify them. Others are managed on a day-to-day basis. All of them are applicable not just to the Halifax-class frigates, but to all RCN warships that might be called upon to operate in the Arctic, including MCDVs and submarines.

Fuel Constraints
The lack of northern fuelling facilities is one of the biggest challenges that the RCN faces in Arctic operations. No major Canadian fuelling depots exist north of St. John’s, Newfoundland. Currently, MARLANT ships participating in Operation Nanook top up their fuel tanks in St. John’s en route to Baffin Bay, expend large amounts of fuel while sailing in Arctic waters, and then conduct a long re-fuelling in St. John’s when returning home to Halifax. While this arrangement is viable for a defined exercise such as Operation Nanook, it is not flexible should MARLANT ships respond to security contingencies when they are in Arctic waters. Canada’s Danish allies maintain a fuelling depot at Nuuk, Greenland, but this is at best an expensive and a non-national means of maintaining Canadian warships on station. Fuelling is such a concern for sustained northern operations that ships proceeding north must typically make arrangements to rendezvous with Canadian Coast Guard ships operating in the Arctic in order to take on fuel while at anchor.

HMCS Montréal passes an iceberg in Strathcona Sound near Nanisivik, Nunavut Territory, during Operation Nanook 2010.

HMCS Montréal alongside in Nuuk, Greenland, taking on fuel and food during Operation Nanook 2010.
Although possible, fuelling by tanker is also not a preferable means of maintaining RCN operations in the Arctic. Stringent regulations governed by the 1970 Arctic Waters Pollution Protection Act (AWPPA) make fuelling at anchor the only viable means of replenishment – and even this relatively benign activity requires the deployment of specialized fuel booms and other monitoring processes to ensure pollution does not occur. With regard to tanker resources, the venerable HMCS Preserver and Protecteur are the only remaining RCN refuelling assets on both East and West Coasts, and neither can be dedicated to the Arctic for extended periods of time. Contracting a civilian tanker is a costly measure, and as the 2010 grounding of a community-resupply fuel tanker demonstrated, fraught with risks for the Arctic's fragile environment.3 This means that Halifax-class warships must take on as much fuel as possible in St. John's and retain as much of it as possible while in Arctic waters. Indeed, the AWPPA regulations state that all vessels navigating in the Arctic must maintain enough fuel either to leave the applicable Arctic zone or reach a refuelling facility.4 Complicating this requirement is the presence of significant ice that can puncture the hull of Halifax-class ships. These ships are most manoeuvrable in close quarters with icebergs, growlers and bergy bits when their two gas-turbine engines are used, rather than the more economical diesel engine. Of course, this engine configuration consumes a considerable amount of fuel if used over an extended period of time, thus necessitating that Commanding Officers carefully balance the risks associated with the presence of ice and fuel considerations in support of the mission.

During previous iterations of Operation Nanook, the frigates have compensated for extended daytime gas-turbine use by turning off main engines and drifting throughout the quieter night hours. This is only safe, however, if ice and weather conditions are benign, and doing so meets the parameters of the mission. Another solution is to take on an additional fuel load in the salt water ballast tanks. These tanks cannot be used for the remainder of the deployment once their additional fuel load is consumed and they are refilled with sea water. Since the purpose of these ballast tanks is to correct trim and list, this function becomes degraded once they are used primarily for fuel storage. These tanks must then be thoroughly cleaned and inspected upon return to Halifax, both a time-consuming and costly process.

Although these fuel-maximizing actions are indeed possible, the most sustainable solution is to build a dedicated fuelling facility in the Arctic. The federal government is planning to achieve this capability by constructing a “deep-water berthing and fuelling facility” at Nanisivik, Nunavut.5 Located on a northern peninsula of Baffin Island, close to an airport and the community of Arctic Bay, Nanisivik already possesses a berthing jetty that is being expanded to achieve full resupply capability by 2015. Its strategic location at the eastern entrance of the Northwest Passage will allow future AOPS to extend their operational deployments in the heart of Canada’s Arctic waters.

Environmental Constraints

One of the RCN’s primary missions in the Arctic is to lend support to other government departments as they reinforce Canada’s integrated security and sovereignty framework in the region. An important plank of this framework is the AWPPA, originally legislated after the infamous transit of the American oil tanker Manhattan through the Northwest Passage in 1969 and 1970.6 The RCN may be called upon to help Transport Canada enforce
the AWPPA regulations upon ill-prepared commercial vessels seeking to utilize the more accessible Northwest Passage. For a navy that has conducted countless fishery patrols and overseas maritime interdiction operations, this is familiar territory. But enforcing the regulations also means abiding by them. Here the operational reach of the Halifax-class frigate is affected, and the ships and sailors must find creative solutions in the interim while AOPS are constructed.

Since a Halifax-class ship carries upwards of 200 sailors, the sewage treatment plant is almost always in use. Normally, ‘black’ (toilet) and ‘grey’ (showers and washing) water is specially treated and then can be discharged more than 12 nautical miles (nm) off shore – essentially, outside Canada’s territorial waters. However there are restrictions on the authorized discharge of black and grey water within Arctic waters – defined as all waters of Canada’s Exclusive Economic Zone (up to 200 nm from land) north of 60ºN. Discharge of untreated sewage is not permitted in Arctic waters. All black and grey water, as well as garburated food waste, is directed through the sewage treatment plant.

In order not to overload the plant, some excess water is collected in the bilges. This can be minimized with severe water restrictions which will affect crew comfort. Since bilges are located under the main machinery spaces, all bilge water is automatically classified as ‘oily water’ and thus cannot be discharged at all in Arctic waters. Based on previous Halifax-class deployments to Operation Nanook, water can be collected in the bilges for three weeks before they are so full that they affect the ship’s safety. This must be incorporated into overall planning of individual Arctic operations.

Because of the low salinity of Arctic seas, large quantities of table salt may need to be added to ensure the proper operation of sewage treatment systems. Without this, the plant runs the risk of becoming inoperable. Without a treatment mechanism for black and grey water, the bilges will fill at least twice as quickly with severe water restrictions, which would severely limit operations north of 60ºN. The dumping of non-garburated food waste and all types of solid garbage is prohibited in Arctic waters. Halifax-class ships have sufficient space to accommodate the collection of solid garbage, however, the accumulation of food waste over a longer than expected Arctic deployment can become a health concern. All of these discharge restrictions may necessitate a Halifax-class ship passing below 60ºN to pump out bilges or dump food waste in extreme circumstances, potentially affecting the mission. All of the above limitations must be carefully planned for and managed prior to deploying north.

Navigational Constraints

The echo sounder is one of the most vital sensors used to help a warship navigate in both open and pilotage waters. In the Arctic, where large areas of the seabed remain unsounded, use of the echo sounder becomes essential. In the Arctic littoral region, however, echo sounders may only be operated at low power if marine animals are sighted. In deeper Arctic waters, where echo sounder use is less essential, it must be powered off. Depending on the mission, the restricted use of the echo sounder may severely restrict a warship’s ability to navigate through littoral waters. Since most of Canada’s Arctic domain consists of an archipelago, and thus the RCN will almost always be operating in littoral waters, this can become a serious concern depending on the mission. Continued route survey work is required in littoral areas in order to build upon existing navigation data to offset these limitations.

Ice remains a threat to the hull integrity of the Halifax-class frigates, but weather-induced ice build-up may also threaten the stability of these ships. The perfect recipe for disaster would be if ice build-up on the Halifax-class superstructure is greater than 25 cm, fuel levels are low and a storm is building. Likewise, ice build-up in the embarked rigid-hull inflatable boat (RIB) may lead to a damaged RIB-launching davit. The RIB and Zodiacs must be winterized, batteries fully charged and bilges dry. These small boats are vital to the rescue capability of the frigates, as well as for local transport and reconnaissance. They were designed for operations in the northern Atlantic and as such are not particularly well suited for Arctic operations and movements of personnel. Another lesson learned in recent years is the importance of using appropriate Personal Protective Equipment (PPE) for the harsh Arctic climate.

Although I have explored some of the restrictions that Arctic weather and environmental concerns present to
the RCN, there are also advantages to the Arctic’s cold weather and cold waters. For example, the *Halifax*-class machinery is generally designed to favour cold temperatures over hot ones. Many pieces of equipment and computers are designed to run at cool temperatures and being in such a cold environment reduces the demands placed on the ship’s chillers and cooling systems.

**Conclusion: Bridging the Gap before AOPS**

Most of the aforementioned limitations posed by the Arctic environment and weather cannot be helped. If there’s one thing that we cannot control, it’s the environment in which we are called upon to operate on a daily basis. However, the *Halifax*-class frigates, and the RCN as a whole, have done a remarkable job of adapting to an Arctic operating area for which they were not originally designed. The construction of AOPS tailor-made for challenging Arctic operations will draw upon these lessons learned, as well as mitigate some of the operating restrictions imposed by ice, weather and the necessity of preserving the Arctic environment.

With the announcement in fall 2011 of Irving Shipyard as the firm contracted to build AOPS, construction of these vessels can begin shortly. The design phase is almost complete and the first of these vessels is expected to be delivered in 2015. They are being designed with a hull that can operate in hard first-year ice, and they will have a greater ability to sustain themselves for longer in challenging Arctic conditions. In the meantime, the RCN is continuing to develop a long-term Arctic operating capacity. Junior officers are being posted to Canadian Coast Guard icebreakers in order to gain experience operating in ice-infested waters. The *Halifax*-class and other RCN warships will continue to sail north to participate in *Operation Nanook* and undertake other Arctic operations, regardless of the challenges and limitations in doing so, gaining much-needed experience and exposure to conducting operations in an Arctic environment. Operating in Arctic waters is not impossible; it just requires some long-term planning and creativity. The men and women of the RCN possess both in spades, and they will continue to secure Canada’s security and sovereignty in cooperation with other government departments in this vital national territory for the foreseeable future. 🇨🇦

**Notes**


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