



CIAS Research Series

# Too Much Geography? Evaluating the Locations of Canadian Armed Forces Infrastructure in the North and Arctic.

Zachary Zimmermann

Master's Candidate at Trent University, Canadian and Indigenous Studies  
Research Fellow at the North American and Arctic Defence and Security Network

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# Foreword

## Improving response in the Canadian Arctic and North

In early conversation with this report's author, the intersection of the operational needs of the Canadian Arctic and the capacity to meet those needs was ripe for exploration. Our initial discussions were based on Zach's previous work on hypothetical combat scenarios in the European Arctic Ocean, examining what would be needed to improve response times in the case of a critical incident. The same methodology has traces and shadows within this report - though with clarity on the stakes, and with realistic assumptions. Many Canadian experts agree that: 1) the Canadian Arctic is not under immediate threat of large-scale serious or deliberate incursion or invasion, 2) being clear in the types of threats 'through, to and in' the Arctic is helpful in providing clear understanding to the public and policy-makers, and 3) Canadian focus in the Arctic must be informed by the needs of the people and broader potential in the region.

In the report, Zach moves into a practical space, developing and answering real questions with recommendations that are based on the needs and Canada's current capabilities. His outcomes show that with strategic focus on coverage in the Canadian Arctic, response times for military, maritime, search and rescue or disaster management are currently strategically adequate, but can be tightened. The infrastructure enhancements to accomplish this can be efficient in cost and can serve to improve local services and development in specific areas of the territories.

## CIAS Research Series

A key goal for the Canadian Institute for Arctic Security is to provide information and actionable solutions to the general public and decision-makers, with a particular imperative to communicate across the North. In order to accomplish this - and to make our products relevant - supporting established and emerging Northern voices is key.

It is only by bringing attention to real-world experience and the deep connection to our lands and cultures that insights from the CIAS gains the edge in relevance and applicability. Hundreds of reports are written about the Canadian North every year. Few of those are written by Northerners. This paper advances that thinking. The author was born and raised in the North. The decisions he seeks to influence aren't abstracted; they are real and will impact the people and places that he loves.

It is also in the interest of the CIAS to ensure that young academics are supported, and that the network of contributors grows alongside the Institute. I am proud that Zach is one of these people who have joined up early in the CIAS' development, and I hope his work continues to show up on our platforms as he becomes an established and pragmatic thought leader in this space.

*Andrew G. Smith*

*Project Lead, Canadian Institute for Arctic Security*

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## About the Author

Zachary Zimmermann is a Master's student at Trent University in the Canadian Studies and Indigenous Studies program. Zach completed his Bachelor's of International Relations at IE University in Madrid, Spain where he co-founded and was the Editor-in-Chief of the university's official academic journal, the IE International Policy Review.

Zach has four terms of experience working as a policy analyst and negotiator for Crown-Indigenous Relations, as well as being a coordinator and researcher for the Canadian Institute for Arctic Security, the only northern-based think tank in Canada dedicated to Arctic security. Zach is also a research fellow at the North American and Arctic Defence and Security Network (NAADSN), where he has contributed to multiple research projects and conferences. Zach is also an alumni of the Students on Ice Youth Arctic Policy Cohort, in which he got the opportunity to deliver a panel discussion at the 2022 Arctic Circle Assembly in Reykjavik, Iceland.

Born in Inuvik, NWT and raised in Whitehorse, Yukon, Zach is passionate about researching the Canadian North and Arctic. Zach's research interests centre around military security/strategy and geopolitics in the Arctic. Specifically, Zach completed his undergraduate thesis focused on applying combat models to hypothetical conflict scenarios in the Arctic to gather strategic considerations for NATO forces in the region. This research was granted the Best Thesis Award by his university, having received the highest grade out of his graduating class. Zach is currently working towards his Master's thesis, supervised by Dr. Whitney Lackenbauer, which will seek to compare Canadian and Nordic defence strategies in the Arctic.

## List of Acronyms

ADIZ — Air Defence Identification Zone

AOPV — Arctic Offshore Patrol Vessel

CADIZ - Canadian Air Defence Identification Zone

CAF — Canadian Armed Forces

CCG — Canadian Coast Guard

DND — Department of National Defence

FOL — Forward Operating Location

NATO — North Atlantic Treaty Organization

NNF — Nanisivik Naval Facility

NORAD — North American Aerospace Defence Command

NOSH — Northern Operational Support Hub

NWP — Northwest Passage

RCAF — Royal Canadian Air Force

RCMP — Royal Canadian Mounted Police

RCN — Royal Canadian Navy

SAR — Search and Rescue

# Table of Contents

## Contents

1.0 Introduction .....	2
2.0 Methodology .....	3
3.0 Threats Facing Canada’s North and Arctic .....	5
4.0 The Strategic and Operational Objectives of the Canadian Armed Forces in the Arctic .....	8
5.0 The Strategic and Operational Value of Existing Locations of CAF Infrastructure in the North and Arctic.....	14
6.0 The Strategic and Operational Value of Proposed Locations of CAF Infrastructure in the North and Arctic.....	21
7.0 The Strategic and Operational Value of Hypothetical Locations of CAF Infrastructure in the North and Arctic.....	25
8.0 Summary of Findings .....	27
9.0 Recommendations .....	29
10.0 Conclusion .....	31
References.....	33

## 1.0 INTRODUCTION

In 1936 in front of the House of Commons, Canadian Prime Minister William Lyon Mackenzie King famously said that “if some countries have too much history, we have too much geography.”<sup>1</sup> Almost 90 years later and this statement is still relevant, especially when considering Canada’s North and Arctic.<sup>2</sup> Holding approximately 40% of Canada’s landmass and less than 1% of the national population, the geography of Canada’s North and Arctic is not only unique, but it presents challenges in the context of national security and defence.<sup>3</sup>

Combined with the increasing strategic and economic significance of the Arctic and the increasing number of threats facing the region, there is a need to analyze and evaluate the roles and capabilities of the Canadian Armed Forces (CAF) in the North and Arctic. Recognizing the vastness of the region, there is a specific need to examine whether the geographical locations of military infrastructure offer the strategic and operational value needed for the CAF to engage in operations effectively throughout Canada’s North and Arctic.

To that end, this report seeks to answer the following research question:

*To what extent do existing, proposed, and hypothetical locations of Canadian Armed Forces infrastructure in the North and Arctic provide the strategic and operational value needed to meet Canada’s Arctic security objectives?*

To answer this question, this report begins by providing a preliminary analysis of the threats facing Canada’s North and Arctic and the ensuing objectives of the CAF in response to these threats. After determining the threats facing Canada’s North and Arctic and the CAF’s ensuing objectives in the region, this report will directly answer the research question by engaging in various quantitative analyses and models to determine whether existing, proposed, and hypothetical locations of military infrastructure in the region grant the strategic and operational value needed for the CAF to meet its objectives. This report then offers several recommendations to the federal government, the CAF, and territorial governments based on the report’s findings.

The topic of Arctic security is clearly top of mind for many policymakers in Canada. With Canada’s defence policy update explicitly describing the Arctic as a “key trend”<sup>4</sup> defining national security and Canada’s recent NATO commitment of spending 5% of GDP on defence by 2035, the contents of this report can help ensure that defence and security policy in the North and Arctic is deliberate, sustainable, and effective. Furthermore, this report responds directly to one of the recommendations in

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<sup>1</sup> Statistics Canada 2008

<sup>2</sup> There is not a single agreed-upon definition of what areas constitute the Canadian Arctic. For the purpose of this paper, the Canadian North and Arctic is limited to the three territories (Yukon, Northwest Territories, and Nunavut).

<sup>3</sup> Arctic Council, n.d.

<sup>4</sup> Department of National Defence 2024, p.3

the 2023 “Arctic Security Under Threat” Senate report, one of the most comprehensive reports on the state of Arctic security in Canada. Specifically, Recommendation 12 suggests that the “Government of Canada evaluate whether changes to the size, locations [emphasis added] or nature of the Canadian Armed Forces’ presence in the Canadian Arctic are required.”<sup>5</sup>

In this context, the report contributes to an urgent national discussion by offering a structured, evidence-based, and quantitative assessment of the CAF’s Arctic footprint. By examining whether existing, proposed, and hypothetical military infrastructure locations align with Canada’s evolving defence objectives, this report aims to inform strategic policymaking and ensure that Canada’s Northern and Arctic defence posture is not only reactive, but proactive and fit for purpose.

## 2.0 METHODOLOGY

### 2.1 Description

This report begins by qualitatively analyzing the various threats facing Canada’s Arctic. To do so, the report will compile existing Arctic security analyses, policy documents, and news reports to identify and describe the most likely threats facing Canada’s North and Arctic.

It is crucial to engage in this preliminary analysis of threats facing Canada’s Arctic because it is the nature of a given threat that determines a military’s preparations, posture, and response. For example, if one only assumes that the biggest threat facing Canada’s Arctic is open conflict with an adversary such as Russia, then it follows that CAF Arctic capabilities should be judged by their ability to mount a strong defence, which may mean having thousands of permanently stationed troops and tonnes of military assets. As Canadian Arctic security expert Dr. Whitney Lackenbauer has consistently argued, these types of assumptions and narratives can be problematic.<sup>6</sup>

By automatically assuming that the biggest threat facing Canada’s Arctic is one of military nature, then the likely conclusions will be that Canada is “undefended” due to Canada’s seemingly limited Arctic military presence. On the other hand, if the most likely threats facing Canada’s Arctic are those of hybrid or environmental nature, then the CAF’s ensuing Arctic capabilities should be judged by a very different standard; namely by their ability to be mobile, travel long distances, and react quickly to incidents with appropriate force. As Dr. Lackenbauer states, “Canadians deserve a more sophisticated appraisal of threats and risks through, to, and in our Arctic, and less sensationalizing hyperbole...”<sup>7</sup> In summary, CAF Arctic capabilities must be judged relative to the most realistic threats instead of assumed ones.

After analyzing the various threats facing Canada’s North and Arctic, this report shifts to a qualitative analysis of the CAF’s objectives in response to these threats. To do so, this report relies on existing Arctic security analyses as well as strategic policy documents from the Royal Canadian Air Force (RCAF)

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<sup>5</sup> Senate of Canada 2023, p.69

<sup>6</sup> Lackenbauer 2024

<sup>7</sup> *ibid*, p.5

and the Royal Canadian Navy (RCN). This analysis is crucial, as the objectives of the CAF in the Arctic enable this report to extract several quantitative benchmarks that can be used to judge whether a given geographical location satisfies a CAF objective. For example, if a CAF objective is the ability to reach anywhere in the Arctic using a CC-138 Twin Otter, then one can extract a quantitative benchmark as follows: The ability for a CC-138 Twin Otter to reach any part of the Canadian North and Arctic, given its maximum range. This benchmark can then be applied to the geographical locations housing CC-138 Twin Otters to determine a radius where the aircraft will be able to reach across Canada's North and Arctic. It can then be determined whether or not the geographical locations that hold CC-138 Twin Otters enable the CAF to satisfy their objective of being able to reach any part of the Arctic.

This methodology of using quantitative benchmarks is applied to different types of military assets and several existing and proposed geographical locations. In doing so, this report provides a comprehensive and compiled overview of the CAF's geographical Arctic footprint and the extent to which these locations enable the CAF to satisfy its various objectives in the region, thus answering the report's research question. Lastly, the methodology also helps identify any gaps in the CAF's Arctic footprint and is then used to determine which hypothetical locations could fill in these gaps.

## 2.2 Assumptions and Limitations

As with any report focused on a geographically and quantitatively informed analysis, there are several assumptions and limitations that must be acknowledged to contextualize this report's findings.

First, the scope of this report's analysis is limited to the roles of the RCAF and the RCN in the North and Arctic. There are two potential issues with this limitation. On one hand, there are other branches within the CAF that have Arctic mandates. For instance, the Canadian Army recently released its 2025 strategic policy document, which underlines the Domestic Arctic Mobility Enhancement (DAME) project. This project will see the delivery of up to 170 amphibious terrain platforms that will "renew our access and ability to operate in the harshest of Canadian environments."<sup>8</sup> It is clear that the Canadian Army will play an important role in ground responses to security incidents in the Arctic, however, this report does not consider the role of the Canadian Army in the CAF's overall Arctic footprint.

Also integrated within the CAF is the Canadian Rangers, a group of community-based Canadian Army reservists that provide the CAF with local presence, operational capability, and expertise across the North and Arctic.<sup>9</sup> The importance of the Canadian Rangers to Canada's overall Arctic security should not be understated. Like with the Canadian Army, this report is limited in its incorporation of the Canadian Rangers as tangible assets used to execute and support military operations. Nonetheless, as seen later in the report, certain findings of this report do prove the importance of the Rangers in the absence of RCAF capabilities.

There are other government departments and agencies – such as the Canadian Coast Guard (CCG),

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<sup>8</sup> Canadian Army 2025, p.14

<sup>9</sup> Lackenbauer and Romagnoli 2024

Transport Canada, and the RCMP – that not only have Arctic mandates, but also have assets that operate in the region. Most notably, this report does not consider the role of CCG assets and port locations in its analyses. By including the RCAF and the RCN as two organizations with significant geographical reach and asset capability in Canada’s Arctic, this report assumes that their inclusion is enough to conduct a thorough analysis and reach useful findings.

Second, this report does not consider the role of unmanned aerial vehicles (UAVs) or satellites in its analyses. While UAVs and satellites are playing an increasingly important role in Canada’s Arctic security, especially in the realm of surveillance and domain awareness, these assets simply fall outside of the methodological scope and framework.<sup>10</sup>

Third, ice coverage was not factored into the operational modelling of RCN activities in Canadian Arctic waters. It is assumed that RCN assets, specifically the Arctic Offshore Patrol Vessels (AOPVs), are able to access any part of the Northwest Passage (NWP) during the summer navigation season. This simplifying assumption allows for a consistent evaluation of geographical locations but it may not fully reflect realistic navigational constraints.

Fourth, this report acknowledges that its analyses and modelling of military operational rollouts in the Arctic are simplified and may not accurately reflect the complexities of Arctic operations. The analyses and models are intended to approximate the strategic and operational reach of military assets from geographical locations rather than replicate the full complexity of military operations in the Arctic.

Finally, and importantly, the report’s analyses and models only evaluate the locations of military infrastructure rather than the state of the infrastructure itself. As will be described, there are certainly problems with Arctic military infrastructure that may affect their operational abilities, however, this report is solely focused on the geographical locations of infrastructure and how such locations enable the CAF to satisfy its strategic and operational objectives in the Arctic.

Overall, these assumptions and limitations underscore that this report is only suited to provide a strategic-level, location-based analysis rather than a comprehensive audit of the CAF’s overall military readiness in the North and Arctic.

### 3.0 THREATS FACING CANADA’S NORTH AND ARCTIC

According to Canada’s 2024 defence policy, Canada’s national security and defence will be influenced by three key trends in the coming years: “a more open and accessible Arctic and northern region driven by climate change, increasing global instability, and rapid advances in technology.”<sup>11</sup> These trends also underline the various threats facing Canada’s North and Arctic – including those of military, environmental, accessibility, and hybrid nature. This section will seek to describe these threats and provide examples of the potential roles that a Canadian Armed Force presence in the Arctic will have in response to these threats.

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<sup>10</sup> Defence Research and Development Canada 2016

<sup>11</sup> Department of National Defence 2024, p.3

### 3.1 Military Threats

From a traditional military perspective, heightened Russo-NATO tensions following the 2022 invasion of Ukraine have thrust the Arctic into a new era of global instability. In response, the members of NATO recently committed to spending 5% of GDP on defence spending by 2035, much of which, especially in the Canadian context, will be spent on defence and security in the North and Arctic.<sup>12</sup> To that end, Canada's 2024 defence policy states that "our contributions to securing the Arctic are an important component in the defence of NATO's western and northern flanks, and directly support broader NATO deterrence efforts."<sup>13</sup>

To a casual observer, these actions might signal that there is a high risk for impending interstate conflict in the Arctic. There is, however, a general consensus among Arctic security experts that the risk of open armed conflict in the Arctic remains low. To that end, military buildup and investments in the Canadian North and Arctic should not be interpreted as Canada preparing for an impending invasion of its Northern region.<sup>14</sup> As the 2024 defence policy states, Canadian military investments in the Arctic are part of a broader effort to contribute to NATO deterrence efforts and continental defence within NORAD.<sup>15</sup> The various threats facing the Arctic extend beyond those of military nature, yet many of them might nonetheless require a response from the CAF.

### 3.2 Environmental Threats

With a 2019 Government of Canada assessment stating that the Canadian Arctic is warming at three times the global average, climate change is a wide-ranging and obvious threat that holds many implications for the Canadian Arctic security landscape, both in the socio-economic and military domain.<sup>16</sup> Climate change will increasingly affect Arctic inhabitants' and Indigenous peoples' livelihoods. The consequences of climate change such as permafrost thaw, coastal erosion, decline in snow and ice cover, and wildfires are changing people's relationship with the land, impacting food security, restricting mobility, and deteriorating infrastructure, just to name a few effects.<sup>17</sup>

The same consequences of climate change will also create new security challenges while affecting the ability of the CAF to successfully operate in the region. For instance, in the 2023 Senate Arctic security report, according to Brigadier-General Godbout, (at the time Commander of Joint Task Force North) "climate change and greater activity in the Arctic are increasing both the likelihood of natural and human-cause disasters and the 'complexity and the frequency of domestic response operations' coordinated by the CAF in the Arctic."<sup>18</sup> One can also point to recent environmental incidents in the three territories - the 2021 flooding in Yukon, the 2021 tainted water incident in Iqaluit, and the 2023

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<sup>12</sup> Prime Minister of Canada 2025

<sup>13</sup> Department of National Defence 2024, p.5

<sup>14</sup> Zimmermann 2025

<sup>15</sup> Department of National Defence 2024, p.5

<sup>16</sup> Government of Canada 2019, p.84

<sup>17</sup> Senate of Canada 2023, p.43

<sup>18</sup> *ibid*, p.44

evacuation of Yellowknife due to wildfires – as examples of the increasing role that the CAF may have to play in responding to environmental disasters caused by climate change.<sup>19</sup> Each of those events activated a response under Operation LENTUS – the CAF’s response to domestic natural disasters.

### 3.3 Accessibility Threats

The nature of accessibility in the Arctic is a topic that demands nuance. From a conventional perspective, the Arctic is indisputably warming at around three times the global average and it logically follows that sea ice will melt and the Arctic Ocean will open. Counterintuitively, a 2024 paper found that global warming is also causing multi-year ice to be “flushed southwards from high-latitude regions” and getting trapped in “so-called chokepoints” along the NWP, thus “reducing overall shipping season length.”<sup>20</sup> Climate change also causes more unpredictable weather patterns, wildfires, permafrost melt, and coastal erosion, which can arguably make the Arctic less accessible.

Despite these points supporting a more nuanced view of accessibility in the Arctic, it is also true that the use of the NWP as an international shipping route has grown, with the number of transits tripling from 1990 to 2021.<sup>21</sup> The increasing use of the NWP and Canadian Arctic waters more broadly presents security threats that must be considered. Increasing use will lead to more scenarios requiring surveillance, enforcement, and search-and-rescue responses from the CAF and the CCG. These scenarios could include instances of unauthorized access, smuggling, illegal fishing, marine pollution, and safety incidents such as the recent grounding of a commercial cargo ship in the NWP.<sup>22</sup>

### 3.4 Hybrid Threats

Hybrid threats are defined as actions taken to “undermine or harm a target by combining overt and covert military and non-military means.”<sup>23</sup> When speaking about threats posed by foreign states in the Arctic, Russia is often discussed in the context of conventional military threats. In the context of hybrid threats that straddle military and civil realms, the actions of China in the Canadian Arctic also raise some concerns.<sup>24</sup>

For instance, since 2014, China has engaged in multiple scientific expeditions involving data collection on “climatic, meteorological, geomagnetic, and marine environmental conditions,” as well as data collection involving “ocean acoustics and bathymetric survey.”<sup>25</sup> According to Canada’s defence policy, this data has to be made available to China’s military pursuant to Chinese law.<sup>26</sup> A 2019 US Department of Defence report on China’s military capabilities goes a step further, saying that Chinese scientific research and data collection “could support a strengthened Chinese military presence in the Arctic

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<sup>19</sup> Government of Canada 2025

<sup>20</sup> Cook et al. 2024

<sup>21</sup> Office of the Auditor General of Canada 2022

<sup>22</sup> Tranter 2025

<sup>23</sup> Rivard Piché and Sylvestre 2023, p.6

<sup>24</sup> *ibid*, p.14

<sup>25</sup> *ibid*, p.14

<sup>26</sup> Department of National Defence 2024, p.4

Ocean, which could include deploying submarines to the region as a deterrent against nuclear attacks.”<sup>27</sup>

Instances of Chinese scientific expeditions near to the Canadian Arctic are also not an infrequent occurrence. For example, the past two summers have seen a Chinese research vessel called the Xue Long 2 operating near Canadian Arctic waters, which prompted the CAF to deploy a frigate and aircraft to shadow and surveil the ship.<sup>28</sup> In the summer of 2023, it was reported that the Canadian military had tracked and found Chinese monitoring buoys in Canadian Arctic waters, demonstrating another way that foreign states can surveil Canada’s Arctic.<sup>29</sup> Also in 2023, due to earlier incidents over the continental United States, it was feared that a so-called “Chinese spy balloon” had entered Canadian airspace over the Yukon. This object was later shot down by American fighter jets.<sup>30</sup> These examples underline the potential hybrid threats facing the Canadian North and Arctic and the necessary role that the CAF will continue to play to surveil and intercept these types of actions in Canada’s Northern region.

As the main organization tasked with defending Canada, there is certainly a role for the CAF to play in responding to the various threats laid out above. Whether threats are military, environmental, accessibility, or hybrid in nature, a key similarity is that the CAF has played, and will continue to play, an important role in many responses. To that end, there is an open question as to whether current, proposed, and hypothetical locations of CAF infrastructure in Canada’s North and Arctic satisfy the CAF’s strategic and operational needs to respond to threats in the Northern region.

Building on the main threats laid above, this report will continue by describing the strategic and operational objectives of the CAF in the North and Arctic. From these objectives, several quantitative benchmarks are extracted, which will be used to evaluate the value of existing, proposed, and hypothetical locations for a CAF presence in the North and Arctic.

#### 4.0 THE STRATEGIC AND OPERATIONAL OBJECTIVES OF THE CANADIAN ARMED FORCES IN THE ARCTIC

The threats facing Canada’s North and Arctic are broad, encompassing threats of military, environmental, accessibility, and hybrid nature. In line with this, the CAF’s objectives in the North and Arctic have historically been quite broad and centred on the general mandate of defending Canadian sovereignty and security.<sup>31</sup> Due to the Arctic’s vast distances and limited infrastructure, there is only a limited amount of activities that the CAF can realistically and effectively execute. To that end, the CAF has had to “narrow its focus” in the Arctic and has positioned itself to defend Canada against the most likely threats that could target, or pass through, Canada’s North and Arctic.<sup>32</sup>

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<sup>27</sup> Department of Defence 2019, p.v

<sup>28</sup> Brewster 2024; Brewster 2025

<sup>29</sup> Fraser 2023

<sup>30</sup> CBC News 2023

<sup>31</sup> Lajeunesse 2015, p.3

<sup>32</sup> *ibid*, p.3

Recognizing that the threat of an adversary invading the Canadian Arctic is extremely unlikely, the CAF has historically favoured adaptive and flexible operational capabilities that can respond to a wide array of security threats, as opposed to a large permanent presence that is positioned to respond to conventional military threats.<sup>33</sup> This was articulated by Brigadier-General Godbout in the 2023 Senate report on Arctic security, which stated that “there is no plan to station more CAF members in the Arctic on a permanent basis, advocating instead a flexible approach that allows members to be sent ‘wherever they’re needed throughout the three territories.’”<sup>34</sup>

Further to this, in a 2015 paper, Lajeunesse proposes that the CAF’s Arctic capabilities should be “measured by the Forces’ ability to respond to the most likely and realistic threats and challenges. This implies the need for situational awareness, the ability to deploy and maintain appropriate mission specific teams adaptable to a variety of situations, smooth integration into joint operations, and the ability to respond quickly and decisively with appropriate force across the Canadian Arctic.”<sup>35</sup> These four broad requirements are key to highlight as they will help form the benchmarks through which this report can quantify and judge the strategic and operational value of the geographical location of CAF infrastructure in Canada’s North and Arctic.

### *Broad Objectives of the CAF in the North and Arctic*

#### *#1. Situational awareness*

#### *#2. Ability to deploy and maintain appropriate mission specific teams*

#### *#3. Smooth integration into joint operations*

#### *#4. Ability to respond quickly and decisively with appropriate force*

The rest of this section describes the specific objectives of the Royal Canadian Air Force and the Royal Canadian Navy in Canada’s North and Arctic. From these objectives, this report will extract specific quantitative benchmarks through which the existing, proposed, and hypothetical locations of CAF infrastructure will be evaluated.

## 4.1 The Objectives of the Royal Canadian Air Force in the North and Arctic

### 4.1.1 Arctic and Northern ‘Hubs’ with the Capability of Receiving Strategic RCAF Aircraft

As the branch of the CAF with the assets needed to travel long distances in a short period of time, the RCAF will have an inextricable role to play in fulfilling the four broad objectives of the CAF in the North and Arctic. The RCAF has a wide array of mission-specific aircraft that it can employ for such purposes. To achieve situational awareness in the Arctic, the RCAF typically employs the CP-140 Aurora, a long-range patrol aircraft used for surveillance, SAR, and maritime and overland intelligence, among other roles.<sup>36</sup> To deploy and maintain appropriate mission specific teams may require the RCAF to use aircraft

<sup>33</sup> *ibid*, p.3

<sup>34</sup> Senate of Canada 2023, p.58

<sup>35</sup> Lajeunesse 2015, p.4

<sup>36</sup> Government of Canada 2025

such as the CH-147 Chinook helicopter or the CC-138 Twin Otter, both of which have the ability to land on unprepared surfaces and can therefore be used to reach extremely remote locations.<sup>37</sup>

In line with the ability to deploy and maintain mission specific teams and having smooth integration into joint operations, the RCAF needs to be able to move large amounts of personnel, equipment, and fuel around the North and Arctic. For this, the RCAF can use larger transport aircraft such as the CC-177 Globemaster, CC-150 Polaris, and CC-130J Hercules.<sup>38</sup> These types of aircraft are also essential to executing evacuations, as was seen during the 2023 NWT wildfires which saw the military using these transport aircraft to evacuate some residents of Yellowknife and other communities.<sup>39</sup>

The use of different RCAF aircraft implies the need for centralized hubs that can accommodate multiple types of RCAF aircraft and sudden influxes of personnel and equipment. These hubs would also serve as launchpads for military responses to incidents occurring in remote locations across the North and Arctic. This is known as the ‘hub and spoke’ system, where larger transport aircraft will service a central operations centre (the hub), and then smaller aircraft (the spokes) can transport equipment and personnel forward to smaller communities and remote locations.<sup>40</sup> Recognizing the importance of Arctic and Northern ‘hubs,’ the first quantitative benchmark that can be used to evaluate the strategic and operational value of a given location emerges:

*Benchmark #1: Arctic hubs with runway lengths necessary to accommodate strategic types of RCAF aircraft.*

#### 4.1.2 Initial and Rapid Response to an Incident Requiring the Military

There is a wide array of potential threats and situations in the Canadian North and Arctic that would require an initial and rapid response from the CAF. With the North and Arctic being so remote and unpopulated, RCAF aircraft are typically the only method of transportation that can move groups of people and equipment in a short period of time.<sup>41</sup> This means that the RCAF will inevitably be involved in a wide spectrum of roles that extend beyond what is typically demanded of a military. For instance, the RCAF are frequently involved in Canadian and global contexts in search-and-rescue (SAR) operations, responses to environmental and human disasters such as an oil spill, and enforcement operations such as rapid responses to smuggling or illegal fishing.

In the case of the incidents mentioned above, the involvement of the Canadian Rangers would also be a key consideration. Due to the nature of the Canadian Rangers – specifically them being part of the CAF, composed of community members, and present in practically every Northern and Arctic community – the Rangers would almost certainly be the first responders to a security incident in and around populated areas. However, with incidents demanding a more complex response or incidents that occur

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<sup>37</sup> Government of Canada 2025

<sup>38</sup> Antoniuk 2021, p.6

<sup>39</sup> Heidenreich and Boynton 2023

<sup>40</sup> Antoniuk 2021, p.6

<sup>41</sup> Evequoz 2019, p.2

in an extremely remote location, the CAF would have to be involved alongside the Canadian Rangers.<sup>42</sup>

In relation to the 'hub and spoke' methodology, troop movement in response to an incident in the Arctic would likely be done in stages. Troops and equipment would first be moved to Northern and Arctic hubs using larger aircraft such as the CC-177 Globemaster or CC-150 Polaris. From there, smaller aircraft such as CC-130J Hercules, CC-138 Twin Otters, or even helicopters such as the CH-147 Chinook would be needed to move troops and equipment to remote communities with smaller runways.<sup>43</sup> In the event of an incident occurring in an extremely remote location, the CC-138 Twin Otters or helicopters would be required as they could land on an unprepared ice, snow, or ground surface.<sup>44</sup>

The importance of the CC-138 Twin Otters to Arctic operations is crucial to emphasize. Due to their range and ability to land on unprepared surfaces, their use would be key to executing a rapid response to any incident occurring far away from communities, which in the case of the Arctic, would be the vast majority of its land area. With this, a second quantitative benchmark that can be used to judge the strategic and operational value of a geographical location is revealed:

*Benchmark #2: The ability for CC-138 Twin Otters to reach any location in the Arctic, given their maximum range.*

#### 4.1.3 Interception and Tracking of Foreign Aerial Objects

A key aspect of the RCAF's presence in Canada's North and Arctic lies in its three Forward Operating Locations (FOLs) in the territories: Inuvik, Yellowknife, and Iqaluit. These FOLs allow CF-18 Hornet fighter jets from larger RCAF bases in Bagotville, Quebec and Cold Lake, Alberta, to land, refuel, be maintained, and take off in order to participate in operations in the Arctic.<sup>45</sup> The roles of Canadian fighter jets in the North and Arctic are limited, with their primary role being to intercept any foreign objects entering Canadian airspace.<sup>46</sup>

The most likely scenario where Canadian fighter jets would need to be scrambled from the Northern FOLs would be to intercept and track Russian aircraft entering the American or Canadian Air Defence Identification Zone (ADIZ), where "sovereign airspace ends and is a defined stretch of international airspace that requires the ready identification of all aircraft in the interest of national security."<sup>47</sup> According to the US and Canadian militaries, instances of Russian aircraft entering the Alaskan ADIZ, for instance, "occurs regularly and is not seen as a threat."<sup>48</sup> Nevertheless, fighter jets are still frequently employed to intercept and track foreign military aircraft in the ADIZ.

The tracking and interception of foreign aerial objects, whether it is Russian aircraft or an unknown

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<sup>42</sup> Lajeunesse 2015, p.6

<sup>43</sup> Antoniuk 2021, p.6

<sup>44</sup> Government of Canada 2025

<sup>45</sup> Senate of Canada, p.56

<sup>46</sup> Lajeunesse 2015, p.14

<sup>47</sup> North American Aerospace Defence Command 2025

<sup>48</sup> ibid

object, is a key objective of the RCAF in both ensuring sovereignty and security of Canada’s North and Arctic, and our continental defence commitments in NORAD. An example of an incident requiring a rapid response from a fighter jet is the February 2023 balloon incident in Yukon when a foreign object entered Canadian airspace over the territory. Because of an incident of a supposed “Chinese spy balloon” entering US airspace earlier that month, it was feared that the object over the Yukon was linked, and as a result, it was shot down by American fighter jets.<sup>49</sup>

This key role relates to the fourth broad requirement described above, the ability to respond quickly and decisively with appropriate force. With this, another quantitative benchmark that can be used to judge the strategic and operational value of a given location emerges:

*Benchmark #3: The ability for fighter jets to complete a round trip to any location in the Canadian North and Arctic, given their maximum range.*

## 4.2 The Objectives of the Royal Canadian Navy in the North and Arctic

### 4.2.1 Projecting and Sustaining a Naval Presence in the Arctic

According to the RCN’s 2023 Arctic and Northern Strategic Framework, a key objective of the RCN in the Arctic is to “enhance the ability to project and sustain military force.”<sup>50</sup> To achieve this objective, the RCN relies heavily on its principal maritime assets in the North, the Harry DeWolf-class Arctic and Offshore Patrol Vessels (AOPV). These vessels have operated in Canadian Arctic waters since 2021, and unlike the RCN’s other frigates, the AOPVs are capable of operating in first-year ice of 120-centimetre thickness.<sup>51</sup> This enables the RCN to reach more parts of the Arctic across a longer period of the year than ever before.

In line with the RCN’s strategic objective of enhancing the ability to project and sustain military force in the Arctic, the RCN and its AOPVs engage in three main roles. First, with a three-fold increase in transits of the NWP between 1990 and 2021, there is a concurrent need for Canada to ensure that its laws, rules, and regulations are being followed while foreign and domestic ships travel through Canada’s internal waters.<sup>52</sup> Alongside increased shipping traffic through the NWP, it follows that illegal activities such as illegal fishing, pollution, and smuggling could also increase in Canadian Arctic waters. While the enforcement of Canadian laws are not explicitly within the mandate of the CAF, the RCN will inevitably play a constabulary role alongside other government agencies to counter illegal activity in the Canadian Arctic due to its assets and capabilities in the region.<sup>53</sup> With the CCG becoming integrated into the RCN,

<sup>49</sup> CBC News 2023

<sup>50</sup> Royal Canadian Navy, n.d., p.8

<sup>51</sup> Government of Canada, n.d.

<sup>52</sup> Canada asserts that the NWP comprises internal waters, and as a result, the NWP is under the full sovereignty and jurisdiction of Canada. This claim is not shared by the US, who asserts that the NWP is an international strait, and as a result, all ships should enjoy the right of free and innocent passage.

<sup>53</sup> Lajeunesse 2015, p.2

the CAF will have a closer involvement than ever in operations traditionally under other organizations' Arctic mandates.<sup>54</sup>

The second role is to "prevent and respond to safety and security incidents in the Arctic and North."<sup>55</sup> This could be related to any number of the threats facing the Arctic, whether it is a naval SAR operation in response to an emergency, shadowing a foreign research vessel that may constitute a hybrid threat, or aiding in an oil spill response. In other words, there could be an infinite amount of incidents that would require an RCN response due to their assets and capabilities in the Arctic region.

The third role relates to another key objective of the RCN as stated in their strategic framework: strengthening "maritime domain awareness, surveillance, and control capabilities in the Arctic and the North."<sup>56</sup> This role is intertwined with the previous two roles as increased domain awareness and surveillance capabilities will enable the RCN to more effectively engage in enforcement operations and respond to incidents.

Across these three roles there is the need for the RCN to not only project but maintain a presence in the Arctic throughout the most active months, typically between June and October. Research has consistently found that the RCN currently lacks the supporting infrastructure needed to sustain a navy presence in the Canadian Arctic. In the 2023 Senate report on Arctic security, witnesses remarked that "during the 2021 voyage of His Majesty's Canadian Ship Harry DeWolf through the Northwest Passage, a contracted tanker refuelled the ship because there are no permanent refuelling facilities in the Canadian Arctic."<sup>57</sup> This also led to a "competition for fuel" between the RCN and the CCG in the Arctic.<sup>58</sup>

Regarding government efforts on building a permanent refuelling facility in the Arctic, in 2007 the federal government announced that a former deep-water port in Nanisivik would be converted into a refuelling facility to support navy operations in the Arctic.<sup>59</sup> Work was expected to be complete by 2018, however delays resulted in the Nanisivik Naval Facility (NNF) not being fully operational to this day.<sup>60</sup>

Furthermore, a 2022 Auditor General's report remarked that the NNF will not be able to heat its fuel tanks, which will "reduce its period of operation to about 4 weeks per year." This means that for the rest of the navigation season, the RCN and CCG will have to depend on "commercial options or allies' cooperation."<sup>61</sup> In response, the Canadian Government has said that they are "working on a longer-term plan to lengthen the operating season once success and capabilities have been established with the current model."<sup>62</sup>

Aside from Nanisivik, several other Arctic ports have been suggested as a way of supporting both

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<sup>54</sup> Government of Canada 2025

<sup>55</sup> Royal Canadian Navy, n.d., p.2

<sup>56</sup> Royal Canadian Navy, n.d., p.8

<sup>57</sup> Senate of Canada 2023, p.63

<sup>58</sup> *ibid*, p.63

<sup>59</sup> Office of the Auditor General of Canada 2022

<sup>60</sup> Coyne 2025

<sup>61</sup> Office of the Auditor General of Canada 2022

<sup>62</sup> Government of Canada 2023

military and economic needs, namely in Tuktoyaktuk, Gray's Bay, and Qikiqtarjuaq.<sup>63</sup> Some Arctic security experts have suggested that due to Nanisivik becoming operational soon and the relatively long ranges of RCN and CCG ships, "an additional port or refuelling facility a few hundred kilometres away would not meaningfully enhance capabilities."<sup>64</sup>

This point suggests a need for examining the strategic and operational value of proposed locations for naval refuelling facilities in the Canadian Arctic, namely Nanisivik, and whether or not these locations will enable the RCN to not only project, but sustain a military presence in the Arctic. To that end, two quantitative benchmarks emerge that can be used to evaluate whether a geographical location will enable the RCN to satisfy this key objective:

*Benchmark #4: Whether or not refuelling facilities are needed for RCN ships to transit the NWP, given their maximum range.*

*Benchmark #5: Whether or not refuelling facilities allow for RCN ships to maintain a presence in the Arctic during the navigation season.*

## 5.0 THE STRATEGIC AND OPERATIONAL VALUE OF EXISTING LOCATIONS OF CAF INFRASTRUCTURE IN THE NORTH AND ARCTIC.

So far, this report has examined the various threats that are facing Canada's North and Arctic and the broad objectives of the CAF in response to these threats. Through these analyses five quantitative benchmarks have been extracted which can be applied to geographical locations to judge their strategic and operational value.

Section 5.0 engages in several analyses and models to apply these benchmarks to existing locations of CAF infrastructure in the North and Arctic, section 6.0 applies certain benchmarks to proposed locations of CAF infrastructure, and finally, section 7.0 applies certain benchmarks to hypothetical locations of CAF infrastructure. These sections seek to highlight some central findings on the value of geographical locations with the ultimate aim of answering this report's research question: To what extent do existing, proposed, and hypothetical locations of Canadian Armed Forces infrastructure in the North and Arctic provide the strategic and operational value needed to meet Canada's Arctic security objectives?

### 5.1 Existing RCAF Infrastructure

#### 5.1.1 Benchmark #1: Arctic Hubs with Runway Lengths Necessary to Accommodate Strategic Types of RCAF Aircraft

The three primary locations hosting RCAF aircraft in Canada's North and Arctic are Iqaluit, Yellowknife and Inuvik. These locations are currently characterized as FOLs, as they have the ability to host and

<sup>63</sup> Exner-Pirot 2025

<sup>64</sup> *ibid*

deploy CF-18 fighter jets, however, the Government of Canada recently announced that these three locations will also become Northern Operational Support Hubs (NOSHs). These NOSHs will “consist of airstrips, logistics facilities and equipment” and will “extend the Canadian Armed Forces’ operational reach, reduce logistical constraints, and enhance support for military operations in the Arctic.”<sup>65</sup> This characterization reflects the earlier analysis of CAF operations in the Arctic operating as a ‘hub and spoke’ system. These three NOSHs will operate as the hubs, enabling the RCAF to land multiple types of aircraft to move large amounts of equipment and personnel, which can then be deployed via smaller aircraft – the spokes – to remote communities in the Arctic.

While Whitehorse, Yukon is not officially characterized as a NOSH, it is home to significant airport capabilities and infrastructure and is frequently used as a staging ground for military transport and exercises.<sup>66</sup> Due to its frequent use by various types of military aircraft and its northern location, it is reasonable to include Whitehorse in this analysis as well.

Table 1 below evaluates whether these four locations – Iqaluit, Yellowknife, Inuvik, and Whitehorse – satisfy the first benchmark by containing runways with the lengths necessary to accommodate strategic types of RCAF aircraft.

Table 1. Runway Length Required for Strategic RCAF Aircraft compared to Iqaluit, Yellowknife, and Inuvik Runways<sup>67</sup>

Aircraft	Runway Length Required (m)	Iqaluit 2700m	Yellowknife 2250m	Inuvik 1800m	Whitehorse 2900m
CC-138 Twin Otter	365	Able to Land	Able to Land	Able to Land	Able to Land
CP-140 Aurora	1520	Able to Land	Able to Land	Able to Land	Able to Land
CC-177 Globemaster III	915	Able to Land	Able to Land	Able to Land	Able to Land
CC-150 Polaris	2250	Able to Land	Able to Land	Not Able to Land	Able to Land
CC-130J Hercules	950	Able to Land	Able to Land	Able to Land	Able to Land

It is important to note that the Inuvik airport runway is currently being extended by 915 metres, bringing the total length of the runway to over 2,700 metres by November 2027.<sup>68</sup> This will enable the RCAF to land more types of aircraft, including the CC-150 Polaris. In effect, one can conclude that the three NOSH locations plus Whitehorse have the runway length needed for the RCAF to land a wide array of aircraft.

Despite having the required runway lengths, some of these locations also suffer from other

<sup>65</sup> Government of Canada 2025

<sup>66</sup> Howarth 2025

<sup>67</sup> Evequoz 2019, p.5

<sup>68</sup> Government of the Northwest Territories, n.d.

infrastructure gaps that may limit their operational effectiveness. For instance, as of 2021, there were no hangers in the Canadian Arctic that were suitable to accommodate large transport aircraft such as the CC-177 Globemaster.<sup>69</sup> Smaller airports, such as Inuvik, also do not have the de-icing infrastructure and services required to enable aircraft to depart during active weather events.<sup>70</sup>

*Finding: With the exception of landing a CC-150 in Inuvik, the three NOSH locations plus Whitehorse currently have the runway lengths necessary to accommodate strategic types of RCAF aircraft. The completion of the Inuvik airport runway extension will put this location on par with the other NOSH locations.*

### 5.1.2 Benchmark #2: The Ability for CC-138 Twin Otters to Reach Any Location in the Arctic

The use of CC-138 Twin Otters is essential to fulfil the various objectives of the RCAF in the Arctic from SAR operations to security incidents. According to the Government of Canada, The RCAF's CC-138 Twin Otters are used by the 440 Transport Squadron stationed in Yellowknife. The maximum range of the CC-138 Twin Otters is 1,250 kilometres.<sup>71</sup> Figure 1 below shows both the maximum one-way and round trip range of the CC-138 Twin Otters from their base in Yellowknife.

Figure 1. The Maximum One-Way and Round-Trip Range of CC-138 Twin Otters from Yellowknife. (Outer Circle: 1,250km radius, Inner Circle: 625km radius)



<sup>69</sup> Antoniuk 2021, p.7

<sup>70</sup> *ibid*, p.8

<sup>71</sup> Government of Canada 2025

Based on Figure 1, it is clear that the location of the CC-138 Twin Otters in Yellowknife would allow them to reach almost anywhere within the continental part of Canada's North on a one-way flight, also including most of Victoria and Banks Island. It is also clear that the location of the CC-138 Twin Otters does not enable them to reach most of the Canadian Arctic Archipelago. This means that in the case of a SAR operation or security incident occurring outside of the red circle that requires a CC-138 Twin Otter, these aircraft would have to make at least one stop to refuel. The current location of RCAF infrastructure does not satisfy the second benchmark of having the ability for CC-138 Twin Otters to reach any location in the North and Arctic. This represents a significant limitation in the RCAF's Arctic capabilities, as SAR responses or an initial and rapid response to a security incident might be delayed if it occurs outside of the range of the CC-138 Twin Otters.

This finding further proves and underlines the crucial nature of the Canadian Rangers in Arctic security, as they will likely be the first responders to an incident occurring around their communities, especially if their communities lie in the Canadian Arctic Archipelago and outside the immediate range of the Twin Otters.

*Finding: The location of CC-138 Twin Otters in Yellowknife does not enable the CAF to rapidly respond with boots-on-the-ground to many areas in the Canadian Arctic Archipelago via direct flight, with landing and refuelling required to get to more remote locations. This further underlines the importance of the Canadian Rangers as the likely first responders to incidents occurring in their backyard.*

### 5.1.3 Benchmark #3: The Ability for Fighter Jets to Complete a Round Trip to any location in the Canadian North and Arctic.

The main role of fighter jets in the Canadian North and Arctic is to track and intercept foreign aerial objects entering Canadian airspace and the Canadian ADIZ. These foreign aerial objects could be a Russian surveillance aircraft, as has happened multiple times within the Alaska ADIZ, or it could be an unknown object such as a balloon, as happened in 2023 over the Yukon.

The RCAF's main fighter jet is the CF-18 Hornet, an aging aircraft originally delivered in the 1980s with a range of 3,700 kilometres.<sup>72</sup> The Government of Canada is set to soon begin the replacement of the CF-18s with new fighter jets, expecting to reach operational capacity by 2029-2030.<sup>73</sup> One contender, the F-35A Lightning II fighter jet, will have a shorter range of 2800 kilometres compared to the CF-18s.<sup>74</sup> Figure 2 below shows the coverage area of the CF-18 fighter jets from the three northern FOLs of Inuvik, Yellowknife, and Iqaluit. These FOLs are typically serviced by fighter jets from larger RCAF bases in

<sup>72</sup> Government of Canada 2025

<sup>73</sup> Government of Canada, n.d.

<sup>74</sup> *ibid*

Bagotville, Quebec and Cold Lake, Alberta, for the purpose of landing, refuelling, and maintenance in order to participate in operations in the Arctic.<sup>75</sup> The red dashed line represents the boundaries of the CADIZ. It is important to note that the radii of the red circles is 1,850 kilometres – half of the 3,700 kilometres range of the CF-18 – as it is assumed that during an operation involving a CF-18 fighter jet, it would have to be able to complete a round trip back to the FOL it departed from. Figure 3 below shows the exact same concept but considering the shorter range of the incoming F-35A fighter jets.

Figure 2. The Range of CF-18 Fighter Jets Compared to the CADIZ

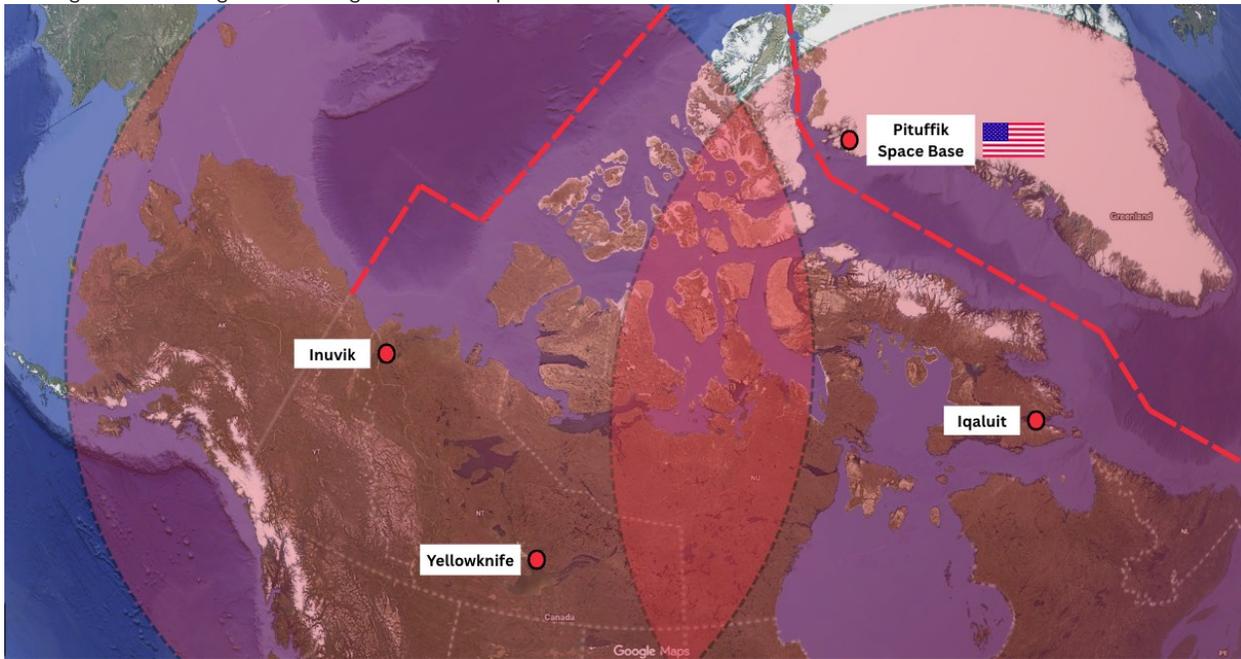


Figure 3. The Range of F-35A Fighter Jets Compared to the CADIZ



<sup>75</sup> Senate of Canada, p.56

Figure 2 and 3 show that the geographical locations of the three FOLS, especially Inuvik and Iqaluit, do enable the RCAF to reach most of the Canadian Arctic and North, including most of the CADIZ. A notable gap in this coverage is present in the higher latitude areas of Ellesmere Island and the northernmost part of the CADIZ.

To cover this gap it is important to note that the United States does have a substantial Space Force base in Pituffik, Greenland with a 3 kilometre long asphalt runway. While Pituffik Space Base does not house a permanent fighter jet presence, it does have the ability to accommodate fighter jets if needed, including the F-35A.<sup>76</sup> In the event of a security incident requiring the deployment of Canadian fighter jets to the northernmost areas of the Canadian Arctic or CADIZ, Pituffik could presumably be used as a stopover location, either at the start or end of an operation, if the incident occurs outside the range of a round trip flight.

Furthermore, the CAF is currently in the process of acquiring a fleet of air-to-air refuelling aircraft, known as the CC-330 Husky. These aircraft will allow the RCAF to “enhance Canadian sovereignty operations” by increasing air mobility and air-to-air refuelling capacity.<sup>77</sup> In effect, this will enable fighter jets to increase their range without having to land. Theoretically, these enhanced refuelling capabilities might also enable the CF-18s and F-35As to reach the northernmost parts of the Canadian Arctic Archipelago and the CADIZ in a single trip.

In effect, one can conclude that with the inclusion of Pituffik Space Base and the eventual inclusion of the CC-330 Husky, the RCAF does have the ability to satisfy the third benchmark, that is the ability to complete a round trip flight to any part of the Canadian North and Arctic. The geographical locations of the three FOL locations generally grant the RCAF the strategic and operational value needed to track and intercept foreign aerial objects in the Canadian North and Arctic.

*Finding: The location of the three FOLs in Inuvik, Yellowknife, and Iqaluit allow the RCAF to deploy fighter jets to most of the Canadian North and Arctic and the CADIZ. In the event of a foreign aerial object penetrating the northernmost areas of the CADIZ, the RCAF would likely be reliant on the use of the US’s Pituffik Space Base as a stopover location.*

## 5.2 Existing RCN Infrastructure

### 5.2.1 Benchmark #4: Whether or not refuelling facilities are needed for RCN ships to transit the NWP

The main role of the RCN in Canada’s Arctic is to “project and sustain military force” in order to counter illegal activities, ensure Canadian laws and regulations are followed, respond to security and safety

<sup>76</sup> Suciú 2025

<sup>77</sup> Government of Canada 2023

incidents, and to provide general maritime domain awareness and surveillance.<sup>78</sup> The RCN will primarily employ its six Harry DeWolf Class Arctic Offshore Patrol Vessels (AOPVs), which have a maximum range of 12,600 kilometres and can navigate through ice as thick as 120 centimetres.<sup>79</sup> Four of the AOPVs are stationed in Halifax, Nova Scotia and the other two AOPVs are stationed in Esquimalt, British Columbia.<sup>80</sup>

One can develop four different scenarios in order to test whether or not refuelling facilities are needed for the AOPVs to transit the NWP from their home ports of either Esquimalt or Halifax. Figure 4 below shows four possible transit routes of the NWP. Transit 1 is from Halifax to Esquimalt (or vice versa) using the southern route of the NWP. Transit 2 is from Halifax to Esquimalt (or vice versa) using the northern route of the NWP. Transit 3 departs Halifax and circles the northern and southern routes of the NWP then returns back to Halifax. Transit 4 departs Esquimalt and circles the northern and southern routes of the NWP then returns back to Esquimalt. Table 2 below shows the length of each possible transit and whether the AOPVs would be able to complete each transit without refuelling.

Figure 4. Four Possible Transits of the NWP from the Ports of Esquimalt and Halifax

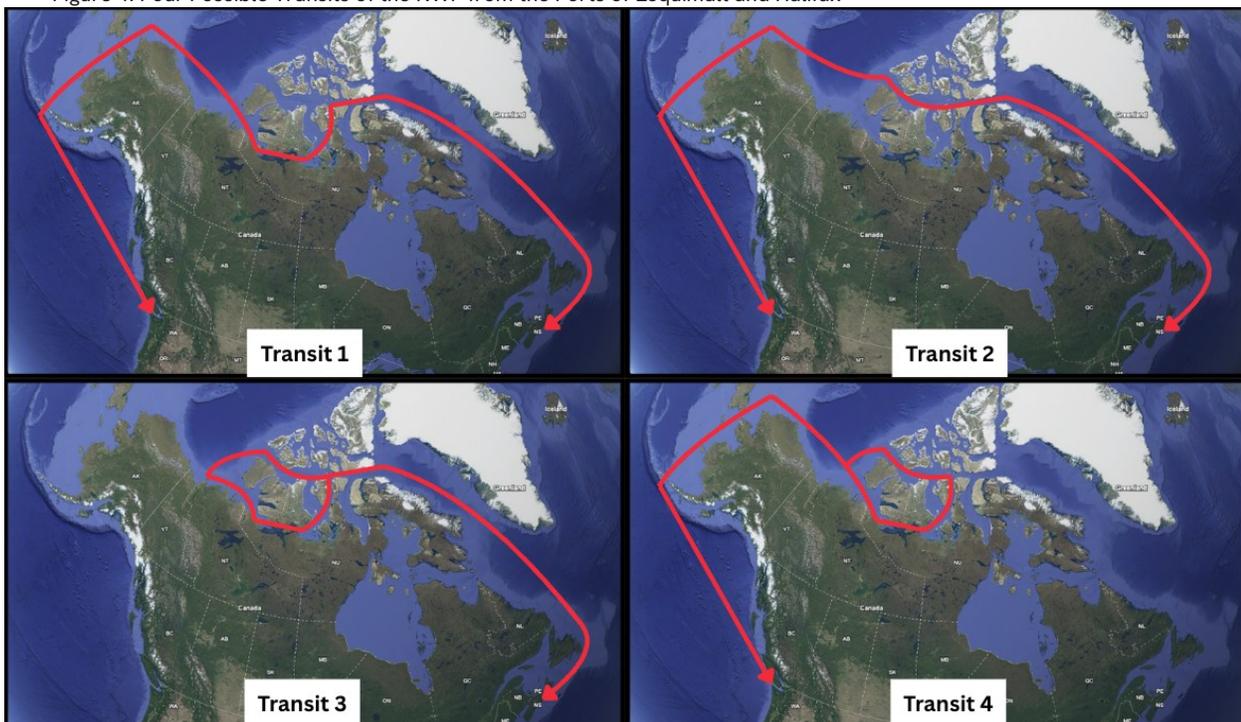


Table 2. Ability of AOPVs to Complete a Transit of the NWP Without Refuelling

	Transit 1	Transit 2	Transit 3	Transit 4
Length of Transit (km)	13,000	11,600	13,200	16,000
Ability of AOPV to	Unable to complete	Able to complete	Unable to complete	Unable to complete

<sup>78</sup> Royal Canadian Navy, n.d., p.8

<sup>79</sup> Government of Canada, n.d.

<sup>80</sup> Government of Canada, n.d.

complete transit without refuelling given the maximum range of 12,600km	transit	transit	transit	transit
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Table 2 makes it quite apparent that the RCN is severely limited in its ability to transit the NWP in the absence of refuelling capabilities. Transit 1, 3, and 4 would be unfeasible without refuelling and Transit 2 offers only 1,000 kilometres of contingency. This means that aside from transiting the NWP in one go, the RCN would also have difficulties responding to an incident if it occurred in an area that would require backtracking or deviating from the route to reach.

These challenges were reflected in a 2021 transit of the NWP by an AOPV when a private tanker had to be contracted in order to refuel the ship because of the lack of permanent refuelling facilities. This also led to a “competition for fuel” between the RCN and the CCG that year while they engaged in their respective Arctic operations.<sup>81</sup> In past RCN operations to Arctic waters, RCN ships have had to make refuelling stops in either Dutch Harbour, Alaska (if departing from Esquimalt) or in Nuuk, Greenland (if departing from Halifax).<sup>82</sup> These examples demonstrate that in the absence of permanent refuelling capabilities in the Canadian Arctic, past RCN operations have had to rely on either commercial alternatives or the cooperation of allies.

*Finding: In the absence of any permanent refuelling capabilities in the Arctic, the RCN is limited in its ability to project, much less maintain, a presence in Canadian Arctic waters from its two ports in Halifax and Esquimalt using only Canadian infrastructure.*

## 6.0 THE STRATEGIC AND OPERATIONAL VALUE OF PROPOSED LOCATIONS OF CAF INFRASTRUCTURE IN THE NORTH AND ARCTIC.

### 6.1 Proposed RCN Infrastructure

#### 6.1.1 Benchmark #5: Whether or not the location of a refuelling facility allows for RCN ships to maintain a presence in the Arctic during the navigation season

Evaluating the strategic and operational value of proposed locations of CAF infrastructure in Canada’s North and Arctic - locations of CAF infrastructure that are fully confirmed but are not yet completely operational - helps develop the future operating environment. As there are very few examples of locations that apply to this classification, this section is devoted to examining the strategic and operational value of the Nanisivik Naval Facility (NNF). The NNF is present at an established location but

<sup>81</sup> Senate of Canada 2023, p.63

<sup>82</sup> Bunt 2021, p.8

not yet completely operational, as seen in Figure 5 below. This section will examine whether the location of the NNF satisfies Benchmark #5: whether or not the location of a refuelling facility allows for the RCN to maintain a presence in the Arctic during the navigation season.

Figure 5. Location of the Nanisivik Naval Facility



In order to determine whether the location of the NNF allows for the RCN to maintain a presence in the Canadian Arctic, factors to consider are the range of the AOPVs (12,600km), the distance of the NNF from an AOPV’s home port (either Halifax or Esquimalt), and the likely rollout of an AOPV deployment in the Arctic.

Assuming a theoretical deployment, an AOPV would first depart its home port for the NNF, and once the AOPV reaches the NNF, the AOPV would then fully refuel. After fully refuelling, the vessel would sail around Canadian Arctic Waters and engage in whatever operations are necessary. This analysis further assumes that the allotted range the AOPV has within Arctic waters is equal to the total range of the AOPV minus the distance from its home port to the NNF. In other words, the AOPV must have enough fuel to make the return journey from the Arctic to its home port, so once fully refuelled at the NNF, it can only sail for as long as the AOPV still has enough fuel to return to its home port (i.e., no secondary refuelling at NNF). Table 3 below describes the different specifications of an AOPV deployment to the Arctic depending on its home port.

Table 3. Specifications of AOPV Deployment to the Arctic

	Distance to NNF (km)	Allotted Range in Arctic Waters once Refuelled (km)	Total Distance of Deployment (km)	Percent of Total Distance within Canadian Waters North of 60°

Halifax home port	4,500	8,100 <sup>83</sup>	17,100 <sup>84</sup>	71% <sup>85</sup>
Esquimalt home port	7,700	4,900 <sup>86</sup>	20,300 <sup>87</sup>	44% <sup>88</sup>

Table 3 also describes the total distance of the AOPV’s deployment, which is the combined total of the distance travelled from its home port to the NNF, the allotted range in Arctic waters once refuelled, and the distance travelled back to its home port. In order to illustrate the proportion of the deployment actually spent in Canadian Arctic waters, Table 3 also describes the percentage of the total distance travelled that occurred in Canadian waters north of 60 degrees latitude.

Because Benchmark #5 relates to whether the NNF allows the RCN to *maintain* a presence in the Arctic, it is also essential to examine what sort of route an AOPV could take given its allotted range in Arctic waters described above. Figure 6 shows a possible route that could be taken by an AOPV given it departs from Halifax, refuels once at the NNF, and has an allotted range of 8,100km in Canadian Arctic waters. Figure 7 shows a possible route taken by an AOPV given in departs from Esquimalt, refuels once at the NNF, and has an allotted range of 4,900km in Canadian Arctic waters. In both figures, the dashed red line represents the route taken to the NNF while the solid red line represents a possible route taken around Canadian waters once refuelled.

Figure 6. Possible Route of an AOPV departing from Halifax



<sup>83</sup> Range of AOPV - Distance from Halifax to NNF: 12,600km - 4,500km = 8,100km  
<sup>84</sup> Distance from Halifax to NNF \* 2 + Allotted Range in Arctic Waters: 4,500km \* 2 + 8,100km = 17,100km  
<sup>85</sup> Distance North of 60 in Canadian Waters / Total Distance \* 100: 12,100km / 17,100km \* 100 = 71%  
<sup>86</sup> Range of AOPV - Distance from Esquimalt to NNF: 12,600km - 7,700km = 4,900km  
<sup>87</sup> Distance from Esquimalt to NNF \* 2 + Allotted Range in Arctic Waters: 7,700km \* 2 + 4,900km = 20,300km  
<sup>88</sup> Distance North of 60 in Canadian Waters / Total Distance \* 100: 8,900km / 20,300km \* 100 = 44%

Figure 7. Possible Route of an AOPV departing from Esquimalt



It is important to emphasize that the above routes are completely arbitrary and their depiction is only to illustrate the amount of area that an AOPV could cover given its allotted range. The Figures show that in both scenarios the geographical location of the NNF generally grants the RCN the ability to maintain a presence in the Canadian Arctic. In maintaining this presence, the Figures show that the location of the NNF also grants the RCN the ability to travel to any location along the NWP and patrol areas of the NWP more than once. To that end, the location of the NNF does have strategic and operational value because it enables the RCN to respond to incidents occurring anywhere along the NWP, even if such responses require the RCN to deviate off course or backtrack a significant distance.

The location of the NNF does favour AOPVs departing from Halifax, as the NNF is over 3,000 kilometres closer to Halifax compared to Esquimalt. As a result, AOPVs departing from Halifax have a greater allotted range in Arctic waters and can therefore maintain a greater presence. With four of the six AOPVs stationed in Halifax, the capabilities of the RCN in the Arctic are optimized.

It is important to reiterate that this analysis only considered the strategic and operational value of the NNF when it comes to its geographical location, not the infrastructure of the NNF itself. The 2022 Auditor General's report found that because of the NNF's unheated fuel tanks, the NNF will only be operational for about 4 weeks per year.<sup>89</sup> There is no doubt that this limitation, among others, will carry many implications for the operational success of the NNF.<sup>90</sup> Nonetheless, this analysis does find that at least the geographical location of the NNF does have strategic and operational value.

*Finding: The geographical location of the NNF allows the RCN to maintain a presence in Canadian Arctic waters. Specifically, the location of the NNF allows AOPVs departing from Esquimalt and Halifax*

<sup>89</sup> Office of the Auditor General of Canada 2022, p.22

<sup>90</sup> Bunt 2021, p.9

*to arrive, refuel, engage in a full transit of the NWP with additional patrol routes, and return back to their home port.*

## 7.0 THE STRATEGIC AND OPERATIONAL VALUE OF HYPOTHETICAL LOCATIONS OF CAF INFRASTRUCTURE IN THE NORTH AND ARCTIC.

### 7.1 Hypothetical RCAF Infrastructure

#### 7.1.1 Benchmark #2: The Ability for CC-138 Twin Otters to Reach Any Location in the Arctic

The previous sections evaluated the strategic and operational value of several existing and proposed locations of CAF infrastructure in Canada's North and Arctic. Specifically, this report found that the four locations of Inuvik, Yellowknife, Iqaluit, and Whitehorse have the runway lengths required to accommodate strategic types of RCAF aircraft. The same three locations, minus Whitehorse, are generally well-positioned as FOLs, enabling CF-18s and F-35s to reach most parts of the Canadian Arctic and the CADIZ. With the inclusion of Pituffik Space Base as a stopover location if needed, Canadian fighter jets are able to reach every part of the Canadian Arctic and CADIZ.

This report also found that without permanent refuelling capabilities in the Canadian Arctic, the RCN is unable to project and maintain a naval presence in Canadian Arctic waters without commercial support or allies' cooperation. Once the NNF is operational, this report found that its location is well placed to allow AOPVs to maintain a presence in the Canadian Arctic even after just one full refuel.

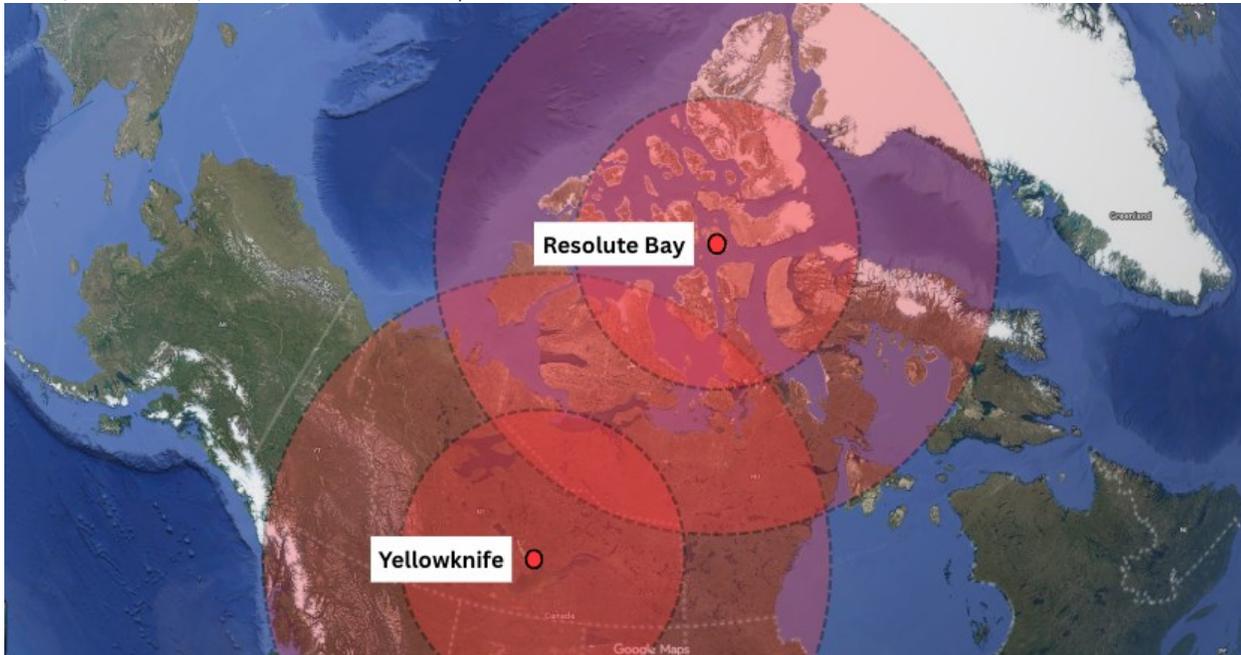
Given these findings, one can conclude that existing and proposed locations of CAF infrastructure do generally provide the strategic and operational value needed for the CAF to satisfy its broad objectives in Canada's North and Arctic.

This report did identify one gap in the Arctic capabilities of the CAF, the coverage of the RCAF's CC-138 Twin Otters based in Yellowknife. As mentioned previously, the positioning of the CC-138 Twin Otters in Yellowknife does allow them to reach most of Canada's continental North and Arctic, however, most of the Canadian Arctic Archipelago is outside of the CC-138 Twin Otters' 1,250 kilometre one-way range. If a security or safety incident requiring CC-138 Twin Otters occurred outside of their range, the CC-138 Twin Otters would have to make at least one stop to refuel, which would add several hours to any response.

Given this gap, this report did recognize the importance of the Canadian Rangers' role as the likely first responders to an incident occurring in their backyards. Admittedly, it is possible that the Canadian Rangers are perfectly suited to fill in the Twin Otters' lack of coverage in Canada's High Arctic. Nevertheless, one can envision scenarios that occur in extremely remote areas and require a rapid response that a land expedition could not meet and where a CC-138 Twin Otter – with their ability to land on unprepared snow and ice surfaces – would be necessary.

To that end, this report will examine the strategic and operational value of Resolute Bay, as seen in Figure 8 below, as a hypothetical location to base CC-138 Twin Otters. While this report has found that the existing and proposed locations of CAF infrastructure are generally well-placed, this final area of analysis will help to see if the inclusion of Resolute Bay offers strategic and operational value and can further enhance the capabilities of the CAF in the Arctic.

Figure 8. The Maximum One-Way and Round Trip Range of CC-138 Twin Otters from Yellowknife and Resolute Bay (Outer Circle: 1,250km radius, Inner Circle: 625km radius)



As seen in Figure 8, Resolute Bay is centrally located in the Canadian Arctic Archipelago, thereby granting the CC-138 Twin Otters an ideal location to engage in operations throughout most of Canada's High Arctic. Not only is Resolute Bay located in a strategic location for the CC-138 Twin Otters, but Resolute Bay itself is no stranger to a CAF presence. While Resolute Bay is a small community of less than 200 people, the federal government has two substantial roles in the community that could facilitate the basing of CC-138 Twin Otters. First is the Polar Continental Shelf Program (PCSP) administered by Natural Resources Canada. The PCSP has a permanent Arctic logistics hub located in Resolute Bay, which is open from February to September and can house 237 people.<sup>91</sup> Second is the nearby CAF Arctic Training Centre (commonly known as Crystal City), which provides a permanent location for training and operations in the High Arctic.<sup>92</sup>

Not only does Resolute Bay offer the RCAF's CC-138 Twin Otters the ability to engage in a one-way operation to most parts of the Canadian Arctic Archipelago without stopping to refuel, but the dual-purpose nature of existing federal government assets in Resolute Bay would ease some pressure of

<sup>91</sup> Government of Canada 2015, p.4

<sup>92</sup> Government of Canada 2023

increased traffic on the local community. These two aspects – a strategic geographical location and existing federal assets – make Resolute Bay a worthy contender to house Twin Otters alongside Yellowknife. Overall, this dual coverage model could enable the RCAF to move personnel, station equipment, and respond to security and safety incidents throughout the three territories and the Canadian Arctic Archipelago more rapidly and efficiently than the status quo.

The increased development of Resolute Bay as a location for the CAF is not a new concept. Colonel (Retired) Pierre Leblanc, a former Commander of the Canadian Forces in the Arctic, has been a notable advocate for developing Resolute Bay as a “security hub” in the High Arctic.<sup>93</sup> Specifically, Leblanc has argued that Resolute Bay’s airstrip should become paved in order to support a wider array of RCAF aircraft, including fighter jets. Leblanc has also argued that a deep-water port be built in Resolute Bay due to its location on the NWP and to support and refuel naval assets.

This analysis aligns with Leblanc’s view that Resolute Bay is an ideal location for the CAF to “support search and rescue, environmental response, safety and security operations,” specifically with the permanent or seasonal housing of CC-138 Twin Otters.<sup>94</sup> Further research should be conducted to determine whether the CAF’s Arctic capabilities would be meaningfully enhanced by also building a deep-water port and the capability to house fighter jets in Resolute Bay. As this report showed, the location of the CAF’s three northern FOLs and the location of Nanisivik would already enable fighter jets and AOPVs to reach most, if not all, parts of the Canadian Arctic. In that sense, the development of Resolute Bay as a “security hub” with the ability to accommodate fighter jets and naval assets may not be necessary.

*Finding: The addition of Resolute Bay as a location for stationing CC-138 Twin Otters, alongside their existing base in Yellowknife, would enable the RCAF to rapidly respond to safety and security incidents throughout most of the continental North and Arctic, as well as most of the Canadian Arctic Archipelago.*

## 8.0 SUMMARY OF FINDINGS

Table 4 below summarizes the findings from the last three sections. Overall, the findings show that the existing and proposed locations of military infrastructure in the North and Arctic generally provide the CAF the strategic and operational value necessary to fulfil their broad objectives in the Arctic.

First, the three NOSH locations of Inuvik, Yellowknife, and Iqaluit all have (or will have) the runway lengths necessary to accommodate strategic types of RCAF aircraft. Second, CF-18 and F-35A fighter jets have the ability to complete a round-trip flight from the same three FOL locations to most parts of the Canadian North and Arctic and CADIZ. With the inclusion of Pituffik Space Base in northern

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<sup>93</sup> Leblanc 2022

<sup>94</sup> *ibid*

Greenland as a stopover location, Canadian fighter jets would be able to reach every part of the Canadian North and Arctic and CADIZ.

In terms of existing infrastructure, notable gaps still exist in two areas. First, the current lack of a permanent naval refuelling facility in the Arctic renders it practically impossible for the RCN to project and maintain a naval presence in Arctic waters without relying on commercial options or allies' cooperation. However, once the NNF reaches full operational capacity, its location will enable AOPVs departing from Esquimalt and Halifax to complete multiple transits of parts of the NWP, thus enabling not only the projection but the maintenance of a naval presence in Canadian Arctic waters. Second, the location of Yellowknife as the only place permanently holding CC-138 Twin Otters does not enable the RCAF to quickly reach most parts of the Canadian Arctic Archipelago with boots-on-the-ground. This fact underscores the importance of the Canadian Rangers as likely first responders to safety and security incidents occurring in their backyard. Alongside Yellowknife, the addition of Resolute Bay as a location to base Twin Otters would allow the RCAF to rapidly reach most parts of the Canadian North and Arctic.

Table 4. Summary of Findings

Benchmark	Finding
Existing Locations	
<i>Benchmark #1. Arctic Hubs with Runway Lengths Necessary to Accommodate Various Types of RCAF Aircraft</i>	With the exception of landing a CC-150 in Inuvik, the three NOSH locations currently have the runway lengths necessary to accommodate strategic types of RCAF aircraft. The completion of the Inuvik airport runway extension will put this location on par with the other NOSH locations.
<i>Benchmark #2. The Ability for CC-138 Twin Otters to Reach Any Location in the Arctic</i>	The location of CC-138 Twin Otters in Yellowknife does not enable the CAF to rapidly respond with boots-on-the-ground to many areas in the Canadian Arctic Archipelago via direct flight, with landing and refuelling required to get to more remote locations. This further underlines the importance of the Canadian Rangers as the likely first responders to incidents occurring in their backyard.
<i>Benchmark #3. The Ability for Fighter Jets to Complete a Round Trip to any location in the Canadian North and Arctic.</i>	The location of the three FOLs in Inuvik, Yellowknife, and Iqaluit allow the RCAF to deploy fighter jets to most of the Canadian North and Arctic and the CADIZ. In the event of a foreign aerial object penetrating the northernmost areas of the CADIZ, the RCAF would likely be reliant on the use of the US's Pituffik Space Base as a stopover location.
<i>Benchmark #4. Whether or not refuelling facilities are</i>	In the absence of any permanent refuelling capabilities in the

<p><i>needed for RCN ships to transit the NWP</i></p>	<p>Arctic, the RCN is limited in its ability to project, much less maintain, a presence in Canadian Arctic waters from its two ports in Halifax and Esquimalt.</p>
<p>Proposed Locations</p>	
<p><i>Benchmark #5. Whether or not the Location of a refuelling facility allows for RCN ships to maintain a presence in the Arctic during the navigation season</i></p>	<p>The geographical location of the NNF allows the RCN to maintain a presence in Canadian Arctic waters. Specifically, the location of the NNF allows AOPVs departing from Esquimalt and Halifax to arrive, refuel, engage in a full transit of the NWP with additional routes, and return back to their home port.</p>
<p>Hypothetical Locations</p>	
<p><i>Benchmark #2. The Ability for CC-138 Twin Otters to Reach Any Location in the Arctic</i></p>	<p>The addition of Resolute Bay as a location for stationing CC-138 Twin Otters, alongside their existing base in Yellowknife, would enable the RCAF to rapidly respond to safety and security incidents throughout most of the continental North and Arctic, as well as most of the Canadian Arctic Archipelago.</p>

## 9.0 RECOMMENDATIONS

The following recommendations translate the findings of this report for relevant stakeholders in Canada’s Arctic security and defence posture. These recommendations are targeted at the Department of National Defence (DND), the RCAF, the RCN, and territorial governments.

It is important to emphasize that while this report is tackling the broad concept of Arctic security and defence, the report’s scope was relatively narrow, analyzing and evaluating mainly the strategic and operational value of geographical locations for the CAF. To that end, policymakers must also take into account reports and recommendations on Arctic security issued by other relevant organizations.<sup>95</sup> Only then will a comprehensive vision of Arctic security be fulfilled that satisfies not only military needs, but community needs as well.

*Recommendation 1: Ensure Infrastructure Locations Continue to Meet the Needs of the CAF.*

<sup>95</sup> Several organizations have issued recent reports and recommendations on Arctic security. See, [Yukon Arctic Security Advisory Council Report](#), [Government of Nunavut and Nunavut Tunngavik Inc. Arctic Security and Sovereignty Strategy](#), [Inuit Tapiriit Kanatami: An Inuit Vision for Arctic Sovereignty, Security and Defence](#), and [AFN Yukon Region: Yukon First Nations Defence and Security](#).

In line with Recommendation 12 from the 2023 Senate report on Arctic security<sup>96</sup>, initiate and continue reviews of Arctic CAF infrastructure locations to ensure they meet the evolving strategic and operational needs of the RCAF and the RCN.

*Recommendation 2: Engage in Public Information Campaigns to Increase Awareness of Threats and to Counter Misinformation*

In coordination with territorial governments and Indigenous partners, launch sustained public information campaigns to enhance northern residents' awareness of evolving Arctic security threats—military, environmental, accessibility and hybrid—and to counter misinformation, misleading narratives, or foreign influence operations.

*Recommendation 3: Leverage Canadian Rangers as a Community-Based Security Resource.*

Expand funding and logistical support for the Canadian Rangers, with a focus on interoperability training with CAF, especially in the Canadian Arctic Archipelago where RCAF range is limited.

*Recommendation 4: Finalize Operational Capability of the Nanisivik Naval Facility (NNF).*

Recognizing that the location of the NNF is adequate to support RCN operations, expedite upgrades of the NNF to include heated fuel storage in order to extend operational periods and to ensure reliability throughout the navigation season.

*Recommendation 5: Reassess Port Infrastructure Expansion Needs*

Conduct studies on the value of secondary refuelling or anchorage points – for example in, North Yukon, Tuktoyaktuk, Qikiqtarjuaq, and Churchill – to assess whether the capabilities of the RCN would be meaningfully enhanced with additional Arctic port infrastructure.

*Recommendation 6: Explore the Feasibility of Enhancing CAF Infrastructure in Resolute Bay*

Engage in deeper analyses and studies to determine whether an expanded military presence in Resolute Bay would meaningfully enhance the capabilities of the RCAF to respond to incidents throughout the Canadian Arctic Archipelago. Such studies must involve community consultation and research as to the potential benefits, risks, and burdens an expanded RCAF presence could have on the community of Resolute Bay.

*Recommendation 7: Establish a Seasonal RCAF Detachment in Resolute Bay*

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<sup>96</sup> Senate of Canada 2023, p.69

If the outcomes of Recommendation 6 support the findings of this report, base a small fleet of CC-138 Twin Otters in Resolute Bay during the high-activity months (e.g., April–October) to enhance rapid response capabilities to incidents that occur across the Canadian Arctic Archipelago.

*Recommendation 8: Support Community-Based Security and Preparedness Planning*

Recognizing that the CAF will not be able to respond rapidly to every single incident occurring in Canada’s North and Arctic, provide funding, training, and resources for communities to enhance planning for local response readiness, communications protocols, and civilian evacuations.

## 10.0 CONCLUSION

Prime Minister King was certainly correct when he stated that Canada has a lot of geography, but does Canada in fact have “too much geography?” From an onlooker’s perspective, it may seem that the vast expanses of Canada’s North and Arctic are impossible to comprehensively monitor and reach, even for some of the world’s most sophisticated militaries. With the Arctic heating up, both literally and figuratively, there are important questions to be asked about whether the CAF is equipped to tackle the various threats facing this massive region. As highlighted in Recommendation 12 of the 2023 Senate report on Arctic security, there is a specific need to analyze whether the locations of CAF infrastructure in the North and Arctic enable the CAF to satisfy their objectives in the region.

This report provides a solid and comprehensive view into this question, finding that the existing and proposed locations of CAF infrastructure in the North and Arctic generally provide the strategic and operational value needed for the CAF to satisfy its objectives in the region. This report did find certain gaps, however, Canadians should view the report’s findings as an indication that the North and Arctic is much more secure than certain narratives make it seem.

To reach these findings, this report engaged in four main steps. First, this report analyzed the nature of threats currently facing Canada’s North and Arctic. This report found that while kinetic military threats in Canada’s Arctic are unlikely, there are very real environmental, accessibility, and hybrid threats facing the region.

Second, this report analyzed the broad objectives of the CAF in the Arctic in response to the most likely threats facing the region. This section recognized that due to the unlikely possibility of foreign invasion, the role of the CAF in the Arctic is not to have a strong defensive presence, but rather to position itself to have comprehensive situational awareness, the ability to deploy and maintain appropriate mission specific teams, the ability to integrate smoothly into joint operations, and the ability to respond quickly to any security or safety incident.

Third, the report analyzed the specific objectives of the RCAF and the RCN, using this analysis to extract five quantitative benchmarks used to evaluate geographical locations of CAF infrastructure in the North and Arctic.

Last, this report applied these benchmarks to existing and proposed locations of CAF infrastructure in the North and Arctic, finding that the combination of existing and proposed locations of CAF infrastructure generally grants the strategic and operational value needed to satisfy the CAF's objectives in the region.

To finish, this report offered eight recommendations targeting the federal government, the CAF, and territorial governments to enhance both CAF Arctic capabilities and community resilience.

This report offered a comprehensive and quantitative assessment of the strategic and operational value of the locations of CAF infrastructure in Canada's North and Arctic, yet further research remains essential. For instance, further research should examine the locations of CAF infrastructure not solely through a military lens, but through a community-oriented one as well. This will recognize that not only strategic and operational military considerations contribute to a secure Arctic, but that the resilience of northern communities and peoples will ultimately ensure the region is protected and prosperous. In doing so, Canada can ensure that its Arctic military presence remains capable, evolves in step with the region's changing realities, and reflects both national interests and the aspirations and needs of its northern communities.

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