SOVEREIGNTY THROUGH SECURITY?
CANADA'S ARCTIC DEFENCE IN THE SURVEILLANCE AGE

SUBMITTED BY:

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ABSTRACT

This project considers how social imaginaries structure the development and use of technology in the Canadian Arctic within the field of security. In particular, this dissertation examines how discourses of risk structure policies focused on the innovation of security technologies designed to make a spectrum of future threats visible in the present. The dissertation asks: does the development of new technologies geared towards surveillance of the Canadian Arctic represent a new approach to security in the North?

It is argued that current technological developments are grounded in a particular sociotechnical imaginary that is at once predicated on historical state practices while drawing from a more comprehensive assemblage of modern state strategies that are refracted through a lens of futurity. In order to demonstrate this, the dissertation draws on recent theoretical interventions in International Relations that call for material-semiotic frameworks of analysis to show how discursive and symbolic expressions of the Arctic are interwoven with material elements. Notably, how the Arctic is understood and rationalized as a space of social and political life is dependent on a uniquely securitized image of the future. Within this imaginary, the Canadian state's rhetorical claims to sovereignty are threatened by the potential for competing expressions of power enabled by climate change, technological diffusion, and other trends at the international scale. Consequently, technologies developed for surveillance, intelligence, and Arctic security more broadly are designed to support practices of pre-emption as techniques of state power.

Canada is prioritizing technological innovation as a governance strategy designed to rationalize and consolidate its power over its Arctic territory. Broadly, this strategy is predicated on illuminating the Arctic using the visible and non-visible spectrums, which contributes to sovereignty as a rhetorical, material, and symbolic signifier of state power and control. In order to demonstrate the interplay between this imaginary and material expressions of state sovereignty, the concept of *full-spectral dominance* is deployed as a technique of power that captures the state's security ambitions through the joint practices of surveillance and intelligence (sensing). This concept is illustrated through an examination of current technological developments being pursued by the Canadian state through the *All Domain Situational Awareness* (ADSA) Program led by National Defence along with related programs and developments. In sum, these developments exhibit how increasingly imaginative views of the Arctic's future contour state-led practices in the present.

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I was warned by several people while contemplating the pros and cons of pursuing a doctoral degree that the whole ordeal was an inherently solitary endeavour because, at the end of the day, it is you and you alone that has to commit to the volumes of emotional and intellectual labour needed to produce a dissertation. This isolationism could be either a pro or a con depending on your position, but it is probably more accurate to say that it is often both. While the work of producing a doctoral dissertation may often feel isolating, no graduate student worth the effort of their research would suggest that they did it (or made it through graduate school) alone.

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DEDICATION

This dissertation is dedicated to my brother, my father, and especially to the memory of my mother, Karen Elizabeth Riley Johnson (7 November 1951 – 30 November 2020), a talented writer in her own right. Without her countless hours of help with reading, writing, school projects, and her constant reminder to my brother and me that ‘education was our key to freedom,’ this dissertation would never have come to fruition.

TABLE OF CONTENTS

Woodcut from *Frankenstein or the Modern Prometheus* by Mary Shelley with engravings on wood by Lynd Ward (New York: Smith and Mass, 1934), p. 242.

Follow me; I seek the everlasting ices of the north, where you will feel the misery of cold and frost, to which I am impassive.

Mary Shelly's *Frankenstein; or The Modern Prometheus*

Introduction: The Arctic Nation

> This national Development Policy will create a new sense of National Purpose and National Destiny. One Canada! One Canada, wherein Canadians will have preserved to them the control of their own economic and political destiny. Sir John A. Macdonald gave his life to this party. He opened the West. He saw Canada from East to West. I see a new Canada – a Canada of the North.
>
> John Diefenbaker, 1958 as cited by Harrington & Lecavalier, 2014, p. 108

Introduction

The Canadian Pacific Railway was a fundamental part of Confederation and critical to building Canada's political, economic, and social linkages. The transcontinental railroad enabled some sense of nation among the disparate regions and peoples, and arguably, the nations that continue to inhabit the lands that now make up the Canadian state. In contrast, Canada's North to South linkages have garnered much less interest and support in nation-building and economic development. In part, this is because Canada's northern region, particularly the circumpolar Arctic, has primarily existed as a symbolic feature of the nation – the 'True North strong and free' - rather than a substantial component to the pursuit of the state's interests outside of narrow security concerns.

The acceleration of anthropogenic climate change and its accentuated effects in the Arctic[1] is predicted to alter the region's relevance to Canada's national interests, along with the interests of other states. Harrington and Lecavalier (2014) highlight the historical role that the Arctic played as an imaginary for nation-building in Canada and note that "John Diefenbaker's election victory in 1958 was largely based on his northern vision of development" (Harrington & Lecavalier, 2014, p. 108). Diefenbaker's northern vision never came to be. However, with

[1] The recent Arctic Monitoring & Assessment Programme (AMAP), which is a working group of the Arctic Council, recently stated that the Arctic is warming three times faster than the rest of the planet and that this can have a massive effect on the global climate system (AMAP, 2021, p. 2-4).

renewed interest in the region, it may be argued that if the project of Canada was historically predicated on connecting its Atlantic and Pacific coasts, the country's future might very well depend on how Canada transforms itself from a littoral Arctic state into a *literal* Arctic nation.

A Brave New World

The Arctic is a microcosm for the widespread changes occurring in our present moment, creating stark implications for the immediate and distant future**.** Whether technological advancement, political contestation, or the planet's acceleration towards environmental transformation, the Arctic serves as a cross-section of the challenges for human progress and wellbeing. Accordingly, it is no surprise that Arctic security has become a thematic focus for politicians, academics, and media commentators alike.

The Arctic is a site of significant interest given its potential for generating a great deal of the earth's remaining extractive resources and the way it invokes a sense of wonder through its natural and atmospheric beauty. The Arctic is also inhabited by many communities, particularly Indigenous peoples, who have lived in their homelands for millennia.[2] However, the Arctic's imaginary quality as a frontier space often reduces the land to its essentialist features within the backdrop of Western culture, stripped of the "human experience" (Chartier, 2018, p. 15) that has characterized the region for centuries longer than the nation-state has existed. Indeed, the Arctic is often remarked upon for its frontier quality as *terra nullius* for human exploration, which has long been captured in stories of adventure and has served as a metaphor to illustrate the struggles

[2] Arctic Indigenous peoples are represented as Permanent Participants in the Arctic Council by six organizations: Inuit Circumpolar Conference (ICC), Saami Council, Russian Association of Indigenous Peoples of the North (RAIPON), Aleut International Association (AIA), Gwich'in Council International (GCI), and Arctic Athabaskan Council (AAC). See "Indigenous Peoples of the Arctic" at https://www.arcgis.com/apps/Cascade/index.html?appid=2228ac6bf45a4cebafc1c3002ffef0c4 for an interactive map and history of Arctic Indigenous peoples and timeline of the Arctic Council.

of the human condition. The Arctic is thus regarded as otherworldly, or in the words of Inuit leader Terry Audla,[3] "elemental and exotic" (2013, p. 7), serving as one of the few remaining spaces of the world relatively unaltered by human incursion; an insular heartland of "splendid isolation" (Zellen, 2013, p. 339; Lajeunesse, 2016, p. 34).

While time and geography may no longer serve as constraints for human ambition, that ambition may ultimately threaten human existence. Against the backdrop of a natural, beautiful, and fierce (but fragile) iridescence, the Arctic is also a world shaped by political imaginations due to the heightened effects of climate change and its place as a theatre for the possible exchange of nuclear weapons during the Cold War (Huebert, 2014). More recently, because the Arctic has been implicated as a new frontier for resource extraction enabled by anthropogenic climate change, this opportunity leads to the potential for interstate rivalry over these resources. The possibility of international conflict, however remote, has fueled dramatic "images of foreign adversaries coming over the Pole to invade through the Arctic, [which were] popular in early Cold War continental defence [and have] been resurrected in portrayals of a *brave* new twenty-first century Arctic world" (Lackenbauer & Lajeunesse, 2016, p. 42, my emphasis). Thus, the Arctic is a complex space of multiple, overlapping, and sometimes conflicting imaginaries that crystallize into ideas about what the Arctic *is* and what it will likely *become* in the future (Hannes, 2015, p. 6).

The Research Problematic

This project focuses on the Canadian Arctic as a case study for researching the development and use of sensing technologies in processes related to security. The Arctic figures

[3] Terry Audla is President of Inuit Tapirit Kanatami (ITK), a national organization representing roughly 60,000 Inuit in Canada's northern territories (see Economic Club of Canada, 2021).

prominently into Canada's identity as a nation, where the interplay between continental defence, environmental security, and national sovereignty has historically served as a salient framework for policy considerations in the region. The Canadian context, in particular, has demonstrated a narrow concern by the state for surveillance capacity in its Arctic territory to support both security and sovereignty. Recent developments linked to surveillance concerns indicate that the Arctic is more routinely considered as a security theatre. However, rather than being characterized by security in commonly understood ways (such as military build-up), developments in the Arctic indicate a conceptually broader understanding of security by Canada related to social, economic, and environmental challenges, in addition to those of military defence.

The Canadian Arctic has become a location for several developments involving technological innovation (e.g., see Campion-Smith 2013; Canadian Space Agency 2018; Heard 2018; Thomson 2017). However, current scholarship on Arctic security has been limited in its engagement with the Canadian state's emphasis on technological development in the North.[4] This research gap is a significant oversight given the prominent place of technology within Canada's security concerns in the Arctic. Existing research within International Relations (IR) theory typically analyzes Arctic security within two broad frameworks. The first framework considers whether the Arctic is re-emerging as a military theatre amid growing tension between Russia and the West, including Russia's enhancement of their northern military capabilities (Charron, Plouffe & Roussel 2012), as well as the rising interest in the region by non-Arctic states such as China (Lasserre, Huang & Alexeeva 2017). Analysis using this state-centric lens generally

[4] There have been noteworthy interventions on Canada's Arctic security technology historically (especially the Distant Early Warning [DEW] line) and in terms of policy considerations linked to geostrategic interests (see Carruthers, 2015; 2018; Lajeunesse, 2016). However, there has been no systematic theorization of current and future Arctic security technologies concerning state power.

agrees that the possibility for conventional military conflict in the Arctic region is low and that cooperation and peaceful dispute resolution will remain the norm, at least in the near-term horizon.

The second framework critically challenges this state-centric view and focuses on broadening our understanding of security through environmental, cultural, and human grounded perspectives (Gjørv 2017; Greaves 2012). Within this context, security imperatives are primarily understood to be defined through processes of *securitization*, where the state circumscribes what subjects and issues are constituted as objects of security, and therefore deserving of attention and resources outside the realm of normal politics (Buzan, Wæver & Wilde 1998). This research framework considers the limits and normative issues with the dominant state-centric lens while demonstrating how Indigenous communities in the Arctic are affected insofar as their interests are assumed to align with the security priorities of the state. In reality, the security needs articulated by these communities (especially those concerning adequate food, shelter, infrastructure, and essential resources) are often undermined and marginalized by the state's security imperatives.

Researchers have made a minimal attempt within either state-centric or critical frameworks to engage with technological innovation for Arctic surveillance. This lack of attention is a curious oversight given the amount of interest demonstrated by Canada in developing new security technologies for use in the Arctic and the great deal of research produced on surveillance in the modern era. Conventional state-centric analytical frameworks have focused on the appropriateness of developing surveillance and intelligence technologies as a strategic framework for policy action and whether the Canadian government is taking the future of its Arctic region seriously enough, with little to no consideration of the politics behind

such a strategy. Further, even critical interventions that subvert the centrality of the state have been primarily limited to theoretically and normatively dislodging the state's priority as a guarantor of human survival and wellbeing, while arguing for a holistic understanding of security that is more responsive to the needs of human and ecological welfare.

Background

Theoretically, security, sovereignty, and technology exist relationally and are shaped by one another. Conceptually, the Greek understanding of *teckhnologia* is defined as applying systematic treatment to *tekhnē* (art, craft), indicating how technology results from creative exercise in addition to the standard view of instrumental design premised on scientific reason. The aesthetic and creative production of technology is vital because it underpins the development of sensing technologies for deployment across the Arctic's physical and electromagnetic domains as social, cultural, and technical artifacts. More specifically, sensing technology broadly refers to those technologies that perform surveillance and intelligence functions across the spectrum of domains within traditional defence thinking.[5] However, sensing technology is increasingly dual-use in its function and design, meaning it is used within civilian and military applications simultaneously. The use and innovation of sensing technologies are a fundamental component of Canada's Arctic security strategy. This strategy represents a historical continuation of previous state-led efforts but embodies novel features grounded within the modern context. Indeed, Canada's recent attention and effort dedicated to defending Arctic

[5] Canada does not have a formal dictionary of military and associated terms that I am aware of. However, the United States Department of Defense (DoD) defines surveillance as "The systematic observation of aerospace, cyberspace, surface, or subsurface areas, places, persons, or things by visual, aural, electronic, photographic, or other means." The DoD defines intelligence as "The product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations."

sovereignty are striking for how much they resemble security concerns around the turn of the 20th century. Before then, Bonesteel notes that

> Although the Arctic Archipelago was not initially specified within the boundaries of the Northwest Territories, until the late nineteenth century, there were no direct threats to Canadian sovereignty of the Arctic islands that required a formal declaration of jurisdiction. Indeed, Arctic sovereignty was not considered an issue worthy of inclusion in Canada's 1867 Confederation agreement (2008, p. 27).

This lack of concern by the state towards its claims to and enforcement of Arctic sovereignty would change rather quickly as foreign nationals began sailing through the Arctic islands towards the end of the 19th century, triggering the state to launch exploration expeditions in order to demonstrate state presence and carry out scientific and navigational studies in the region (Bonesteel, 2008, p. 28). These studies and the state's concerns for Arctic sovereignty were almost cyclical over the 20th century in response to the broader geostrategic environments of the time and the particular ways in which the Canadian Arctic was situated within those environments. Since at least the turn of the 20th century and especially following World War II, Canada has demonstrated a preoccupation with surveillance of and presence in the Arctic that has waxed and waned in strength over the decades.

While the state's interests in the Arctic were historically and contextually specific to the conditions of each time, there is a great deal of thematic consistency across these eras. Canada's rhetorical focus on Arctic sovereignty continues unabated as sovereignty enjoys an emphatic role in official policy and government language. Current efforts centred on technological innovation for Arctic surveillance are also consistent with earlier developments. Historically, there was a perceived need by Canada and the United States to develop new surveillance technologies that could automatically detect and provide intelligence on Soviet submarines, bombers, and eventually ballistic missiles with nuclear capabilities approaching Canada's Arctic borders. The

compression of time and space through ballistic missile technology in particular incentivised the development of new radar-based surveillance with early warning capabilities by the U.S. with two early warning stations in Greenland and Aleutian islands using "antennas as large as football fields and great power" which were "designed to give early warning of the launching of Soviet ballistic missiles" (Baldwin, 1958). In Canada, this Cold War interest in developing early warning capabilities resulted in the development of the Distant Early Warning (DEW) line and its upgrade, the North Warning System (NWS), and other innovative research and development projects centred on underwater detection within Canada and the Northern Atlantic. Indeed, like other new technological systems in development, the 'New DEW Line' was anticipated to finally offer the military defence and surveillance presence that Canada would need if commercial and other activity in the Arctic increased, as was expected (Magnusson, 1985).

In conventional terms, technological development can be understood broadly as the result of three interrelated processes across structural, instrumental, and functional lines. Structurally, Canada's current interest in technological research and development (R&D) embodies a similar developmental logic in that technological innovation is understood to be a key requirement to defend the state against emerging threats. These threats are produced through changes in the structure of the international system itself via technological evolution.[6] Structural changes in the international system then produce the impetus for technological innovation in which technology is used in an instrumentalist fashion based on perceived need. Within the strategic thinking of defence policy, the actual function of technology informs the long-term defensive goals of the state and shapes further technological innovation. Thus, within this framework, technology itself

[6] For example, the invention of nuclear weapons is typically understood as contributing to a fundamental structural transformation of world order following World War II. Likewise, rapid technological innovations and greater access to technology (such as cyber) among smaller state powers and non-state actors are often raised as causal agents of transformation in the current geostrategic environment.

is the critical agent and driver of change, where social and political forces simply respond to those changes rather than act as agents of technological innovation in themselves.

Current research and development efforts emphasize the automatization of sensing practices, which is enabled by developments in artificial intelligence (AI). The character of Canada's current Arctic surveillance and intelligence efforts are linked to broader trends in security and defence thinking that prioritize the rationalization of as much data as possible into a coherent intelligence picture of *possible* futures. The Arctic is increasingly invoked as a sociotechnical imaginary of the future as a region undergoing radical transformation requiring sovereign intervention in the present. Within security concerns, imagination has become a key vector of strategic thinking following the September 11, 2001 attacks. The post-9/11 moment underscored a risk-based understanding of the future within a de-territorialized world in which threat was constructed through the terrorist Other – everywhere and nowhere. The proliferation of surveillance regimes after 9/11 shares a developmental rationale with current Arctic security efforts that emphasize the integration of existing and future sensor architectures into a unitary sensing regime. Formally, Oxford defines a sensor as any "device which detects or measures a physical property and records, indicates, or otherwise responds to it." In practice, what acts as a sensor has expanded exponentially as the internet of things (IoT) facilitates endless webs of digital connection between humans and their materials. Thus, Canada's current emphasis on technological development for surveillance and intelligence in the Arctic exhibits historical dependencies with earlier efforts but is firmly embedded within novel trends that embody a particular social, political, and cultural form in addition to their technical and instrumental capacity.

Modern and future sensing technologies hold important implications for how the Canadian state practices sovereignty in terms of its *de facto* application, and this is particularly important for the Arctic. Like security, these technologies demonstrate both historical and novel orientations concerning state sovereignty. Historically, legal claims to territory made by the state were premised on effective occupation and the delineation of formal boundaries. Boundary making was supported by scientific practices, like cartography and exploration, that enabled the rationalization of geography into state territory. In the late 19th and early 20th centuries, Canada's legal or *de jure* claims to its share of the Arctic were sustained by a lack of foreign contestation, and so the state's weak *de facto* control over the Arctic was less significant. However, current interest in the Arctic for its economic potential and the region's re-securitization within geostrategic thinking indicates that Canada's relative lack of *de facto* control of the Arctic territory is no longer tenable.

Consequently, the development of surveillance and intelligence technologies for Arctic situational awareness represents a critical pathway for Canada to demonstrate and practice sovereignty, given the material limits to other forms of sovereign governance. The Arctic represents approximately 40 percent of Canada's total landmass and is the most extensive coastal border globally, stretching over 160,000 kilometres. Canada's small population and its concentration in southern areas makes effective governance over that expansive area a difficult challenge, at least from the classical perspective of demonstrating territorial control. Sensing technology offers a potential resolution to this issue by enabling the rationalization of Arctic territory within state-led processes of control that can be practiced within and outside of the Arctic. From a policy standpoint, technological innovation represents a potentially cost-effective

way of practicing sovereignty minimally and digitally to support the efficient allocation of materially limited resources.

There are theoretical implications resulting from this strategy in terms of state sovereignty. Traditionally, territorial borders served as the symbolic limits to the state as a power container. Of course, the relationship of territorial borders to the sovereign's limit has never actually existed in practice, as centuries of imperialism, colonialism, and other forms of inter-state intervention can attest. However, the digitization of sovereignty as a material practice within a securitized framework of risk invokes a uniquely current iteration of *de facto* sovereignty in which the state's authority is extended spatially and temporally. Given that Canada's Arctic territory is expected to be increasingly vulnerable to exploitation by state and non-state actors in the future, there is a perceived need to pre-emptively encounter these threats away from border zones. As a sovereign practice, security is produced by expanding state power spatially across the globe (to foreign ports of departure, for example) and rationalizing the future into sets of potentialities using data assembled from an integrated sensing architecture that draws from an expansive set of sensors. This architecture is not an existing system but rather an ideal-type construct embodied by the logic of current surveillance technologies and developments that are premised on pushing sovereign power outward while consolidating sovereign territory inward.

Hypothesis

It will be argued here that Canada's policy focus on technological innovation for Arctic sensing must be understood as resulting from the dialectical and mutually constitutive forces of socially determined pathways for action in addition to the materially determined capabilities of a

technology's instrumental potential. Further, the development of surveillance-related technologies, especially those predicated on remote sensing and artificial intelligence, contributes to the securitization of the Arctic in ways that are not often articulated with the explicit terms of *security*. For example, government departments like Fisheries and Oceans Canada and the Canadian Ice Service have used sensing technologies for monitoring ecological and environmental phenomena in Canada's Arctic and coastal areas. Notably, these surveillance capabilities continue to be developed and hold the potential for military application. The militarization of technology is important because dual-use technologies, which are emerging from partnerships between the Canadian federal government and other actors (including universities and private firms), are contributing to the establishment of a unique security assemblage that includes but is not limited to conventional security features of militarization and defence**.**

The securitization of the Arctic is also important insofar as it potentially undermines other forms of place-building that could lead to more equitable and sustainable forms of living rather than one premised capitalist expansion and narrow concerns associated with *raison d'état*. These developments represent a continuation of Canada's historical approach to securing the Arctic, which has focused on supporting state sovereignty through situational awareness of the region's expansive territory while enhancing the federal government's footprint through occupational strategies that demonstrate evidence of state responsibility and control. The innovation of surveillance technology became a core strategy for Canada during the Cold War, and current technologically driven initiatives are a direct outgrowth of earlier projects, particularly those in the air and maritime domains. Whereas previous research in the Canadian context has focused on historical iterations of Canada's approach to Arctic security and

sovereignty, recent technological developments indicate an intensification of surveillance as the dominant mode of security governance. The need for technological solutions to problems stemming from changes in the current international environment are routinely linked to Canada's rhetorical emphasis on sovereignty concerns rather than security *per se*. However, security and sovereignty are related and ultimately inseparable from the vantage point of the state. The state's interest in protecting and demonstrating sovereignty legitimates particular security actions, including investment in and the use of sensing technologies. Additionally, sovereignty's rhetorical purchase as a discursive short-hand for security policy is supported by an economic logic of fiscal conservatism. The Arctic is an opportune site for using technologically mediated forms of security due to its large geographic size and challenging climate, making extensive militarization both labour-intensive and costly.

This argument challenges conventional analysis of the Arctic by indicating the degree to which the state's Arctic security policy has been depoliticized through the blurring of social fields between traditional defence issues and other security concerns. Surveillance technologies are understood to embody a dual-use character that straddles security-military-civilian thresholds by occupying multiple functional categories simultaneously. Moreover, dual-use technology supports political and economic objectives by complementing a security strategy based on creating an integrated sensor network and a whole-of-government approach. The civilian-military distinction loses meaning within a dual-use focused strategy, and cost-sharing between departments navigates budgetary constraints while promoting better returns on technological investment.

Theory and Methodology

Resisting easy categorization as either *traditional* or *critical*, this dissertation employs a bridged approach by embracing a sensitivity to both state-centric and critical concerns in the Arctic. While technology and surveillance-focused research has found a home within security studies, these insights have yet to be applied to the Arctic within a contemporary lens. Consequently, the research approach here approximates a middle-range theory on the innovation and use of security technologies in the Canadian Arctic. How the Canadian state practices Arctic security, or at least how it envisions such practices through a technologically mediated strategic framework, is important insofar as it alludes to broader changes in the makeup and application of state power domestically and internationally, including its economic and military capacity.

Surveillance technology has generated significant academic research concerning its use in several areas, including militaries and policing agencies. Surveillance has been given only cursory attention by Arctic security experts and policy commentators, who repeatedly highlight Canada's weak Arctic surveillance capacity in relation to emerging threats. Conceptually, this dissertation's approach begins to fill this research gap and draws on the material, discursive, and practice-based elements mobilized towards Arctic security. In general, this methodological approach operates by considering how particular social and material orders are organized around security and how security effects come into existence through a diverse network of actors, including humans and non-human objects (Müller, 2015). Drawing on materials, discourses, and practices through a material-semiotic framework demonstrates the social and cultural histories of technology rather than positing technology as an instrumental application of scientific discovery through a functionalist necessity, where technology advances with scientific knowledge as the latter grows linearly in response to structural need (Latour, 2005, p. 80-81).

A material-semiotic framework displaces the notion that technology can be analyzed instrumentally in a tool-like and straightforward manner, where agency is typically reserved for humans who *use* technology. Recent scholarly interjections considering the relationship between technology and politics challenge the idea that technology is neutral in eliciting particular social and material orders. Understanding technology as embodying agency and integrated within the intersection of material and social forces is valuable for studying the relationship between technology and security outside of an instrumentalist or functionalist manner, especially as developments in artificial intelligence undermine, in a very literal way, conventional views of agency as a distinctly *human* feature.

The empirical focus of this project centres on developments within and related to the Canadian federal government's *All Domain Situational Awareness* (ADSA) program, a broader funding initiative with private and public partners created to develop Canada's surveillance capacity in the Arctic. The ADSA program was launched in 2015 with the plan to "[invest] $133 million between 2015 and 2020 to support the development of innovative solutions to address surveillance challenges in the North" (Defence Research and Development Canada, 2018; Government of Canada, 2020a). The Canadian federal government goes on to describe the function of the ADSA program:

> Surveillance solutions achieved under the ADSA S&T Program support the Government of Canada's ability to exercise sovereignty in the North and provide a greater awareness of safety and security issues and transportation and commercial activity in Canada's Arctic. They will also contribute to joint efforts between Canada and the United States to modernize elements of the North American Aerospace Defense (NORAD) Command (Government of Canada, 2020a).

Under the ADSA program, the federal government has awarded development contracts to several universities and private firms (Government of Canada, 2017a).[7] Due to the public nature of these actors and the awarding of contracts, a list of technological projects was created (see Appendix). This list was used to generate specific search parameters and draw on data sources from scientific, corporate, policy, and military communities. These sources include, but are not limited to, secondary interviews and presentations transcribed from conferences and media sources, government documents, project descriptions, scientific papers, contract tenders, corporate ads, and social media posts. The methodological intention is to 'open the toolbox' and draw from as wide a range of sources as possible to consider the range of projects under the ADSA program in relation to each other. Examining the breadth of projects under the ADSA program and situating them within the state's historical trajectory and recent theoretical interventions within the field of International Relations allows for a broader understanding of the sociotechnical assemblage developing in response to contemporary issues posed for Canada in the Arctic.

Outline of the Thesis

The organization of this dissertation is as follows. Following this introduction, chapter 1 offers a discussion and overview of the dissertation's core theoretical framework. Specifically, this chapter discusses the role of technology in International Relations theory and the discipline's

[7] The ADSA program has awarded contracts to the University of New Brunswick and Raytheon Canada, both of which are part of the ADSA program's *Over The Horizon Radar* (OTHR) efforts; GeoSpectrum Technologies Inc. and Cellula Robotics under the *Canadian Arctic Underwater Sentinel Experiment* (CAUSE); MDA and Complex Systems Inc., who are contributing to the *Threat, Requirement Gap* (TRG) Analysis Project; and the firms Airbus, C-Core, Com Dev, Globvision, Larus, MDA and UrtheCast Corp. under the Compression of the *Tasking, Collection, Processing, Exploitation and Dissemination* (TCPED) Cycle Project. These projects are not an exhaustive list as other firms have been awarded contracts under several other projects and sub-projects but represent several of the larger projects currently underway (see Government of Canada, 2020a for a promotional overview of the ADSA program and the Appendix for a more exhaustive list of projects and their descriptions).

focus on the discursive construction of security. The chapter offers a holistic framework for examining security as a product of relational forces between the material, practice-based, and discursive elements, creating a material-semiotic framework. The core argument is that a material-semiotic framework can analytically capture the multiple and heterogeneous components that make up the security field. As a particular constellation of these relational forces, the security field is often an exclusionary and hierarchical space that analytically describes the political movement of events, places, words, and materials away from public discussion.

Chapter 2 reviews the academic and, to a lesser extent, the grey literature on Arctic security. The chapter situates the Arctic's historical importance in the early to mid-20th century as a geostrategic theatre and discusses the different theoretical orientations to Arctic security and governance. More specifically, the chapter argues that the subject is characterized, on the one hand, by the mainstream understanding of Arctic security and governance, which can be subdivided into realist and liberal-institutionalist approaches. The second theoretical lens for the Arctic among academics is broadly characterized as the critical school, which follows human and environmentally-grounded understandings of security outside of the protection of the territorial state. Lastly, the chapter reviews the academic contribution of surveillance studies and that field's theoretical contribution to this dissertation.

Chapter 3 provides an overview of Canada's interests in the Arctic and historically situates the Canadian state in relation to those interests. The chapter discusses historical and ongoing interest in colonizing and taming the Arctic as a wild place through scientific research and control as nation-building actions of sovereignty. The chapter argues that these historical

patterns are routinely present in contemporary developments, many of which are premised on technological innovation to support the state's Arctic awareness capacity through acts of sensing.

Chapter 4 considers the role of imaginaries in supporting Arctic security policies and developments premised on sensing technologies. This chapter draws on Daniel Chartier's notion of the *imagined North*, which is the Arctic's ontological representation by a confluence of essentialized symbolic elements. However, I build on Chartier's concept by expanding the imagined North to address the securitized character of this imaginary and demonstrate how it contributes to the development and use of specific security technologies for Arctic awareness.

Chapter 5 engages with contemporary policy discussions and considers Arctic security's theoretical, political, and ethical dimensions in relation to technological innovation and geostrategic interests. Broadly, the chapter seeks to advance discussion beyond the conventional military-strategic framework by focusing more emphatically on the philosophical and ethical dimensions of Arctic security and how it is approached in terms of policy implications by Canada within the context of North American defence. The chapter discusses the presumed need to develop advanced sensing and warning capabilities to proactively counter threats from competing states (namely Russia and China) and situates this need against the ontological primacy of a networked and complex world requiring epistemic intervention based on achieving a globally integrated awareness.

Lastly, I provide a concluding analysis that revisits the dissertation's central theoretical and empirical questions and summarizes the dissertation’s findings. Following the conclusion is an afterword that discusses the Russian invasion of Ukraine and briefly comments on its potential ramifications for Arctic security and governance. Given the timing of this event and its ongoing status, it is difficult to predict what will happen in the mid to longer-term horizons. The

dissertation concludes with a review of the knowledge gaps that future research on Arctic security and governance can begin addressing.

Chapter 1: Theory and Methodology

> The dream of creating computer vision belongs to an old branch of the machinic phylum, the branch of surveillance and punitive technology. I have discussed how concrete, physical artifacts join the phylum when they are given a sufficiently abstract formulation, which then migrate to other technologies […] Similarly, punitive technology is punctuated by the emergence of these kinds of abstract machines, like the Panopticon prison designed toward the end of the eighteenth century by Jeremy Bentham. The Panopticon was a "surveillance diagram" originally applied only to prisons, but it later migrated to hospitals, schools and other institutions. The name of this architectural machine reveals the strategy behind it: to make optics (the surveying eye, the watching gaze) ubiquitous and pervasive through the use of technology.
>
> Manuel DeLanda, *War in the Age of Intelligent Machines*, 1991, p. 203

1. Introduction

Bentham's panopticon is more than an architectural design and symbolizes the link between the state's increasing need for disciplinary power and the role of technology as a medium for governing human beings, their relationships, and their environments (Foucault, 2003, p. 241-245). The panopticon is an *idea*, or in Foucault's words, "the oldest dream of the oldest sovereign: None of my subjects can escape and none of their actions is unknown to me. The central point of the panopticon still functions, as it were, as a perfect sovereign" (Foucault, 2007, p. 66). The technology and materiality of the panopticon and surveillance generally are more than the sum result of a pre-ordained need (to *discipline* and *punish*). Rather, they are entwined within the production of intersecting and overlapping discourses that organize space and bodies while reproducing segments of power. Thus, the materiality of technology is not neutral and pre-given but culturally, socially, economically, and politically determined.

To the extent that technology is considered within international relations and the Arctic, it has been largely within an instrumentalist framework that promotes a reactive view of technological innovation. Within this view, technological innovation simply responds to changes within the international system, which are partly the result of technological shifts themselves. In

contrast, this chapter develops a holistic framework that embraces the ability of technology to transform international politics but does not limit the use and innovation of technology to strictly instrumental terms. Innovation in this context refers to state-led development practices towards new technologies through procurement, scientific research, and their testing in experimental and field applications. Technological development and the use of technology are understood as interwoven processes rather than a series of discrete practices that progress over time as rendered in traditional development cycles.[8] In practice, it is not clear or easy to differentiate when development and experimentation stop and in-field usage of technology begins (i.e., a technology's normalization and adoption by users). This difficulty in establishing clear segments in technological development and adoption is especially true concerning security technology as the employment of specific technologies in security practices may be unannounced and often classified.

At one end of the spectrum, the material aspects of security technologies lend themselves to an obvious consideration within rational choice approaches. For instance, realism shares similar considerations with policy-oriented thinking on geostrategic reasoning and understands technology in terms of its raw capabilities and quantifiable power, emphasizing weapons and defence systems. The discourses involved in legitimating the use and production of these technologies within the broader remit of security practices and the *securitization* of the Arctic provide an obvious counter-analysis to realism within constructivist and poststructuralist frameworks. In contrast to both of these approaches, this project's theoretical framework draws

[8] The traditional lifecycle of technology as rendered in business and management studies is typically understood in four phases: research and development, ascent, maturity, and decline, emphasizing their functional and economic viability in a competitive technological ecosystem. While useful, this process offers a relatively linear account of technological development that does not capture the interlocution of political, historical, and cultural factors in developing and adopting a specific technology, which is often uneven and messy over time.

on recent research interventions on technology in critical security studies (CSS) and argues instead for a material-semiotic framework that considers both material and discursive elements, which are conditioned by and enable specific practices relevant to the field of security.

Using a material-semiotic framework enjoys both theoretical and methodological value. Theoretically, the traditional method within critical security studies of analyzing security processes using discourse (especially speech acts made by elite actors) is severely limited. The limits of securitization theory are exposed when security operates outside of the explicit language of security. Methodologically, this framework allows for a systematic analysis of heterogeneous empirical sources, including but not limited to discourse. For example, images, symbols, materials, and discourses are found from several sources of empirical value and offer a more robust analysis.

Discourse refers to the elements captured in language, including policy, speeches from state elites, media, and other sources. However, semiotic representation is not limited to language as it is regularly captured in the symbolic, including in pictures and other sources that embody aesthetic qualities laden with meaning. In this respect, semiotic representation includes but goes well beyond the limits of speech and text to include multiple types of media and representational forms.

Materials, in its broadest sense, refers to objects that become relevant to security through processes of securitization. Technology inherently embodies a material quality as an existing thing in the world, but materialism's relevance can be extended to any material that holds importance for security. Materials are worked upon (literally and metaphorically) through discourse, symbols, and practices and securitized through meaning-making processes.

1.1. Security and Securitization in International Relations

Theorizing the role of technology within International Relations has, by and large, tended towards the consideration of how technology interacts with and affects the structural conditions of the international system, including balances of power and actor (i.e., state) behaviour. For example, Kenneth Waltz (1981) credits the introduction and vertical spread of nuclear weapons following World War II as a critical element underpinning the post-war bipolar order dominated by the United States and the Soviet Union. In turn, according to Waltz, bipolarity is responsible for the relatively limited incidents of conflict in the intervening decades of the post-war era. However, a technologically deterministic account such as Waltz's does not consider the social and political context of *creating* and legitimating the use of nuclear weapons. For example, a technologically deterministic account of nuclear weapons development does not offer a satisfactory account of why and how they were used to kill upwards of 100,000 Japanese civilians who lived in Hiroshima and Nagasaki (see Hubbard, 2009).

Within critical security studies, the relationship between technology and security has experienced a scholarly resurgence in recent years. While critical researchers in International Relations, philosophy, and science and technology studies (STS) have examined the relationship between technology, security, and warfare for some time (e.g., DeLanda, 1991), this research has remained limited within the core of CSS until recently. Arguably, this myopia is partly due to the focus in CSS on discursive aspects associated with securitization and questions related to identity and power within critical International Relations more broadly (e.g., see Balzacq, 2010; Buzan, Wæver, & De Wilde, 1998; Edkins, 1999; Wendt, 1999 as core CSS texts). The Copenhagen school of securitization theory has famously written about the various ways political issues are *securitized* and made extra-political, especially where issues are removed from the so-called

'normal' realm of politics (principally in democratic spaces) (Kalyvas, 2008).[9] Generally, according to the Copenhagen school of thought, an issue or object is securitized successfully when a particular audience accepts it as such. For example, national borders are understood as securitized spaces through the intersection of multiple discourses on immigration, weapons, drugs, undeclared goods, among others that create and legitimate a *de facto* understanding of what borders are (see Salter, 2013). Theoretically and methodologically, this focus has created a fixation by researchers on discourse, both written and spoken, in the form of speech-acts that create a disjuncture between the space of normal politics and the space of security. In practice, this securitized space legitimizes specific policy choices and practices by elites (those who enjoy the authority to speak in the name of security) through a particular rhetorical structure away from public overview. Under processes of securitization, the conditions by which security is practiced and legitimated imply a need for protection, a service typically (but not exclusively) performed by the state (Buzan, Wæver, & De Wilde, 1998, p. 24).[10]

Securitization theory has become a significant framework of analysis for security researchers and a source of theoretical and methodological debate (resembling what Mark Salter once remarked upon as a 'cottage industry' as a comment to an ISA panel in 2019). However, one specific line of critique of securitization theory has been its narrow focus on discourse, primarily limited to state policy and speeches by state elites that designate threats (McDonald, 2008, p. 564). The issue with a strictly discursive focus is that "security involves saying, doing or

[9] An example of this process is the mass processes of securitization following the September 11, 2001, terrorist attacks, ranging from airports and borders to the creeping securitization of daily life under the increasing penetration of surveillance and other security practices into routine existence. More obviously, the 9/11 attacks legitimated the creation of an entirely new institutional body within the United States, namely the Department of Homeland Security (which enjoys a breadth of powers discrete from public overview), the passage of the Patriot Act, and a foreign policy strategy largely premised on the War on Terror (Anderson, 2012; Feldman, 2011; Vultee, 2010).
[10] While the state retains a central place in realist, liberal, and critical views of security, other research demonstrates how multiple actors speak and act in the name of security, including private firms, international organizations, non-profit groups, among others (see Krahmann, 2005).

thinking a great variety of things in different circumstances and in multiple ways" (Davidshofer, Jeandesboz, & Ragazzi, 2017, p. 205). While a cursory search of the term "Arctic security" suggests that a securitization move has been made somewhere (a google scholar search provides over 3000 hits and a regular google search provides over 72,000 hits), limiting the analysis to the explicit terms of 'security' becomes complicated when examined from the perspective of Canadian policy. Canada has not employed the term 'security' or its associated language to the same degree of fervour as media and some academic authors. Indeed, from the perspective of securitization theory, the Arctic is not necessarily a successful case of securitization. To elaborate, the Arctic is undoubtedly politicized since the region garners significant media attention and political scrutiny for its potential as a resource theatre and as its symbolic role in demonstrating the effects of climate change. However, in many cases, the Arctic has not generated the necessary urgency often argued to characterize securitization in the form of consistent and rapid policy intervention or significant budgetary allocation by the state. This apparent lack of urgency is indicative of the Arctic's complexity as a policy space. For example, the critical issue of climate change, while partially securitized by states and other actors, does not (as yet) consistently demonstrate the emergent effects thought to be required for a clear pathway to securitization as an existential threat to survival through a point of 'critical gravity.' Put otherwise, the Arctic and its relationship to climate change may be perceived as an issue of the more distant future, thereby removing some of the *gravitas* of proximity and imminence that is arguably needed to securitize an issue and make it extra-political.

Unlike the events of September 11, 2001, and other exogenous triggers with clear security relevance to the state that temporally delineate *before* and *after* an event and create an inflection point with historical importance, the Arctic does not present a case of straightforward

securitization due to the lack of an analogous trigger.[11] In short, if the speech act 'does something' by eliciting a securitization move, this suggests a politics of contestation over how the Arctic is framed between and within academic, media, and policy discourses. For example, the word 'security' is rarely uttered by state departments, including Global Affairs Canada and the Department of National Defence (DND), in official discourses on the Arctic. Indeed, even the presence of DND and the Canadian Armed Forces (CAF) in the Arctic is not strictly military-related as they support a range of security requirements outside of military operations, including the state's search and rescue capacity (Hubert 2011, p. 60).

Instead, Arctic *sovereignty* is the preferred lexicon of the Canadian state, whereas Arctic *security* is more widely employed by academics and media commentators, though this is not a rigid distinction as the media impacts political discourses and vice versa. Academic, media, and political discourses have, to different degrees, employed sovereignty as a security device and worked to popularize the idea of a "looming sovereignty crisis" during the Cold War and, more recently, in the 21st century (Huebert & Lackenbauer, 2016, p. 146). Evoking a threat to sovereignty rather than security per se achieves a level of securitization that might not otherwise be possible in terms of legitimating attention and resources, given that sovereignty is understood to be the core inviolable right of all states, implicitly locating security as a nested effect of protecting sovereignty. Because sovereignty requires constant attention (even in peacetime), actions taken in the interests of sovereignty are rarely, if ever, questioned by public debate. In

[11] Theoretically, successful securitization does not necessarily require a threat to be objectively true, only that an audience accepts it as such. For example, in climate change, the breadth of modeling scenarios points towards a radical alteration of existence (or the ability to live at all) for vast sums of people on the planet. Climate change is, at least from the perspective of climate scientists, an ontological threat to human wellbeing and survival. However, the politics of contestation over framing climate change are not incidental or trivial given conflicting interests (particularly over resource extraction), the long-time frames involved (decades), and the differentiated effects of climate change on populations (not everyone will be affected equally). In short, securitization is an explicitly political process rather than an instrumental response (security) for a need (protection) against an objectively true threat.

contrast, evoking security threats may elicit political challenges, especially if the threat is not accepted as legitimate by different audiences (public, media, other elites). Actions in the name of sovereignty often obscure how security may be practiced outside of explicit militarization and securitization.[12]

The Arctic's political space is heterogeneous, where actors engage with different audiences for different purposes and at different scales. Likewise, the state must be regarded as a heterogeneous actor that is assembled out of different sub-components rather than as a monolithic entity, including the various departments and institutional bodies with different interests (Davidshofer, Jeandesboz, & Ragazzi, 2017, p. 213; Muller, 2012, p. 382). For example, at the state level, responsibility for developing and implementing Arctic policy, especially that which is relevant to national and international security issues, is housed in several departments, including Global Affairs Canada (GAC), DND, and CAF. However, DND and CAF can be further broken down by their civilian and military components, which may have compatible but not necessarily the *same* perspectives or interests in the Arctic. Other actors include numerous departments and organizations (e.g., Transport Canada, Canadian Border Services, Environment Canada, the Royal Canadian Mounted Police, the Canadian Coast Guard, and others,) as well as political elites from the Prime Minister's Office, Parliament, and sub-committees, all of which may include experts from various professional and academic communities, who often cross-over into the media sphere as commentators. The point here is that a holistic analysis of Canada's Arctic security strategy should consider perspectives including, but not limited, to narrow military and elite discourses.

[12] For example, the practice of issuing passports as an expression of sovereignty to citizens may not be typically thought of as a security action, but the security implications are relatively clear (Salter, 2004).

Theoretically and empirically, this begs the question: is the Canadian Arctic being approached by the Canadian state as a security theatre, and what actors and processes are relevant to securitization?

1.2. Who/What Does Security?

The question of agency (who or what possesses it) and 'actorness' (how agency is practiced) has traditionally been limited to states, institutions, and humans within IR. Several IR scholars note that the focus on discourse within CSS has come at the expense of attention towards non-discursive elements that are still relevant to security, including practices and materials (Balzacq et al., 2010; Connolly, 2013; Davidshofer, Jeandesboz, & Ragazzi, 2017; Jacobsen & Monsees, 2019).[13] Traditionally, the integration of materials has been limited to rationalist approaches in IR (Lundborg & Vaughan-Williams, 2015), especially realism and historical materialism within a hierarchical ontology in which materials are *acted* upon by agents and transform structures of the international system (i.e., the balance of power among nation-states or class relations). More recent discussions in IR and CSS draw from a broader range of theoretical paradigms to offer a richer analysis of materials that go beyond rationalist approaches (e.g., see Aradau & Munster, 2010 on the materialism of critical infrastructure). Continuing the interdisciplinary trend in IR has led researchers to draw on insights from political theory, sociology, and social and STS in order to open the 'toolbox' for researching, studying and generating a better understanding of the relationship between security and technology (Mayer, Carpes, & Knoblich, 2014).

[13] The field of security studies is understood to be sub-disciplines of International Relations theory. See Huebert (2021) for an overview of the further differences between *defence* or *strategic* studies and critical security studies in relation to Arctic research.

The theoretical approach to this dissertation is inspired by an interest in the joint forces of discourse and materiality. It employs a theoretical framework that draws on assemblage theory as advanced initially by Deleuze and Guattari (Bousquet, 2014, p. 94), as well as actor-network theory (ANT) as pioneered by Bruno Latour and others (Stockbruegger & Bueger, 2017). Deleuze and Guattari's contribution to our thinking of materiality is expansive and beyond the scope of this chapter, but a core aspect of their approach is de-territorializing materialism from rigid boundaries, binaries, and relationships (for example, between organic and inorganic). Their *rhizomatic* approach is critical in this regard, understood as root system that grows laterally and continuously, and is seen as a metaphor for materialism's complex and shifting forms within assemblages of connection to other materials and subjectivities. More pointedly, an assemblage is "the contingent combining of materials and symbolic elements to form a semi-durable arrangement of objects, texts, practices, institutions and affects that function relationally to produce a particular effectivity" (Deleuze and Guattari, 1987, p. 88, 504 as cited by Roderick, 2018, p. 240). In contrast, ANT is typically interested in how actors are related in multiple and often ephemeral ways. The two terms are often used interchangeably, which is an error because there are subtle differences espoused by their core theorists (namely Deleuze and Guattari, along with Massumi, DeLanda, and Bourdieu, among others).

Specifically, I understand assemblages to refer to stable and semi-stable constructions of materials, texts, and practices (including technologies). In contrast, actor-networks refer to relationships between political agents, who are mobilized by and who also mobilize assemblages towards fulfilling their motivations. This difference is valuable because it enables a more nuanced understanding of how materials and practices are organized through multiple technologies in their assembled forms and mobilized through networked connections between

political actors, including those that make up the state apparatus. Assemblages and actor-networks are not mutually exclusive as they operate in a co-terminus fashion.[14]

Overall, assemblage-thinking and ANT have gained traction within International Relations as a theoretical approach to analyze the relationship between technology and global politics (Bousquet, 2018) in addition to the assemblage of security regimes that encompass multiple and fluid actors (e.g., Demmers & Gould, 2018; Frowd & Sandor, 2018). In particular, assemblage theory helps understand how securitization is occurring outside of the discursive level. Empirically, the 'material turn' of CSS examines objects of security that are central to security practices, including technology (e.g., airport x-ray scanners), biometric objects of surveillance (e.g., passports), and more mundane objects that are securitized in specific localities (e.g., water bottles). Materials are understood as heterogeneous and multi-faceted or dual-use in their securitized form (water bottles become objects of security through specific discursive and material practices that make them *threatening* in specific contexts, such as airports). Materials are also instruments of security (e.g., x-ray scanners that detect securitized objects and make up a part of a security assemblage). These technologies may be similarly dual-use outside of their securitized application (e.g., x-ray scanners are also used for medical examination). Thus, securitization can be understood as more than a rhetorical and discursive process that incorporates materialism and involves applying certain practices, which may not be structured

[14] For example, the securitization of borders and migration involves networks of multiple actors at different scales, such as in the EU where national, regional, and transnational bodies intersect in networked governance regimes and draw from an assemblage of technologies to monitor borders and migration flows, such as satellites, marine patrols, and border crossings. Networked organizational structures can produce assembled materials. The economic example of this is the post-Fordist 'system of systems' approach to production, where a network of actors (multinational firms, governments, among others) are interlinked through complex supply chains in order to develop, manufacture, and distribute a product through disparate manufacturing centers across geographic points (i.e., territorial and economic globalization). The 'post-Fordist' system of 'just-in-time' production (where supply is mapped more narrowly to demand) stands in contrast to a centralized production and distribution apparatus as epitomized by earlier Fordist production models in one locality.

discursively in terms of security but are *securitizing.* Practices and materials can be securitizing because they can contribute towards producing specific forms of governance that center on, borrowing from Foucault, regulation, discipline, and punishment that service the well-being of particular *forms* of life more so than the well-being survival of life itself.

In general, assemblage theory and ANT consider how particular orders of political and social life come into existence through a heterogeneous network of actors, discourses, and materials, including the human and non-human (Müller, 2015). Assemblage thinking and ANT displace the notion that technology can be viewed in a simple, tool-like manner where agency is reserved for humans and technology is thought of exclusively in instrumental and technical terms. In short, assemblage theory and ANT challenge the idea that objects and technology are neutral and exogenous in eliciting particular social and material orders. Using assemblage theory and ANT as an approach to studying the relationship between technology and security is especially useful as developments in artificial intelligence undermine, in a very literal manner, conventional views of agency as a distinctly *human* feature. In a simple sense, agency is understood as "the ability to make a difference" (Sayes, 2014, p. 141). Rather than existing through a material ontology of instrumentation, technology can be understood as a mediator between actors (human and non-human) that modifies relations between them (Latour, 1999, 2002a as cited in Sayes, 2014, p. 138). At the more radical end of conceptualizing technological agency, the agency of non-human objects and the envisioned 'smart' agency of embodied machines is an essential thematic element of *posthuman* International Relations, where machines may come to be understood as the fourth image of analysis (Coker, 2018).[15] What these

[15] Coker's suggestion builds on Waltz's levels of analysis in International Relations theory, in which artificial intelligence may become as important (or critical) explanatory variable for global politics, potentially more so than any of the other levels or 'images' (the individual, state, and an anarchic international structure).

machines do in their isolated or human-augmented capacities (their independent and co-constituted agencies) is important for empirical considerations concerning their contribution towards the construction, stabilization, or transformation of a security field. Mutlu depicts this construction in his proposition for three points of analysis which "capture important stages of actor-network relationships as they are mediated by actants or as actants impact their surroundings" through emergence, continuity, and transformation (Mutlu, 2013, p. 175). This process is focused on temporality and the (in)stability of networks.

The goal here is to think of assemblages and networks as always emergent, making the security field a set of materials and activities that are always in the process of *becoming* rather than a permanent fixture. Social fields often enjoy stability, but they constantly evolve and shift to incorporate new cultural, political, and economic dynamics.

1.3. Towards a Material-Semiotic Framework of Security

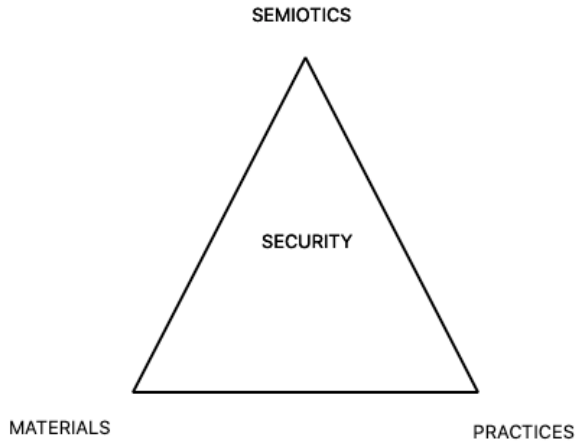
This dissertation employs a theoretical framework that bridges discursive analysis with practices and materials. Employing a bridged approach like this approximates a material-semiotic framework similar to that used by Grondin (2013) in his research on drones. Broadly, a material-semiotic approach understands security to be co-constituted by material and social elements interwoven and embedded within one another. For the materiality of technology, "[t]he interweaving of technology and social practices creates a hybrid world in which the separation in human and non-human no longer makes sense," particularly within the military sphere (Mayer, Carpes, & Knoblich, 2014, p. 6). Methodologically, a material-semiotic approach involves being sensitive to the life-histories or genealogy of technologies, materials, discourses, and practices and their attendant logics defined by various actors and institutions (Anaïs, 2013; Grondin, 2013).

Deconstructing the material/discourse binary as a methodological approach has two inherent strengths for studying Arctic security. Security is more than a discursive process and involves a level of materialism that exists through a particular relationship with discourse (for example, in the way that counter-terrorism narratives condition the development and use of biometric scanners in airports along with the securitization of materials, such as liquids and electronics). However, as per insights from assemblage and actor-network theory, matter enjoys a degree of agency that is not dependent on its mobilization via discourse. Instead, as Lundborg and Vaughn-Williams point out, matter and discourse should be thought of as existing through a "complex and radical *intertextuality*" (2015, p. 7, original emphasis).

There is also a practical component addressed by a material-semiotic framework. Several researchers have noted the difficulties associated with studying issues related to security with empirical rigour given the limited access due to the secretive and classified nature of security issues (Anaïs, 2013, p. 196-197; Williams, 2015). Researching technology involves an added burden in that these technologies are also often proprietary. Consequently, both public and private institutions involved with technological development for security purposes may employ a level of secrecy similar to defence institutions of the state. Using a framework that employs both discursive and material elements in its analysis offers a degree of flexibility because researchers can draw from a broader range of data sources in an exploratory manner that does not rely on specific categories of knowledge or variables conceived *a priori*.

This thesis expands on the material-semiotic framework by utilizing a triangulation model that enables a simple but effective framework for analysis, which can be understood in the following way:

Figure 1.1. Security as an assemblage



This triangulation model draws conceptually from Robert Cox's understanding of a historical structure or "framework for action" using a dialectical relationship between three forces, namely material capabilities, ideas, and institutions (Cox, 1996, p. 97-98). According to Cox, this framework does not structure action in a mechanical sense but creates "pressures and constraints" for social actors (1996, p. 98). Cox's model offers a simple but elegant way of conceptualizing security as a field of social action composed of material-semiotic assemblages that are integrated with practices dialectically.

There appears to be an inherent contradiction between this model and a purely Deleuzian-inspired rhizomatic approach to assemblages, which eschews boundary making in this form. However, Cox's understanding of the model also offers a solution to this issue. This framework for action represents a "limited totality…like ideal types they provide, in a logically coherent form, a simplified representation of a complex reality and an expression of tendencies, limited in their applicability in time and space, rather than fully realized developments" (ibid., p. 100). Thus, a rhizomatic approach to assemblages does not contradict with understanding the field of action as a limited totality because that limited totality represents a snapshot of reality that is constantly changing morphologically rather than a pre-existing and enduring structure.

For the purposes of this dissertation, the three triangulation points of analysis are semiotics, materials, and practices. Securitization is understood as the result of heterogeneous and multi-iterative processes that condition something (whether itself a material object, discursive space, or political issue) as relevant to security and thus part of its co-constitution. From an assemblage and ANT approach, security may be considered a bounded field – a space of social activity - relevant to human survival and wellbeing. The field concept is drawn from Bourdieu and can be defined

> as a configuration of objective relations between positions. These positions are defined objectively in their existence and in the determinations that they impose on their occupants, agents, or institutions by their current and potential situations (situs) in the [wider] structure of the distribution of different currencies of power (or of capital), possession of which provides access to specific profits that are up for grabs in the field, at the same time, by their objective relations to other positions (domination, subordination, equivalents and so on) (Bourdieu and Wacquant 1992a, p. 20 as cited in Bigo, 2011, p. 239).

According to Bigo, fields enjoy varying degrees of stability and permeability in their relation to other fields, which are necessary to delineate the contours between one another (2011, p. 239). Importantly, reiterating Cox's argument concerning his framework for social action, a Bourdieusian-field is not the same thing as a structure that exerts top-town forces on agents in a mono-causal fashion, nor do those agents constitute the field through their agency alone.

Instead, the field draws on DeLanda's insight that an assemblage is characterized by bottom-up and top-down causality (Delanda, 2016, p. 74), including technologies constituted within that field. Furthermore, this dialecticism promotes an understanding of security that does not reduce it to a "ready-made grid of intelligibility" (Bengtsson, Borg, & Rhinard, 2019, p. 119) where actors draw from materials, practices, and semiotics found within that grid *apriori*. Instead, security is a socio-material field constituted by a heterogeneous network of actors, practices, objects, and texts, which are themselves shaped by and shape other fields through the

circulation and overlapping of specific institutional logics. The field of security, at its extreme, is considered extra-political when the agents operating within that field are isolated from influence or power jockeying by other fields within the state. Fields are transversal in that their boundaries are shaped and reshaped by agents within the field and by outside interventions from other fields (Bigo, 2011, p. 240).

The security field is not a definition of security but rather a general consideration of what security is as an intended effect (survival and wellbeing) without any consideration to the content of the threats posed or their referent object (whether that referent is human beings as a first-order priority or a lower-order recipient of security through another referent object, as in traditionally the state). In short, the content of security as a bounded field is not pre-given but context-dependent, continuously being shaped by a reservoir of historical, political, social, economic, and cultural sensibilities.

An obvious question posed by this framework then is how does something become securitized in the first instance? Put otherwise, what triggers the initial act of securitization? Securitization may be triggered by an exogenous event (an inflection point like 9/11, for example) that then substantiates a security move that rebuilds the security field, potentially by expanding and incorporating elements from other fields. Hence, a great deal of focus within International Relations is on inflection points in history. However, this focus relies on a Cartesian dualism (before/after; non-security/security) that does not capture the *longue durée* of social processes. An *event-focused* view of security is analytically limited when such an event is not easily identifiable or clearly located. Moreover, an event-focused view of security assumes the relationship between event and securitization is self-evident, i.e., that there is a one to one, causal, relationship (even if causality as an idea is not invoked). A security event facilitates a

precise “securitizing moment with critical gravity” or “a moment in which one had a non-security situation before and a security situation after” (Huysmans, 2011, p. 377), is not easily identifiable or clearly located. There is (as of yet) no 'Arctic 9/11' or an equivalent watershed moment to spur such a securitizing move. To be clear, I am not suggesting that there *should* be some watershed security moment in the Arctic for the sake of analytical comfort and the simplicity of demonstrating securitization. Rather, the emphasis on inflection points as historical moments obscures how security is practiced and occurs without much fanfare or attention in the minutia of social and institutional activity. An event-focused view is especially poor at capturing security dynamics when anticipating the future. In contrast, the security imaginaries contouring how we think about the Arctic (see chapter 4) are more like a 'ticking time bomb' or looming catastrophe in the future rather than an immediate threat to the present.

Consequently, understanding security as a bounded field in a constant state of production with varying degrees of stability that gives the field greater or lesser coherence suggests a less segmented understanding of time, where the field is grounded in multiple historical and futuristic pathways. Securitization theory recognizes that all threats are allusions to a possible future by definition, but there is a particular salience of the future for the Arctic. Salter (2019) points out the importance of the future concerning Foucault's understanding of the state and its implications for the Arctic, where he states (quoting Foucault) that

> ‘The specific space of security refers then to a series of possible events; it refers to the temporal and the uncertain, which have to be inserted within a given space.’ Security is thus a future-oriented practice that attempts to prefigure and manage potential events and delimits the responsibility for those events. [...W]e must look at the security logics, made up-of interlocking and overdetermined discourses about economics, epidemiology, ecology, identity, and international relations, which structure the conditions of possibility for the management of future uncertain events, and the limits of potential intervention in the alleviation of future threats and dangers (Salter, 2019, p. 4-5).

Conceptualizing Arctic security as an emergent field allows examining the intersection between Canada's history and its imagined future and at different nodes within a trans-historical and trans-spatial space. In particular, this follows the observation that securitization may be institutionalized such that "[t]he need for drama in establishing securitization falls away because it is implicitly assumed that when we talk of this issue, we are by definition in the area of urgency" (Buzan, Wæver, & De Wilde, 1998, p. 28).

Within the Canadian Arctic, the issue of sovereignty embodies the degree of institutionalization deemed necessary for securitization. Sovereignty exemplifies a ready-made set of qualities that legitimates security practices based on those taken-for-granted qualities, particularly as an inviolable right of *all* states. When a state is expressing or demonstrating sovereignty, it is establishing and practicing security through the normative weight sovereignty carries as the key attribute of the international system (or the “fiction of absolute national sovereignty” as Walter G. O’Donnell [1949, p. 91] called it). Security is understood as heterogeneous and multi-iterative. Security’s specific bounded reality is created out of repetition across multiple points, spatially and temporally, through different avenues involving multiple actors that are complementary enough to create a degree of stability to be bounded. However, the meaning of security is not static. Indeed, security as an “essentially contested concept” indicates that it is always in flux and often contradictory as specific *securities* are manifested relative to and often mobilized against one another (e.g., state security versus human insecurity). Nonetheless, specific conceptualizations of security require continuous labour to remain stable as part of a field of intelligibility, making the bounded field circumscribing that reality always emergent.

1.4. Triangulation

Within the schematic of the field (fig. 1.1), there are three points of analysis: semiotics, materials, and practices.

Semiotics is drawn from the work of Charles Sanders Pierce and its broader use in anthropology and sociology. Generally, semiotics is understood to entail the communication of icons, indexes, symbols, and discourses in speech, text, and visual artifacts to transmit meaning to an audience. Rather than limiting the analysis to the use of the word 'security,' its analogues, or its explicit connotation in language via discourse and speech acts, semiotics broadens the field of analysis to pay greater attention to sign processes such as metaphor and symbolism.

The second point, *materials*, refers to all physical structures, environments, bodies, technologies, and objects that partially make up or are incorporated into that bounded security field. These materials can exist simultaneously inside and outside of that field because they are not limited to security applications or effects, meaning that materials embody multiple aesthetics, characters, and symbolic features. This multi-character nature of materialism speaks to the dual nature of technology that may not be explicitly securitized can be mobilized for securitized application (e.g., satellite surveillance data or financial transactions). As discussed, the study of materials within CSS has gained traction by using assemblage and actor-network theory. With respect to technology and security, assemblage theory is generally used to appreciate the complex binding of various technologies with other objects, including humans, into a complete assemblage. For example, Donna Haraway's (2006) understanding of the cyborg can be thought of in a general sense as the assemblage of cybernetic and corporeal elements. Likewise, certain security practices are enabled by the assemblage of multiple environmental, technological, and human components into a coherent and stable regime, such as the routine use of x-ray scanners

by border security agents on air passengers or the drone-enabled surveillance of particular geographies and populations by military personnel. Materials enjoy an ontological status in themselves that is semi-independent of their representation through practice and discourse. For example, weapons may be de-securitized in terms of their rhetorical and political focus, but which are nonetheless, in an objective sense, dangerous to human life. Stavrianakis offers the illustration of nuclear weapons as an issue that has gradually been removed from the public consciousness, but which continues to exist in large numbers and remains an objective threat to human existence. Consequently, Stavrianakis argues that

> In some ways, the materiality of weapons is constant, even if our emotional or affective responses to them change. Who's afraid of nuclear war? Not as many people as used to be. Yet the weapons are still there: they don't go away just because we're not (as) afraid of them any longer – indeed, some of them are degrading and becoming more dangerous [...] Critical scholars have been better at suggesting what we shouldn't be frightened of than what we perhaps ought to be" (in Salter (ed.), 2019, p. 26).

Importantly, even though they are material, these assemblages do not necessarily entail proximity in time and space, especially as technology is increasingly de-territorialized. A straightforward example of this deterritorialization is the networks of space-based surveillance and communications satellites connected to the countless internet-capable devices across the planet.

Lastly, practices are, in one sense, simple acts of 'doing,' or as Kustermans terms, "the *things that we* do" (Kustermans, 2016, pp. 189, author's emphasis). Kustermans (2016) points out that how practices have been employed by International Relations theory has not enjoyed a consistent meaning or application. Nonetheless, understanding practices as 'the things that we do' embodies a practical element for application. Practice is signalled by agency and is empirically validated by its effects, but 'the things that we do' cannot be reduced to those effects as practices are historically and socially grounded. The empirical content of practices - the things 'done' – do

not simply happen out of structural necessity or agentic capacity. Again, drawing from Bourdieu and his concept of the *habitus* offers a theoretical mid-point that avoids the classic structure/ agency issue and grounds the practices of agents in their past experiences in tandem with the structural pressures of the social field of action, which are not separate but incorporated into an actor's memory and affect their orientation to the world (Bigo, 2011, p. 241-242). However, for analytical purposes, practices cannot be *anything* done. They must embody motivational agency at some level (see below), even if it is separated in degree from an action, such as with technical automation. This distinction means that processes like chemical reactions are not practices in the sense that is meant here because they do not embody motivation, which is a political, psycho-social process mediated by affect.

To that end, securitization is achieved in part through the habitual everyday practices; the unseen 'doings' that go on without much consideration and are partly driven by the application of tacit knowledge reproduced in specific institutional settings along with events that are more spectacle oriented. The onset of surveillance as a central, if not *the* central mediating condition of late modernity (Lyon, Haggerty & Ball, 2012, p. 1) exemplifies how security is practiced in the minutia of social activity and intensified as a logic and technique of state power because of security events like the 9/11 attacks. The theoretical focus of surveillance research within security studies often considers how objects, subjects, and practices are assembled through diverse networks over time and distance that independently have little obvious significance to security compared to blatant securitizing moment with 'critical gravity.' Huysmans (2011) terms these elements as 'little security nothings,' which have become the focus of researchers analyzing the security turn towards risk management, pre-emption, and routine surveillance now prevalent in the Wars on Terror and Crime. The analytical task is not to lose sight of how the

exceptionalism of security is practiced across these disparate points that appear as otherwise mundane and routine and calls into question the types of acts that perform securitizing work (Huysmans, 2011, p. 376).

Understanding material objects as embodying agency creates an issue for conceptualizing practices within the remit of human action. Practices are primarily anthropogenic because, in the final analysis, they are political and structurally conditioned. Other cognitive agents can 'do things' (such as animals and artificial intelligence), but there is an explicit connection between humans and practices involving technology. However, there is no contradiction between the posthuman and the human when practices are mediated through technology and technological agency. Technology may enable practices in an instrumental sense, but technological agency also conditions practices as it operates outside of strict human reason. However, technology is never divorced from a sociopolitical connection because technology does not exist outside of human creation. Technologies do not have life histories outside of human history and remain dependant on humans to act and evolve, and thus they embody our biases and prejudices. This humanness is essential because it displaces the idea that technology itself is politically neutral in its *thingness* as an object. Technologies are social and political artifacts that manifest human subjectivities in unforeseen ways, such as the reproduction of racial biases in facial recognition technologies (Bacchini & Lorusso, 2019; Garvie & Frankle, 2016).

Aside from the possibilities implied by developments in artificial intelligence, technological agency is distinct from human agency in one critical way. Forms of agency can be distinguished between *intentional* and *motivational* (Schandorf & Karatzogianni, 2018, p. 93). Schandorf & Karatzogianni argue that "[w]here motivation is inherently rhetorical and affective, and inevitably embodied, affective force or capacity grounded in symbolic social identifications,

intentionality is a programmatic, even algorithmic, goal-oriented force or tendency characterizing any agent, human or otherwise, pursuing a set of outcomes and having an influence on other agents in its world" (2018, p. 95). The critical underlying difference between intentional and motivational agency is the presence a "relationally (socially) self-conscious [actor] within a symbolically mediated social system, broadly defined" (Schandorf & Karatzogianni, 2018, p. 95). Humans and other sentient beings enjoy a privileged link between emotion and affect not (at least yet) experienced by technological agents. However, technological agents are political agents because they are involved in political actions, and these technologies include "an automated network surveillance system" (Schandorf & Karatzogianni, 2018, p. 95), such as the types being developed to watch over the Arctic. Intentional assemblages are "parasitic upon motivational agencies which they intentionally and instrumentally manipulate" (Schandorf & Karatzogianni, 2018, p. 100). Given that technology is a product of human agency and that the intentional agency guiding technological behaviour is parasitic upon the motivational behaviour of humans, this indicates that it does not make sense to think of technology as entirely non-human even if it is posthuman. Technologically mediated practices are important because they enable a specific conceptualization of surveillance, where surveillance technologies are understood as security tools that ‘embody practices’ (see Balzacq 2010b, p. 15-18).

A specific technology's insertion into a field at the level of materiality is not pre-given; it results from a particular 'technological imperative' produced through specific practices associated with a field. In terms of research, studying policy helps account for the growing importance of technology as a reflection of the production of that bureaucratic field and its justification (Davidshofer, Jeandesboz, & Ragazzi, 2017, p. 207). However, reducing practices to policy is

problematic because it only captures one part of their production in bureaucracies by social agents. Consequently, policy may not adequately represent the heterogeneous politics of discussion and contestation that typically go into policy-making by multiple actors at different scales. Nonetheless, studying policy offers an accessible and pragmatic entry point to studying the construction of the technological imperative. The field of security (as all social fields) is a historical artifact that in turn structures the technological imperative grounded in "political action underpinned by structural regularities rather than as the functional response to governance needs arising from externally given 'new threats'" (Davidshofer, Jeandesboz, & Ragazzi, 2017, p. 210). The future acts as an imaginative construct that applies pressure upon actors and approximates a functional necessity to combat emerging threats. The field installs a habitus for action that draws on the future as part of its repertoire for conditioning political activity. In turn, invoking future threats promotes the development of certain technologies, specifically those predicated on anticipation and risk (Davidshofer, Jeandesboz, & Ragazzi, 2017, p. 212).

1.5. Relationships

Triangulating these three points creates a framework of analysis that draws on each point's connections to the others. Relationality is an essential methodological principle because "discourse and materiality are co-constitutive and do not pre-exist their relations" (Aradau et al., 2015, p. 61). Following this insight and Mutlu's (2013) focus on stages (emergence, continuity, transformation), we can consider these stages through the material-semiotic framework to address the research focus on Canada's Arctic security and technological innovation.

1.5.1. Semiotics and Materials

The first connection is the relationship between semiotics and materials. Within this connection, particular materials gain a specific meaning. For example, clothing and tapestry become *uniforms* and *flags* that signify the nation; a building becomes a *border post;* corporeal bodies become *citizens.* On the one hand, this relationship examines how materials become politically significant to the security field. However, the material is not simply ascribed meaning through text and signs because matter enjoys its own agency that services or augments the political work of bordering. This work may not be strictly accomplished through discourse but intertextually through discourse, texts, and signs. Foucault's panopticon is illustrative in that "there is [...] a certain *materiality of the prison* which is directly linked to the production of a mode of visibility, gaze, or way of seeing" (Lundborg & Vaughan-Williams, 2015, p. 20, my emphasis). That mode of visibility is not independent of the discourses of power that categorize certain bodies as requiring surveillance in a specific (i.e., criminalized) manner. As Milliken points out, "[i]n Foucault's analysis, a significative process of definition was necessary – but not by itself sufficient – in order to create a disciplinary society. Rather, the meaning of categories for 'the criminal' and 'the delinquent' also had to be operationalized through measures organizing space in prisons and practices of surveillance developed to regulate the lives of prison inmates" (Milliken, 1999, p. 241). The institutions and technologies of modern surveillance are based on a particular "mode of visibility" or system of light that is explicitly concerned with technologically augmenting regular visibility to peer into the sub-stratum of perception, such as infrared, low acoustic sound waves, and other sources that lie outside of human awareness. While the panopticon separates criminals from non-criminals (literally and in terms of the categorization of subjectivities), the state likewise uses surveillance to make boundaries figuratively and literally between territories and peoples. These modes of visibility are based on a particular gaze that

affirms the separation of space through state borders and establishes a particular means of sovereign power over the state's domain. The state's "way of seeing," whether through digital surveillance technologies or the panoptic infrastructure of the prison, is entwined with the application of power, which requires textual and representational interaction with material organization to make ideas and the application of state power concrete.

1.5.2. Materials and Practices

The relationships between materials and practices are significant to technology as technology enables and is enabled by specific practices in a recursive and mutually constitutive relationship. Borrowing again from Foucault's classic analysis of biopolitical surveillance and the panopticon, Bentham's panopticon demonstrates how matter (the panopticon) is used to shape practice (surveillance and discipline) that converge with discourse to make specific bodies visible and knowable through their categorization (Lundborg & Vaughan-Williams, 2015, p. 20). Raw materials are shaped and refined by physical labour into objects through discursively constructed needs that legitimate power and authority over space and bodies. These objects are then used instrumentally in practices that also shape their development through use and refinement (often referred to as 'test cycles' within product development fields involving technology). Specific material conditions of the Arctic's natural environment, such as extreme temperatures, atmospheric disturbances, and unstable ice sheets, are refracted through state security discourses and are shaping the development of specific technologies, which are then used for surveillance in securitized forms in order to protect against these conditions. Theoretically, this relationship examines how materials mediate certain practices and how those

practices recursively inform material development. Surveillance can be thought of as an effect of the interplay between materials and practices.

1.5.3. *Semiotics and Practices*

The final connection examines the relationship between semiotics and practices. Through discursive and symbolic iterations that are context-specific, practices are translated into political actions via *performance*. For example, walking becomes *patrolling*; talking becomes *lecturing* to an audience; speech becomes *speech acts*; standing becomes a form of *patriotism* in relation to a national anthem. In short, the relationship between semiotics and practices is concerned with how agency is rendered as a political act relevant to the security field. An important caveat to this relationship is that, while political acts necessarily involve human agency, this does not mean that only human agency is political. Following assemblage and actor-network theory, agency is not limited to human beings because technology possesses agency that is likewise political due to technology's embodiment of human subjectivity.

1.6. Methodology and Sources [16]

Locating empirical sources of information for security-related issues is challenging because, as mentioned above, the nature of security creates access barriers for researchers. Consequently, as Grondin (2013) argues, it is prudent for researchers to be open to the types of

[16] The original intent methodologically was to draw on the sources mentioned in addition to original data by performing primary interviews with subjects drawn from the Canadian federal government (specifically Global Affairs, DND/CAF, and DRDC) as well as experts within epistemic communities located in various private firms, research institutions, and development labs. Further, I intended to spend time at the Canadian High Arctic Research Station (CHARS) as part of these efforts and gain access to other field sites. However, the onset of the global COVID-19 pandemic forced me to shift my methodological approach to better accommodate the limitations imposed on travel and lack of willingness or ability for those individuals I had already connected with to engage in virtual discussions on the subject matter.

sources used in their analysis and creative in how they find them. In principle, this approach fits well with Jef Huyman's recent call for CSS to reassess "the processes through which security becomes politically meaningful" by exploring "ways of understanding security practices, concerns, and logics within a social and political situation that is not just or primarily driven by security but made up of entangling between multiple and heterogeneous practices and concerns" (in Salter (ed.)., 2019, p. 15). This dissertation draws from mixed sources including (but not limited to): secondary interviews found in media and conference proceedings; publicly available technical documents; scientific databases and research publications; social media; industry advertisements; government policy reports; and contract tenders issued by the federal government under the ADSA program. The collection of this material has been acquired through online-based applications, government and partner websites, and secondary literature. I began by focusing on federal government websites that detail the ADSA program and used those sites to find other materials in a snowball approach through direct site links, keyword identifiers, and shifting my focus to the private firms involved in technological development for Arctic surveillance. These private firms offered diverse sets of materials, ranging from technical documents to social media posts that provided empirical references for analysis within the existing structures and narratives surrounding Arctic security.

This approach follows Huysmans' observation that pursuing a research strategy that recognizes the complex social fields from which security becomes "politically meaningful […] can be done, for example, by multiplying the actors and/or discourses beyond security-focused ones or by giving primacy to complex analytical categories through which conceptions of politics or the social are mobilized, such as citizenship, freedom, democracy, public, welfare,

without reducing or hierarchically subordinating them to security" (Huysmans, in Salter (ed.), 2019, p. 15).

Methodologically, this dissertation uses the theoretical framework outlined above and draws explicitly on critical discourse analysis, focusing on how security is articulated and practiced by the state and how those discourses interact with materials to produce specific technologies and practices (see Milliken, 1999, p. 240). In terms of process, sources are analyzed using a double-reading process, where the first reading identifies core themes and issues, while the second reading is framed using the material-semiotic approach. Sources are coded for each point of triangulation with descriptive analyses made for each of the three relationships between the points, with the task being to explain the production of and relationship to the field (Arctic security). Combined with the material-semiotic framework discussed above, these methods allow for a 'thick description' of Arctic surveillance and its relationship to the field of security as a site of bureaucratic governance and therefore drawing out the implications for Canada's role and capacity in the region.

1.7. Conclusion

This chapter makes a case for a material-semiotic framework using a triangulation model that incorporates materials, semiotics, and practices to analyze the role of technology and technological development in Canada's Arctic security. Arctic security is not something 'out there' as a pre-given interest of the state. Instead, it is understood as a bounded field made up of social-technical assemblages that are defined by and overlap with other fields of social activity.

The specific goal of this dissertation is to detail both the technological and social agents involved and trace Canada's historical relationship to surveillance technologies in the Arctic

while theorizing their current and future development. The theoretical and methodological framework outlined in this chapter offers a holistic and critical pathway to analyzing Canada's Arctic security policy and its focus on technological innovation compared to rational choice approaches alone. In contrast to a limited interest in the capabilities of technology to transform security and defence through their instrumental function, this critical framework pays attention to the historical, social, cultural, economic, and other overlapping contexts that define and produce security. Security is understood as more than the sum of weapons capabilities and their strategic use by states. Rather, security is a field of social activity defined by these contexts and structures the behaviours, interactions, and logics governing technological innovation in the first place. Technology is thus a political artifact that serves the application of state power and represents a particular orientation to the world. The remaining endeavour of this project is to tease out the logics shaping technological innovation, and in turn, shaping techniques of state power.

CHAPTER 2: LITERATURE REVIEW

2. Introduction

As Nazi Germany prepared for conflict against the Soviet Union in the European theatre, several commentators and defence experts believed that the Arctic would become a critical strategic battlefield in an ensuing war. Indeed, the Globe and Mail ("Arctic bases ready in war") wrote on February 11, 1937, that "European statesmen believe that the next war will be fought between the two Powers in Scandinavia and on the fringe of the Arctic Circle" and that "Military experts all over Europe are now working hard on the problems that would be raised by a war in the Arctic." In the intervening decades since World War II, the Arctic has waxed and waned as a site of geostrategic interest for state practitioners and defence analysts. Current discussions on the Arctic are reminiscent of those in the early to mid-20th century that emphasized the region's geostrategic relevance within the framework of war and peace. Indeed, interest in the Arctic has been reignited since experiencing a relative lull in attention following the end of the Cold War, which dissolved the region's relevance as a geostrategic theatre during the 1990s.

The Arctic experienced a resurgence in Canadian public consciousness during the early to mid-2000s following several media spectacles focused on Canadian sovereignty over internal waters, Canada's disputed ownership of Hans Island with Denmark, and Russia's installation of a national flag on the Arctic seafloor (Landriault, 2021, p. 63-74). However, the Arctic also received significant interest as a symbolic representation of climate change, which became more salient as a matter of global public interest and agenda setting among governments and research communities (Forbes & Stammler, 2009, p. 30; see for e.g., Hassol, 2004; Gareth, 2004). Beginning most emphatically during Stephen Harper's tenure as Canada's Prime Minister beginning in 2006, Arctic security has often been framed as both a national and regional issue

that coincides with a deteriorating global security environment, including climate change. From a geopolitical perspective, this framework is linked to the perceived return of "major power competition" on the international stage (National Defence, 2017, p. 50; see Mearsheimer, 1990; 2019, who, against the 'end of history' narrative, has consistently argued that the end of the Cold War's bipolar order would result in greater international instability through greater multipolar tendancies). Consequently, the Arctic is once again positioned in media, academic, and public discourse as a potential arena for the high politics of war and peace.

Interlinked with the Arctic's securitization as a geostrategic theatre of military importance is the current proliferation of discourses that emphasize the Arctic as a final frontier for non-renewable resource extraction as climate change makes the region more accessible to development.[17] Interest in natural resource development in the circumpolar region by nation-states has drawn comparisons to the American frontier expansion as a "great Arctic gold rush" (Borgerson, 2008, p. 64) and the colonial surge during the last quarter of the 19th century, creating what Huggan has called a "scramble for the Arctic" in order to exploit its resources (Huggan, 2015, p. 133; see also Steinberg & Dodds, 2015, p. 108). In tandem with the potential for interstate conflict are discussions focused on the technical, economic, and legal issues associated with securing access to the Arctic's minerals and non-renewable energy supplies, along with the environmental implications of resource extraction. These implications are captured in the public imagination by the Arctic's melting ice caps and the suffering of

[17] An interesting avenue of potential collaboration between the west and Soviet Union on surveillance efforts in the Arctic was suggested by Professor Grigori A. Avsyuk, then head of Soviet ice studies. Professor Avsyuk presented a paper at the international conference on Arctic sea ice and "proposed that it may be possible to remove ice from the Arctic Ocean, opening it to world shipping" and thereby "revoluntioniz[ing] the economies of Canada and the Soviet Union" while also potentially "hav[ing] a radical effect on climate" (Sullivan, "Melt Arctic Ice, Red's Proposal," March 3, 1958).

ecologically displaced animals such as the polar bear, which may very well be the "dodo-bird of the twenty-first century" (Oreskes & Conway, 2013, p. 47).

The intersection of environmental, social, political and economic issues in the Arctic is represented through different, and at times competing, ways of understanding security. The multiplicity of security considerations in the Arctic can be grouped within two broad frameworks. The first is the conventional state-centric approach that prioritizes geostrategic thinking and national defence linked to military mobilization. The second involves a diverse group of critical approaches that challenge territorial defence's prioritization as the central locus of security and argues for a holistic account of what security is and requires, especially for human beings and the environment. Some authors have reproduced IR's gendered conventions and distinguished the difference between these security paradigms in the Arctic as reflecting either "hard" or "soft" concerns, the former associated with narrow military defence and the latter concerning the range of threats that conceptually proliferated following the end of the Cold War (Stokke, 2014, p. 122). While the state-centric framework is characteristic of policy discussions centred on Canada's ongoing sovereignty concerns and promoting its national interest, the critical security research agenda has made at least a superficial impact on how Canada defines its security interests in the Arctic. More pointedly, Canada's northern Indigenous communities occupy a notable role within the critical literature but are also important to Canada's broader Arctic interests. A significant thematic contribution made by critical approaches demonstrates how Canada's efforts to promote its national interests often undermines the security of northern communities.

Current policy, academic, and media discourse considers the need for enhanced surveillance capabilities in the Arctic, particularly as early warning capabilities developed during

the Cold War have become obsolete against modern technologies, including advanced missile delivery systems. However, there is a notable gap in the Arctic security literature as a whole concerning surveillance within a critical and theoretical lens. This oversight is a curious absence given the proliferation of research on surveillance practices and technology in recent years.

Rather than identifying with either a conventional or critical school, this project occupies a middle ground that bridges these literatures by considering the interplay between Arctic politics and international relations with a critical sensitivity. This sensitivity recognizes the traditional importance of the state towards global politics but does not take the state or current trends in international relations as pre-given, nor is the state's political reign a necessarily enduring feature of the international system. States and state policies are historically produced and contextually bounded entities that can never be separated from specific world views and political consequences. The breath of literature on Arctic security does not adequately consider how Canada understands the region as a security theatre nor the state's focus on enhancing surveillance and intelligence capabilities through technological innovation.

This chapter is organized as follows. It begins with a discussion of recent literatures concerning Arctic security from the state-centric approach, which often mimics larger debates within International Relations theory between structural realism and liberal institutionalism. The chapter then offers an overview of the critical approaches to Arctic security, emphasizing the concerns for human and environmental wellbeing in the Canadian Arctic. Specifically, the chapter considers the place of Indigenous peoples in Canada's Arctic by examining how traditional security discourse can function as a mechanism of colonial management that services state interests. Lastly, the chapter introduces surveillance using a critical lens and summarizes its relevance to Arctic security.

2.1. State-centric Security

Recent geostrategic interest in Arctic security has deliberated on the potential for interstate conflict in the region, especially between Russia and western Arctic states. The geostrategic literature is reminiscent of earlier Cold War discussions that framed Arctic security in terms of building and managing defensive and offensive capabilities through "the language of *Realpolitik*" (Lenarcic & Reford, 1989, p. 160). In contrast to the Cold War's narrow geostrategic framework, Arctic governance efforts since the 1990s have also yielded policy interest in and cooperation on several security-related issues, including on search and rescue capabilities and environmental matters.

The framework of cooperation and confrontation (or deterrence and *détente*) among state powers in the Arctic shares a thematic link to the broader debates of International Relations theory. Historically, security has been a major site of academic inquiry since the Great War dissolved Europe's balance of power and expanded warfare into a truly global enterprise. The inception of IR as a discipline in Aberystwyth, 1919 initially focused on the enduring legacy of geopolitical conflict and questions related to war and peace. This focus became more pronounced as international efforts to institutionalize peace through the League of Nations following WWI crumbled and continued into the horrors of World War II followed by the Cold War's escalating 'balance of terror.' Consequently, these experiences continue to shape much of IR's disciplinary boundaries, which are dominated by various theoretical iterations of *realism* and *liberalism.* Notably, while significant differences exist, both theoretical views are supported by an ontological priority occupied by the state (Collins, 2019, p. 2; Tamnes & Offerdal, 2014, p. 6).[18]

[18] Within International Relations theory, Security Studies is understood as "*the* sub-discipline" where "it was the carnage of the First World War, and the desire to avoid its horrors again, that gave birth to the discipline of International Relations in 1919 at Aberystwyth, United Kingdom" (Collins, 2019, p. 1).

It follows that the field of security studies has conventionally been preoccupied with analyzing the state's role in defending its interests, pursuing war, and creating the conditions for peace. Within a geostrategic framework, security is entwined with the high politics of war and peace under the international condition of anarchy, which is understood as a structural feature of the global order. Anarchy exists because the global order lacks an international authority analogous to the domestic authority enjoyed by states and enshrined through the principle of sovereignty. *Neorealism* (also termed *structural* realism) in particular employs a methodological individualism of state behaviour within a contractarian field, meaning states are understood as self-interested and rational actors that seek to maximize those interests and preserve their security (Krause & Williams, 2015, p. 39-43). Put otherwise, neorealism projects a field of security primarily concerned with existential threats to state survival that typically invite militaristic responses. As such, threats and responses are primarily understood in the material terms of raw power politics, the kind that creates and responds to a Hobbesian "fear of death" that represents “the only truly human condition” (Krause & Williams, 2015, p. 36). The neorealist security framework is given a universal quality that is timeless and immutable, particularly as threats to the state are projected as threats to individual wellbeing. The security of citizens is defended by, above all else, the protection of the state.

The Arctic has been positioned as an important theatre of geostrategic interest and historically defined by the parameters of the century’s great power confrontations. During World War II, the region was encompassed within the Battle of the Atlantic and subsequently transitioned into a critical defensive arena for North America after 1945 as the introduction of nuclear weapons shifted competing geostrategic interests with the onset of rivalry between the Soviet Union and the United States-led Western alliance (Lajenuesse, 2016, p. 36; Evans, 1999;

Lindsey, 1989; Tamnes & Holtsmark, 2014, p. 21-29). Writing in January of 1947, Charles J.V. Murphy for *Life Magazine* writes, "to believe in peace in this imperfect world is to acknowledge the ever-recurring fact of war. The polar concept simply assumes that if another war is in, the cards the arctic and subarctic regions will inescapably provide the pathways for the first and perhaps decisive blow" (Murphy, 1947, p. 61). In the same article, retired US General H.H. Arnold is quoted as stating that “if there is a third world war, it’s strategic center will be the North Pole” (Murphy, 1947, p. 61). The introduction of nuclear weapons as the fundamental structural change for military strategy during the Cold War rendered the circumpolar region a critical area for collective security (Haftendorn, 2011, p. 337, 342; Huebert, 2014a; 2014b, p. 66). Current discussions within mainstream and Western policy circles continue to understand Arctic security from a nationalistic and geostrategic point of view. This framework is animated by concerns emanating from the breakdown of relations between Russia and the West across several political and geographic fronts. Indeed, Russia’s long-term strategic intentions have increasingly dominated international considerations by western states, particularly in the European theatre and especially for its Norwegian neighbour (Wilhelmsen & Lundby Gjerde, 2018, p. 383, 387-393).

The Cold War’s geopolitical framework has regained currency and remains a salient approach for those seeking to capitalize on the dramatic imagery of an invading force and the potential for major inter-state conflict. The 'new Cold War' framework has been focused on the foreign policy actions of Russia (Åtland, 2009; Staun, 2017) because, according to authors like Romaniuk (2013, p. 49, 66), Russia is prepared to make aggressive advances to secure its Arctic claims in the future. From a geostrategic point of view, this framework considers whether the Arctic is re-emerging as a military theatre analogous to that of the Cold War amid growing

tension between Russia and the West and indicators signaling the Arctic's re-militarization (Keil, 2014, p. 162-166; Roberts, 2010, p. 958; Staun, 2017, p. 314-314; see also Charron, Plouffe, & Roussel, 2012). Further, geostrategic considerations are complicated by growing interest by non-Arctic states such as China in becoming significant 'near-Arctic' players (Lajeunesse, 2018, p. 7; Lasserre, Huang, & Alexeeva, 2017, p. 31).

There have been multiple rhetorical remarks and concrete acts of militarization by Russia in the Arctic, especially in the Barents region by the Norwegian border. President Vladimir Putin has linked the Arctic to traditional security interests for the Russian state, and 'hawks' such as Dimitri Rogozin (ambassador to NATO and former Deputy Prime Minister) have made some aggressive statements, fueling these Cold War analogies (Staun, 2017, p. 324). Russia's annexation of Crimea in 2014 and its continued presence in Ukraine has led to a reassessment of Russia's interests in the Arctic and how far it will go to serve those interests. In particular, Crimea's annexation leads to questions regarding the influence that international conflicts may have and spill-over into the Arctic. This thread of analysis considers whether international governance efforts that characterize the region as a zone of peace are at risk of devolving and whether such conflicts may provoke a regional security dilemma, leading to increased militarization (Åtland, 2014; Byers, 2017; Konyshev, Sergunin, & Subbotin, 2017, p. 106-108; Rahbek-Clemmensen, 2017; Scopelliti & Perez, 2016).

Policy discussions premised on questions related to national defence, international stability, and institutional governance tend to be analytically limited in that they consider security almost exclusively in terms of the state, including military build-up, the protection of territorial sovereignty, and the risk of escalation towards armed conflict (e.g., Braun & Blank, 2017; Foxall, 2017). In the Canadian context, Canada's claim to its share of the Arctic's territory

and resources has fueled discussion on the policy implications of Russian aggression and Russia's place as the world's hegemonic Arctic power (Charron, Plouffe, & Roussel, 2012). The narrative resurgence of Cold War imagery in Canada can be partially credited to the domestic policy rhetoric used by former Prime Minister Stephen Harper during his leadership between 2006 and 2015, which was coloured by militaristic spectacles and speech, such as the annual military exercise *operation NANOOK* and his widely cited 'use it or lose it' declaration (Lackenbauer, 2013, p. 472; Lackenbauer & Lajeunesse, 2016, p. 12). Former Prime Minister, Stephen Harper declared at the outset of his Far North policy that "Canada has a choice when it comes to defending our sovereignty over the Arctic. We can use it or lose it. And make no mistake, this government intends to use it" (Government of Canada, 2007). Harper's 'use it or lose it' rhetoric continued to be circulated by his government and gained notable media and academic attention. On a five-day Arctic tour in 2010, Harper reiterated his slogan and was quoted by reporters as stating that "The first and highest priority of our northern strategy is the protection of our Arctic sovereignty" and that "as I have said many times before, the first principle of sovereignty is to use it or lose it" (CBC News, 23 August 2010).

Dodds describes Harper's approach to the Arctic as a strategy of gradual or paternal sovereignty, where the Harper government stated that "providing adequate security in, and to, the region is now a strategic imperative and truly serious action must start today. Canadians of the 22nd century deserve, and will accept, no less" (Dodds, 2012, p. 994). Harper's 'use it or lose it' rhetoric and his appeal to Canadians in the next century, while dramatic, are indicative of Canada's use of sovereignty as a cognitive shortcut for policy interests, including security considerations. Indeed, Harper's consideration for the distant future represents wider policy

discussions in the Arctic as a futurized space undergoing rapid environmental changes in the present, leaving it vulnerable to the negative effects of raw power politics.

Despite this rhetoric and the prevalence of concern for interstate rivalry, Keil (2014, p. 179-180), Roberts (2010, p. 969) and Staun (2017, p. 328) all note that the 'new Cold War' thesis is not an accurate reflection of the existing conditions in the Arctic, which appears to remain an island of multilateral cooperation amidst the return of state-based hostilities elsewhere in the world (see also Brigham, 2010, who states that "Anarchy does not reign at the top of the world"). Indeed, according to these authors, the Arctic is a region characterized by strong relationships between states and is mediated by a developed legal-institutional regime (including the Arctic Council and international law)[19] that underlays a shared interest in resource development and governance norms rather than focusing on traditional security interests (Hoel, 2014, p. 56-57; Offerdal, 2014, p. 91-92). The question is then whether this institutionalism is sufficient to facilitate a degree of complex interdependence between states that will maintain the Arctic a zone of peace given the deteriorating global security environment. With respect to Arctic cooperation with Russia, results appear to be mixed. For example, cooperation with Russia along military and economic fronts has been largely halted but continues in other areas, such as search and rescue operations, fishing regulations, and the Arctic Council (Byers, 2017, p. 376). This mixed result suggests that the Arctic exists somewhere between anarchy and complex interdependence, which are conceived as two opposite ideal-types on a spectrum between

[19] The Arctic Council (AC) was established in 1996 through the *Ottawa Declaration*, which includes the eight Arctic states and acts as a "high-level forum for to provide means for promoting cooperation, coordination and interaction among the Arctic States – including the full consultation and full involvement of Arctic Indigenous communities and other Arctic inhabitants" (Arctic Council, 2020). Broadly, the AC's work focuses on civilian projects, particularly those related to environmental issues and scientific studies. A fundamental gap in the AC's mandate relates to security, with military and state-based security issues remaining firmly under the sovereign control of member states.

realism and liberalism (Byers, 2017, p. 385).[20] Despite the return of military tensions between the West and Russia, there appears to be a broad agreement among even among hawkish analysts that the possibility for conventional military conflict in the Arctic region is low (at least for the time being) and that cooperation and peaceful dispute resolution will remain the norm. Cooperation, however tenuous or superficial, will likely continue for the time being due to the prohibitive costliness of full-out militarization as well as the unique requirements needed to access Arctic spaces and resources in terms of financial capital, expertise, and the technology required for resource development.

The 'Arctic scramble' for resources analogy comparing state interest in exploiting the Arctic's natural resources to the 19th-century race to colonize Africa is also overstated (Claes & Moe, 2014, p. 98) and challenged on at least two points. First, the actual resource potential of the region is mainly hypothetical because exploration has thus far been limited due to technical, environmental, and cost-related prohibitions, and because the extractive industry is subject to several extra-regional forces, including environmental conditions, global commodity prices, and competition with other resource areas (Claes & Moe, 2014, p. 118).

Second, unlike the carving of Africa in the 19th century and subsequent wars over imperial control of colonial territories, the control of Arctic territory in terms of its landmasses is not in dispute other than a few minor areas, such as between Canada and Denmark over Hans Island. Even the rights to resources within the sea bed are highly institutionalized and governed through the *United Nations Law of the Sea* (UNCLOS).[21] Moreover, other regimes of common

[20] Defining the 'West' in the context of Arctic governance typically refers to Canada, the United States and western European Arctic states, but it is also implicitly linked to other western states (including those in Europe and Australasia) and the West's leading role in NATO.

[21] Fisheries and Oceans Canada states that "UNCLOS is an international treaty that sets out the legal framework for ocean activities. It defines the maritime zones along a country's coastline and the rights and duties of a country regarding these zones. UNCLOS also recognizes that coastal states have sovereign rights over the natural resources

interests, such as the intersection of fishing resources and environmental issues, encourage strong institutions and cooperation (Hoel, 2014, p. 51-52; Stokke, 2014, p. 134).

Thus, while the scramble for Africa was characterized by an actual multipolar system without a developed legal and institutional regime, the same cannot be said for the Arctic (Lackenbauer & Lajeunesse, 2016, p. 22). The combination of global forces, national interests, and institutional development suggests that "in reality, few geopolitical tensions [exist] in the region" (Kessel, 2016, p. 242). On this point, Canada submitted part of its formal claim to part of the Arctic Ocean to UNCLOS at the United Nations headquarters in New York City on May 23, 2019. At the time, Global Affairs Canada stated that "All Arctic Ocean coastal states have committed to resolving continental shelf overlaps in a peaceful and orderly manner in accordance with international law" (George, 2019; see United Nations, 2020). Given the Arctic's robust institutional and normative regime and an apparent desire for Arctic states to avoid military confrontation, any argument characterizing the Arctic as a future warzone is at best speculative of an unlikely future that is based on historical anecdotes with little grounding in reality.

However, other authors argue that the Arctic's existing institutional cooperation is superficial and does not inherently limit the potential for armed conflict in the future. For example, Åtland argues that "despite being a low-tension region, located far away from the world's major conflict hot spots, the Arctic is not devoid of security dilemma dynamics" (2014, p. 157; see Romaniuk, 2013, who approaches this question from a historical and contemporary perspective in relation to Russia, energy, and the international system). In particular, there is no

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of the seabed and subsoil of the continental shelf, as well as jurisdiction over certain activities like marine scientific research" (Fisheries and Oceans Canada, 2019). Importantly, "countries can extend their territory beyond 200 nautical miles if they show that their continental shelf is a natural prolongation, or continuation, of its land territory" and is called "the extended continental shelf" (EEZ) (Fisheries and Oceans Canada, 2019).

regional institutional body to manage dialogue between states on traditional defence issues in the Arctic. Instead, conventional state security issues remain the prerogative of national governments and are considered 'off the table' for the Arctic Council. While NATO has lobbied for an increased role in matters of Arctic security, it has been pointed out that this position would not be acceptable to Russia and may instigate conditions of insecurity, thereby triggering a classic security dilemma scenario (Blunden, 2009, p. 129-130; Scopelliti & Perez, 2016, p. 675-676). Similarly, a recent analysis by the RAND corporation concerning US interests in the Arctic argues that an increased "NATO presence in the Arctic region might be perceived as a military threat warranting a response in kind" (Pezard et al., 2017, p. xiii).[22] Sergunin and Konyshev support this position when they argue that the Arctic Zone of the Russian Federation (AZRF), especially the Kola Peninsula, holds strategic importance for Russia's national security (Sergunin & Konychev, 2017, p. 3). Based on this understanding, Foxall (2017) argues that the prevalence of multilateral agreements and other international governance mechanisms in the Arctic obscures the degree to which tensions between Russia and the West have already spilled over into Arctic relations. Given that the Arctic is understood by Russia to be of critical strategic importance, Foxall argues that "it is now clear that Russia is pursuing an aggressive and revisionist foreign policy," although it is less clear what that revisionism implies for Russia's role in terms of its Arctic strategy (2017, p. 3).

Thus, while the Arctic is characterized by a developed institutional system, gaps remain that may prove problematic and inadequate at maintaining peaceful conflict resolution, especially if those conflicts are extra-regional in character and spill-over into the Arctic. From a strategic viewpoint, the main challenge is finding institutional avenues for pursuing security discussions

[22] RAND Corporation was created in 1948 and is considered by many to be the preeminent think tank in the United States aligned with the US military and the state's more geostrategic interests more widely.

and confidence-building measures among Arctic states that are inclusive of Russia while enhancing traditional deterrence capabilities in the region without signalling a provocative stance *against* Russia, thereby risking the devolution of cooperative postures.

Deterring aggression and defending against other states is not the only concern for policymakers within the remit of traditional security considerations. The same effects associated with climate change opening the Arctic to state-based interests are also opening the region to potential exploitation by non-state actors, including criminal and terrorist organizations. These concerns are typically represented at the state level and captured through policy discourses that emphasize the Arctic's potential for exploitation in terms of newly accessible territory by these groups. Importantly, concerns centred on illegitimate non-state actors are a core aspect of Canada's overarching interest in protecting sovereignty and territorial integrity.

Consequently, while many authors note the conflicting evidence surrounding the Arctic's potential as a future battle zone, this does not indicate that greater resources are not needed in the region. More pointedly, states may become more active in protecting their interests in the Arctic (whether it be territory and sovereignty, access to resources, or other concerns) through military investment along with enhancing the capabilities of security, policing, and other civilian agencies that take on a more significant role in security efforts as a whole.

2.2. Critical Security

The end of the Cold War, combined with the widening of security's conceptualization at the policy level beyond military concerns, shifted the analytical focus from state-based conflict to human wellbeing, cultural preservation, and especially the environment (Huebert & Lackenbauer, 2016, p. 2; Huebert, 2021, p. 85-88). The conceptual introduction of human

security by the United Nations in their 1994 Human Development report is particularly influential in this regard. The broadening of the security ecosystem came as the end of the Cold War dissolved security's preoccupation with interstate rivalry and great power competition, while other trends shifted the discourse of security to focus on a new series of anxieties and threats. In particular, environmental degradation, the rapid transition of the former Soviet bloc to market economies, and the persistence of high rates of poverty in developing contexts led to a greater focus on human rights issues and the rise of non-state actors such as Islamic terrorist groups. Importantly, the conceptual broadening of security has led Canada and other Arctic states to likewise expand their notion of security outside of narrow concerns for territorial defence and military strategy.

Despite this shift, the state remained a key actor for defining the post-Cold War era's reigning security interests. As Bogdan, Mera and Oroian (2014, p. 113) highlight, the discursive void left at the end of the Cold War enabled issues like the environment and alternative conceptualizations of human wellbeing to be securitized in a narrow fashion that was agreeable to the imperatives of liberal capitalism as the Cold War's bipolar power structure gave way to a unipolar moment led by American hegemony. In particular, the end of the Cold War was met with a proliferation of other security dynamics, primarily through the intersection of development concerns with peace and conflict issues that became more salient in parts of the global south where state fragility undermined western interests. As a consequence of this shift, migration has become more prominent as a source of insecurity for European and other societies (Mavroudi & Nagel, 2016, p. 46-47). While mass migration is not a new phenomenon, the multiple conflicts and "disintegration" of states argued to characterize the post-Cold War world of the 1990s and onward (Kaldor, 2005, p. 491) have engendered a heightened concern for

border security and other threats emanating from conflict zones and humanitarian disasters. The state focus on migration as a source of threat is highlighted by Sergunin and Konyshev, who argue that "illegal migration is one more potential security challenge for Russia and neighbouring countries," even in the Arctic where "refugees from the Middle East have taken the so-called Arctic Route through Russia, crossing the Norwegian border by bike as Russia does not allow anyone to cross by foot" (2017, p. 8).

Despite the enduring focus on state security within the post-Cold War shift, security has also experienced a conceptual "deepening" and "widening" by scholars and policymakers. The post-Cold War order signalled a need for new analytical tools to make sense of the world experiencing this unipolar moment dominated by the United States. Threats to human wellbeing and the major power competitions of the 20th century could no longer be linked to a competing ideological paradigm (the Cold War triumph of capitalism over fascism, communism, and other various *isms*) nor to a powerful enemy state – the "end of history," as it were (Abrose, 1993, p. 374 as cited in Close, 2000, p. 11; Fukuyama, 2006). Consequently, the Arctic has also become a key site of critical analysis because the spectre of communism and the explicit military threat posed by the Soviet Union no longer legitimated Arctic imaginaries predicated on global nuclear conflict, at least during the early post-Cold War years.

Several authors have recently signalled the post-Cold War break as a catalyst for a constructivist and post-structuralist turn in security studies (e.g. Aradau & Munster, 2010; Balzacq, 2010; Jensen, 2013; Heath-Kelly, 2016), which found a significant audience in the 1990s and has featured prominently in recent Arctic security research (e.g., Greaves, 2016; Hossain et al., 2016; Hossain et al., 2017; Jacobsen & Herrmann, 2016). In general, critical approaches to security analysis, consider issues that represent threats to human wellbeing and

survival outside of state-based warfare. Critical security also traditionally focuses on the discourse of security itself by analyzing how an issue is framed as a *security* issue (*securitization*) using constructivist and post-structural frameworks of analysis. Securitization is politically unique because it legitimates extreme and immediate responses in a 'state of exception' to issues that are constituted as threats.[23] Securitization is an intersubjective process that encompasses a "specific rhetorical structure," incorporating a sense of immediacy and severity concerning threat assessments (Buzan, Wæver, & De Wilde, 1998, p. 26).

More importantly, critical security analysis involves a departure from the state as the ontological priority of analysis and an epistemological shift to include forms of knowledge outside of positivism, especially as they relate to alternate understandings of power other than purely militaristic, economic, and other material forms. Further, critical security analysis typically embraces a clear normative dimension that reflexively challenges the conventional reification of the state as a guarantor of human wellbeing and survival. Symbolic positions such as citizen and sovereignty occupy specific political subjectivities that are deployed to support some and deny others a status of protection. Within the Arctic context, human and environmentally grounded approaches have dominated the critical study of security in the region. At the policy level, these concerns are often represented in discussions within international institutions such as the Arctic Council, especially as the rights and wellbeing of northern Indigenous communities, who make up make up a significant amount of the population in Arctic

[23] Aradau and Munster highlight the importance of Agamben's theorization of the state of exception, in which "the state of exception does not just produce sovereignty but also its mirror image of bare life, i.e., life that can be killed with impunity. Underpinned by sovereign power, security is understood as an exceptional practice that draws boundaries between political life (*bios*) and abject, disqualified, or bare life (*zoe*). For Agamben, the concentration camp exemplifies the space where we find the most extreme form of bare life, in as far as prisoners do not enjoy legal protection against the atrocities of the guards who act as sovereigns" (2010 p. 109).

regions, have become interlinked with threats induced by climate change and development related issues (see Figure 2.1 below).

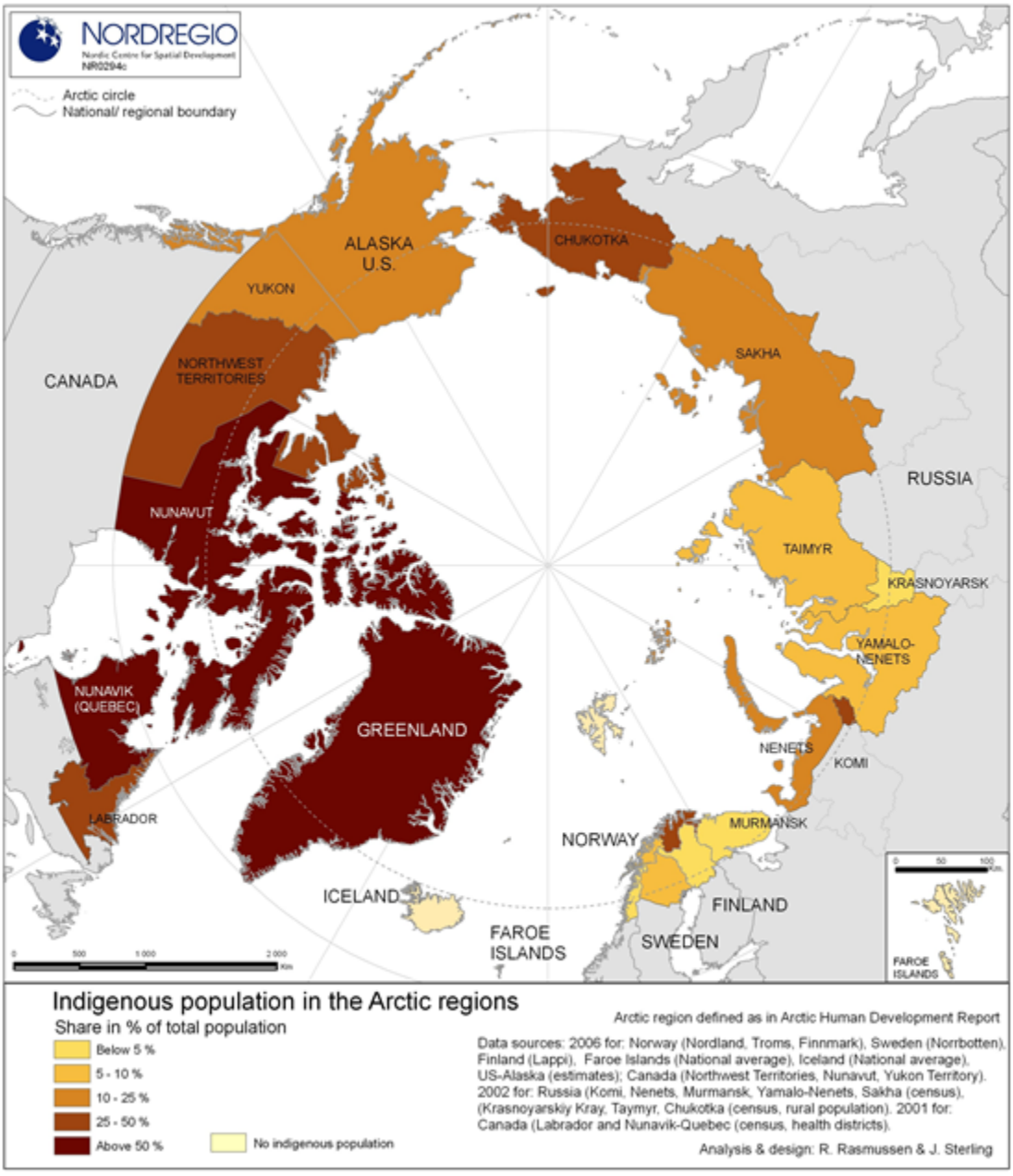


Figure 2.1. Share of Indigenous population in the Arctic region (Nordregio, 2010).

Canada has embraced several critically oriented aspects of security's normative dimension, particularly concerning the need to promote the wellbeing of Indigenous peoples and protect the environment (see Government of Canada, 2019). Indeed, Canada's security and development ambitions at the discursive and policy level include a prominent role for northern Indigenous communities.[24] For example, the Canadian federal government emphasizes the importance of resources and waterways while highlighting the role of the Inuit in Arctic governance as bilateral partners (Government of Canada, 2019). On this point, Bonesteel argues within a federal report that "as gauges for human adaptation to global climate change, Inuit are anxious to participate in studies and discussions leading to the development of global policies that will mitigate the changes to their environment" (Bonesteel, 2006, p. 34). The theme of bilateralism is a persistent feature of official state discourse focusing on the relationship between Inuit and the Canadian government that reflects normative, legal, and political positions of Canada in the Arctic. Shadian captures the theme of bilateralism in the concept of *co-management*, which encompasses the multiple non-state actors that influence Arctic governance. Co-management "aims to deal with the fact that often resource management is controlled equally by states and various non-state actors including private companies" (Shadian, 2014, p. 520). The notion of co-management speaks to the complexities of Arctic governance, especially concerning oil and gas development, which involves multi-scalar relations between communities, governments, corporations, and institutions (Shadian, 2014, p. 536; see Johnstone & Hansen, 2020).

[24] While census and National Household Survey data provide estimates of those who identify as Aboriginal (as defined in *Canada's Constitution Act*, 1982, section 35) in the population in Canada, Young and Bjerregaard argue that "[d]espite the importance of the indigenous population in the Arctic, an accurate estimate of its size and distribution remains elusive" (2019, p. 1). Using 2011 Census data, the authors state an estimate of 53.1 percent of Canada's northern people identify as Aboriginal (either First Nation single identity, Métis single identity, Inuit single identity, multiple Aboriginal identities, or Other Aboriginal identities) (Young & Bjerregaard, 2019, p. 7).

On an instrumental level, human and environmental security have thus become prominent rhetorical concerns of the state. However, Greaves (2012, p. 220) argues that these concerns have been assimilated and de-radicalized from their initial conceptualization and deployment because the state continues to prioritize its role as a security guarantor in ways that are not aligned with the actual security needs of Indigenous peoples and the environment. The dilution of critical security's radical character to accommodate conventional priorities of the state is also discussed by Hossain, Zojer, Greaves, Roncero, & Sheehan (2017), who argue that the field of human security remains a useful framework for analyzing the security needs of Arctic populations and to promote normative goals grounded in their cultural and societal security. The normative move makes a comprehensive or critical approach to human security distinct from the dominance of neorealism in security discourse and foreign policy rhetoric. As the authors state, "Critical security studies is generally characterized by a normative concern for promoting conditions of human freedom and emancipation" (Hossain et al., 2017, p. 55). However, in practice, the incorporation of human security concerns within state-directed policy priorities has privileged a Western preoccupation with liberal individualism that frames security "as a service offered by the global north to the global south" and therefore "risks being another example of 'virtuous imperialism' by a hegemonic and interventionist West" (Hossain et al., 2017, p. 56). Indigenous peoples are presented within this framework as groups to be managed through what Williams calls "racialized rescue narratives," which are used to justify state-led projects that reassert state power (Williams, 2011). A notable consequence of this framework is that it circumscribes Indigenous peoples and their interests within the subjective positionalities of 'local' and 'traditional.' In the Canadian Arctic, the Inuit are often portrayed as communities in stasis, which justifies intervention by governmental and non-governmental forces under the mandate of

"improving the lives of Indigenous northerners" (Cameron, 2012, p. 106). However, the form of this intervention is typically one that is compatible with a status quo that prioritizes the state as a settler-colonial authority, which undermines the international recognition of Indigenous peoples as legitimate international actors with their own pan-Arctic agenda.

The disconnect between Canada's rhetorical interest in promoting human security and actual state policy is reflected through the division between national and international. Greaves (2012) argues that human security provides the most coherent and consistent framework for Canadian foreign and security policy in the Arctic since the end of the Cold War. More specifically, the Canadian security context is characterized by the management of risk by preventing violent harm to *foreign* subjects (Greaves, 2012, p. 220, my emphasis). Problematically, there is a vast disconnect between the human security studies paradigm that emerged as a critical discourse in the post-Cold War environment and the actual practice of human security by nation-states. Greaves argues that human security in practice marginalizes "the socioeconomic and intersubjective dimension of human wellbeing [which] are central to holistic human security" and that "the Canadian approach ignores the radical reconceptualization of security that forms the core of human security studies" (Greaves, 2012, p. 220).

Rhetorically, human security is linked to the Canadian state's practice of liberal internationalism and the discourse of international human rights, which emerged as a central security concern of foreign policy after the Cold War. While human rights may be institutionalized domestically (e.g., through the Canadian Human Rights Commission), the discourse employed is typically separate from any securitization moves that would necessitate a need for immediate action at the domestic level. Consequently, the actual security needs of northern communities cannot be discussed independently of the state's historical relationship to

those communities. Whereas the framework of *human rights* is traditionally under the purview of foreign policy (because Canada is assumed to be a practitioner of human rights and a guarantor of them in foreign contexts where those rights are not present or are threatened), Indigenous human security is linked to the domestic policies centred on claims to state sovereignty. Nicol argues that "for Canada's government, it seems that sovereignty is something that Indigenous groups "give" to the state rather than a quality that the state shares with its Indigenous peoples" (Nicol, 2014, p. 129). Indigenous sovereignty is complex and multifaceted, but conceptually reflects sets of rights accorded through the UN Declaration on the Rights of Indigenous Peoples (UNDRIP), which differ from Human Rights in their ontological foundation (Johnstone, 2020, p. 49). Human rights are grounded in individualism on a universal level, whereas Indigenous rights, (while complemented by human rights) encapsulate the social collective and embody cultural dimensions linked to ancestorial sovereignty through notions of responsibility and self-determination (Ross-Tremblay, 2019, p. 3; Johnstone, 2020, p.49).

Indigenous sovereignty remains a complex and contested issue within and beyond the community level through the interaction of Indigenous peoples with the Crown (Ross-Tremblay, 2019, p. 3). Canada's own claims to offshore waters in the Arctic are based "upon the acceptance of state sovereignty in areas where claims have not been agreed upon or their consultative provisions not fully implemented" (Nicol, 2017, p. 794). The prioritization of state sovereignty over Indigenous sovereignty is reflected in the Arctic's governance structure. While Arctic governance is understood and accepted to involve numerous non-state actors by states themselves, the actual inclusion of these groups is not widely practiced (Steinberg & Dodds, 2015). The language of Westphalian sovereignty acts to construct the empirical reality of actors making claims because it circumscribes how actors can make claims at all. For example, "land

claims and other self-government agreements "are not simply formalizing jurisdictional boundaries among pre-existing First nation polities" (Nadasy, 2012, p. 502 as cited in Nicol, 2014, p. 138). Rather, land claims and self-government agreements serve as "instruments for creating the legal and administrative systems that bring these into being" through "the language of state sovereignty" (Nicol, 2014, p. 138).

Like Canada's use of use of Westphalian sovereignty as a framing mechanism for the state's formal relationship with First Nations and Indigenous peoples through land claims and self-government agreements, the language of security acts in ways that circumscribe the relationship of Canada to its northern communities in the name of protection. Following Alfred and Corntassel's understanding of postmodern imperialism, the role of state-based security discourses can be theorized as a disciplining instrument of the state, which is always "evolving and inventing new methods to erase Indigenous histories and senses of place" (Alfred & Corntassel, 2005, p. 602). In short, defining the parameters of security and controlling the process of securitization allows the state to use security as a prioritized policy field that is discursively constructed along with state-based interests, even when those interests are not articulated in explicit military or security terms.

In a similar manner from the European perspective, Gunhild Hoogenson Gjørv discusses the growth in environmental and energy security discourses during the 1980s and 1990s along with their implications for the survival of states and communities, which crystallized in the vacuum left by the end of major East-West power competition (Gjørv, 2017, p. 37). Economic, environmental, and energy security have created tensions for Arctic communities and states due to the conflicting priorities of these security concerns. The economic dependence of many Arctic states on resource extraction (primarily oil, gas and coal) poses obvious contradictions when

juxtaposed with the growing salience of environmental insecurity created by this dependence. The notion of state survival is important because it highlights the degree to which a state-centric understanding of the world continues to dominate discussions on Arctic security, even discussions that have expanded to capture a wider range of threats that endanger humans and their communities. The tensions created between environmental security and economic security and the conflicting implications for community wellbeing are not resolved. However, they are at least partially reconciled discursively by retaining a security framework that perceives threat as both "immediate and existential" (Buzan et al. 1998 as cited in Gjørv 2017, p. 39). Security needs are thus privileged according to a hierarchy where threats that are understood to be the most relevant to the survival of the state take priority because the state remains the implicit guarantor of human survival.

Even though Canada and other Arctic states have adopted wider and more holistic conceptualizations of security into formal policy and discourse, this expansion does not necessarily challenge the state as a neutral frame of reference *for* security. Put otherwise, the implicit assumption that the state can and does act exclusively as a protector of human life and wellbeing remains intact. However, this is problematic from the perspective of Indigenous security given the persistence of colonialism as an important mediating condition of Indigenous-state relations and within Canadian society more widely. As Slowey argues, “for the Aboriginal peoples of the Canadian Arctic, the traditional, narrow perception of security as a purely military phenomenon is insufficient because security is not simply about Canada protecting its Arctic territory, but Canada protecting the security of the people who live there” (Slowey, 2013, p. 190). Within security traditionally conceived at the international level, human security is framed within the narrow confines of explicit violence and is often linked to foreign policy rather than

domestic security. In practice, this has had significant consequences for the Arctic Indigenous communities because it “excludes from the scope of its analysis the most pressing insecurities in the Canadian north” (Greaves, 2012, p. 220). Rather than existential threats provoked by foreign competitors, these insecurities are constituted by a lack of infrastructure, housing, food, medicine, and other necessities of life, all of which require the state to look *inward* rather than outward.

Consequently, acts of securitization by the state may be thought of as a form of contemporary colonization, which according to Alfred & Corntassel (2005, p. 597), is "a form of postmodern imperialism in which domination is still the Settler imperative but where colonizers have designed and practice more subtle means (in contrast to the earlier forms of missionary and militaristic colonial enterprises) of accomplishing their objectives." Historically, like the experiences of other Indigenous peoples in Canada, Inuit of the Canadian Arctic have suffered and continue to suffer from colonial practices by the state, which have often been carried out in the name of security. The most well-known example is the forced relocation of Inuit families from Inukjuak, Quebec, to the high Arctic of what are now Grise Fiord and Resolute Bay at Ellesmere Island, Nunavut. During the Cold War, this relocation was used as a tactic by the Canadian government for claiming state sovereignty in the Arctic and protecting the state against Soviet incursion. The Canadian government has symbolically recognized the harm caused to the relocated Inuit and their descendants in an official apology in 2010. These Inuit were ill-equipped and ill-prepared to face the ultra-harsh environment of the high Arctic despite promises by the government of better hunting opportunities and an option to return to Inukjuak after two years (Sponagle, 2017; see Grant, 2016; Tester & Kulchyski, 2011). Rather than presenting new opportunities, Ellesmere Island came to be seen by at least one survivor and his family as a

“prison island” (Sponagle, 2017). The Government of Canada issued its official apology for the Inuit high Arctic relocation through former Member of Parliament John Duncan, who stated on behalf of the government that “acknowledging our shared history allows us to move forward in partnership and in a spirit of reconciliation” (Government of Canada, 2010). Elsewhere, the government has acknowledged its role in the Inuit relocation while attempting to portray that role as an error in judgement that was nonetheless well-intentioned. A report for Indian and Northern Affairs Canada highlights a 1993 Royal Commission tasked to investigate claims against the federal government made by Inuit and their decedents involved in the relocation. This document cites an argument by the Commission that “the Government did what it believed to be best for the Inukjuak Inuit in the institutional context of the time” (Bonesteel, 2006, p. 29). The uncritical reflection by the government on its intentions is striking for its reification of well-meaning paternalism towards Indigenous peoples. Dodds comments on the issue of a ‘well-meaning’ state by arguing that “women and [I]ndigenous communities were put in their place, quite literally. But, unlike the 'frontier myth' in the United States with accompanying cultures of violence, Canada's occupation of the North was rendered, however opportunistically, as something more akin to a benevolence occupation by pioneers" (Dodds, 2012, p. 1000). Indeed, the theme of benevolent occupation has persisted as a colonial narrative since the Arctic was solidified in the public consciousness as a destination for adventure, exploration, and economic trade, where occupation by whites was argued to benefit Inuit communities (e.g., see figure 2.2.).

ESKIMO STANDARDS RAISED BY WHITES

Taught How to Trap, Arctic Natives Fare Much Better

Edmonton (CP).—Eskimos of the Arctic coast have benefited by invasion of the white man in the opinion of L. F. Semmler, tall and raw-boned free trader who operates three fur-trading posts on Coronation Gulf, 1,000 miles north of here.

White men have taught Eskimos how to trap and have improved the Arctic natives' standard of living, said Semmler, here en route to visit his mother at Portland, Ore.

"When the white man first went into that country the Eskimos had only a few traps and did not know much about trapping," the hardy northerner said. "The white men have taught them how to trap and now they catch large quantities of fur.

Figure 2.2. A headline and article from the Globe and Mail, Toronto, Wednesday February 17, 1937, extolling the virtues of colonial "invasion" in the Arctic.

The 'virtuous' or benevolent intentions of the Canadian state are crucial because they have been recurrently used to justify technocratic and professional management of the environment and Arctic Indigenous peoples. The unstated logic is that 'traditional' and 'local' are worthy of protection in a normative sense but are limiting to Indigenous groups themselves in a developmental sense. In particular, the threats posed by climate change to the Inuit are encompassed within the field of security itself, which is viewed as a site exclusive to technical intervention (see Cameron, 2012, p. 107). This intervention includes militarization, speaking to the interest of DND in the Arctic and the recent commitment to upgrading surveillance and

defence infrastructures in the North, including the use of surveillance drones, which had at least previously progressed without Indigenous consultation (Loukacheva, 2009, p. 103).

2.3. Surveillance

Despite Canada's emphasis on the need for surveillance in its Arctic territory, it has been surprisingly neglected as an area of analytical focus in current Arctic security research. Elsewhere, surveillance practices and their technologies have generated a great deal of theoretical and empirical examination in recent years across disciplines (e.g., see Ball & Snider, 2013; Ericson & Haggerty, 2006; Lyon, 2003, 2006, 2007; Zureik & Salter, 2013). This should not be surprising given that surveillance has emerged over "perhaps the past 40 years [...] as the dominant organizing practice of late modernity" (Lyon, Haggerty, & Ball, 2012, p. 1). Kaluser defines surveillance, borrowing from Lyon, as the "ensemble of focused, systematic and routine practices and techniques of attention, relating to human or nonhuman objects, for purposes of influence, management, protection or direction" (2013, p. 275). Tracing surveillance practices into post-modernity out of the French revolution, James der Derian argues that

> power is here and now, in the shadows and in the "deep black." It has no trouble seeing us, but we have had great power of surveillance. This modern panopticism takes many forms, but it is the communications intelligence (COMINT), electronic intelligence (ELINT), radar intelligence (RADINT), telemetry intelligence (TELINT) and photointelligence (TECHINT) - that constitute a new regime of power in international relations [...A] central problematic of the surveillance regime is that it normalizes relations by *continuing both war and peace by other, technical means* (1990, pp. 304-305, my emphasis).

Der Derian's notion that the existence of techno-surveillance regimes represents a shift in how war and peace are practiced in international relations resembles Foucault's inversion of Clausewitz's famous definition of war, such that politics is now the continuation of war by other

means (Foucault, 2003, p. 15). Foucault argues that with the development of the state as an apparatus, war was practiced “on the outer limits of the great State units” (2003, p. 48). The politics of interstate relations are literally borne out of warfare through war’s relationship to the consolidation of state power (Foucault, 2003; see Tilly, 2017). According to Foucault, "the role of political power [then] is perpetually to use a sort of silent war to reinscribe that relationship of force, and to reinscribe it in institutions, economic inequalities, language, and even the bodies of individuals....Politics, in other words, sanctions and reproduced the disequilibrium of forces manifested in war” (Foucault, 2003, pp. 15-16). For Massumi (2015), this inversion indicates that in the post-9/11 era, war must be viewed within a continuum of power where the military and civilian spheres are collapsed because an ontology of threat becomes the mediating condition for all social activity. Massumi states that

> In a crisis-prone environment, threat is endemic. Uncertainty is everywhere. A negative can never be proven. Positive military response must then be ever at ready. The on-all-the-time, everywhere-on-the-ready of military response operatively annexes the civilian sphere to the conduct of war. Civilian life falls onto a continuum with war, permanently potentially pre-militarized, a pole on the spectrum (2015, p. 27).

The endemic character of threat follows Massumi’s correlate observation that threat has become an ambient quality of the contemporary political era insofar as threat is environmental, which requires an equally environmental response by the state to manage those threats. Drawing on der Derian, Foucault, and Massumi, the relationship between politics and surveillance practices in the Arctic becomes more apparent. Surveillance practices in the Arctic are increasingly linked to the issues of defending sovereignty and providing security for the Canadian state, which can be understood to reinscribe the power of the state where that power may be contested or where it does not effectively exist. This emphasis is not altogether new as various state actors and commentators have repeatedly made a case for investing in and developing the state's

surveillance capabilities in the Arctic. However, within the intervening years since the September 11, 2001 terrorist attacks, there has been a renewed emphasis by states on the centrality of borders to the national interest and defining those interests in the language of security. Following the end of the Cold War, the 'end of history' signalled a new era of globalization such that defining borders as rigid territories of demarcated sovereignty became less useful as local, regional, and global spaces became interconnected and populations became more mobile across the globe. The 9/11 attacks pointed to many the consequences and vulnerabilities inherent to this increasingly global movement of flows (Ignatieff, 2003; see Castells, 1999; Sassen, 2016). Rather than understanding the issues inherent to border security in terms of defining and defending those borders against other states, security discourse in the post-9/11 era emphasized the growth of new types of transnational threats related to terrorism, organized crime, and illegal migration (Donaldson, 2013, p. 174).

Within academic research, surveillance has become an intense focus of study among sociologists, political economists, geographers, and critical security thinkers, among other fields. The research focus has primarily considered the effects of surveillance practices on human bodies as subjects at the scale of individuals, communities, and whole societies within the theoretical frameworks of risk and Foucauldian biopolitics. In post-modern societies, information communications technologies (ICT) have enabled what many authors have conceptualized as new forms of digital panopticism. Within a political economy lens, modern surveillance techniques are linked to disciplinary power wielded by actors (both state and non-state) in the context of what Gill terms “disciplinary neoliberalism,” where new forms of self-management are constructed under the threat of constant observation (Hier & Lyon, 2004, p. 131; see Gill, 1995a, 1995b). More currently, surveillance is directed at examining and shaping behaviour at

increasingly micro-scales through the endless supply of personal data that has been made available to private firms, governments, and other actors through the massive and rapid increase in digital engagement by people across social media and other platforms, which has enabled an almost complete commodification of daily life through our digital subjectivities (see Prybus, 2015, p. 237-238; Coté, Gerbaudo, & Pybus, 2016, p. 9).

Consequently, it can be argued that surveillance is a central mediating condition of everyday life, such that surveillance practices and technologies are becoming a fully integrated and seamless component of our daily existence (Kaluser, 2013, p. 275). Found in tandem with the growing creep of surveillance practices is the blurring of those practices among their institutional forms. For example, there are striking similarities between the use of algorithms in Big Data analysis for detecting and predicting consumer preferences and counter-terrorism efforts (see Ganor, 2021, p. 606; Bunnick, 2016), pointing towards the blurring of non-security and security practices.

The geography of surveillance spaces has garnered a similar level of attention, especially in terms of security. For example, while the airport has become a site of surveillance practices since the growth in commercial air travel and the rise of transnational terrorism in the 1960s onward, the events of 9/11 instigated an intensification of those practices over bodies and other objects specifically in airports, such as cell phones, computers, shoes, and water bottles (see Salter, 2008a, 2008b). Material objects with otherwise no immediate relevance to national defence or security are transmuted within the specific geography of the airport using surveillance practices that discursively, symbolically, and materially separate those objects (including people) as threatening and dangerous.

While the translation and enhancement of the airport into a site of securitized governance may suggest that surveillance is an exceptional and discrete process, the integration of surveillance practices into the theatre of everyday life has also made the more mundane spaces of daily existence an equal focus of attention. This attention is especially prominent towards urban spaces as policing efforts have adopted more intrusive surveillance practices. Private firms have widened the net of data captured to promote tailored and individualized analysis for several purposes that package individuals into discrete subjectivities as consumable data packages. Indeed, individuals have willfully contributed to these systems by adopting security-surveillance practices (such as home security cameras) and facilitating their integration into dataveillance regimes contoured through consumer capitalism and its inscription into public life. Surveillance technologies are not just metaphorically part of the spaces of everyday life – they are literally being integrated into the material infrastructure of urban cores - i.e., 'smart' cities (Kitchin, 2014, 2016; Leszczynski, 2016).

Surveillance has also grown in relevance for international security practices and is a fundamental to the interaction of security with development through the trend of 'digital humanitarianism' (Duffield, 2016). For security practitioners, increasingly sophisticated surveillance practices enabled by technology are envisioned as a way of creating informational superiority that offers an operational advantage against competing actors, especially in conflict zones. The protection of "unevenly vulnerable" domestic borders and territories (Salter, 2013. p. 41) have been prioritized within national security discourses along with a focus on international borders that may be in dispute or disrepair, for example, as evidenced by the use of armed surveillance drones in the FATA region of Pakistan (Ronald Shaw & Akhter, 2012). Thus, surveillance practices are enabled by the growth of information communications technologies,

which allow for the creation of surveillance tools or the transformation of other tools into objects used for surveillance purposes (e.g., biometric-enabled passports, web browser searches, and digital banking records). The data generated from these tools can then be then distilled into specific images of behaviours and environments, of both the present and possible futures.

Lyon notes that the emergence of modern surveillance practices is linked to the political and economic restructuring of the 1970s (2004, p.139). In a similar respect, fulfilling Canada's long-held position on the need for surveillance capacity in the Arctic would not be possible without these more significant structural shifts in late modernity. However, Lyon argues against technological determinism or understanding technology as a black box for social processes (including those related to surveillance, security, and war), where "the mere existence of new technologies is far from a sufficient reason for them to be used" (2004, p. 140, 142). Within the Canadian Arctic, innovation in surveillance technologies will potentially enable the state to use them for situational awareness and security. However, as Lyon might suggest, the development of these technologies is dependent on the specific historical and political context of the Canadian state. Surveillance has become associated with the control and management of societies within a risk and biopolitical governance framework. While governance involves several actors outside the state, Lyon points out (citing Edward Higgs) that the origins of centralized surveillance practices are linked to the English state and "arose first as a means of shoring up state power itself, over against other states, and not primarily as a means of social control" (Lyon, 2004, p. 136). A prominent historical example of using modern surveillance technology for 'shoring up state power' through warfare was during the Napoleonic wars, where weather balloons were used to generate a situational awareness of the battlefield (Wilson, 2014, pp. 271-272). In addition to changing military strategy in battle, surveillance techniques have been employed in the service of

constructing and maintaining boundaries - both literally in the form of borders and metaphorically through the construction of binaries dictating who *is* and who is *not* allowed inside those borders (Marx, 2013, p. 13). By extension, Canada's use of surveillance practices (and those envisioned) can be understood as a continuation of the state's historical form and its desire to consolidate power over a specific bounded territory.

There is an important connection that must be teased out between surveillance and sovereignty's *performance*. Performance in this sense is conceived as an ontological status, in that sovereignty is something that is continuously enacted or performed. David Chandler argues that "'understanding ontology as performance or enactment brings to the fore the notion of ontological multiplicity, where different stories and practices are neither describing something existing ultimately 'out there' nor are they a mistake or metaphorical, but actually enact or 'world'" (Chandler, 2018, p. 73). Likewise, Corine Wood-Donnelly points out that understanding sovereignty as a performance involves "the repetition of certain types of behaviours and rules associated with the structure of the state, the state has the ability to perform the story of itself to both its domestic audience and to the international community, creating a semblance of legitimacy (2019, p. 12). In the Arctic, sovereignty is performed in multiple ways, such as by extending environmental legislation over the North West Passage (where Canadian sovereignty is disputed by the United States) (Wood-Donnelly, 2019, p. 12). Other practices and technologies have underpinned the state's sovereign performance in the Arctic, including cartography, scientific exploration, the material transformation of space through architecture, the relocation of Indigenous bodies northward, among others (Wood-Donnelly, 2019, p. 13). As Wood-Donnelly also argues, "These administrative performances are often what constructs the physical aspect of the state. The state comes into physical being when it has a material manifestation of the political

social construction throughout a spatialized territory" (2019, p. 13). Thus, surveillance practices must be understood to form part of the state's repertoire of administrative performances. However, surveillance is more than symbolic of state sovereignty and is a direct outgrowth of sovereignty's legal, symbolic, and material qualities, and is purposefully used to reinforce and reconstruct those qualities in new ways.

The task is to outline how surveillance contributes, or is expected to contribute to sovereignty, through their connection to security in the modern context. Sovereignty can be understood as an ontological multiplicity because it is produced through performances and other material-semiotic identifiers, including those linked to surveillance practices, which serve to the construct a context-specific and historically bounded world of social action. Surveillance practices and technology are important components of this ontological performance because they enable specific forms of world-building through their conceptual and material link to sovereignty. This concept echoes the sentiments of Hier and Lyon, who argue that

> institutional forms of surveillance, now in their computer-assisted variants, are crucial to governance, and to the ongoing patterns by which power relations are shaped. Surveillance is implicated in the processes by which social activities are enabled and constrained and is peculiarly bound up with new technologies and the management of risk. Even when computer-coded - perhaps especially when computer-coded - surveillance makes a material difference (2004, p. 131).

As will be shown in the subsequent chapters, current surveillance practices and those envisioned by the Canadian state in the Arctic through ongoing technological development strategies embody a particular post-modern character and are productive through their (re)construction of sovereignty in a globalized space, where sovereignty must be transformed and augmented from a discursive and symbolic idea (*de jure* sovereignty) codified in various representations to a set of materially iterative practices; they are more than representative of sovereignty in their materiality but do not disregard discursive representation. Technologically

mediated surveillance is enabled by but also reshapes and continuously produces *existing* sovereignty.

Whether serving as a practical function of sovereignty by fulfilling the requirements of security as defined through the sovereign state or representing a symbolic function in terms of demonstrating the enforcement and presence of sovereignty by the state, Canada's policy discourse routinely argues the need for an enhanced Arctic surveillance capacity (e.g., see Dean, Lackenbauer, & Lajeunesse, 2014, p. 1; 12). Consequently, the CAF and DND have played a central role in developing Canada's surveillance capacity in the region. Lackenbauer and Lajeunesse note that the *Canada First Defence Strategy* (CFDS) "singles out surveillance as a central requirement – an area of emphasis confirmed in subsequent policy statements produced by other government departments" and where DND documents "echo this idea that sovereignty is strengthened by effective governance, control, and the consistent application of Canadian law" (2016, p. 26). However, it must be noted that the *recognition* of sovereignty by foreign actors (juridical sovereignty) and the *enactment* or performance of sovereignty (de facto sovereignty) do not enjoy any linkage in terms of international law. On this point, Lackenbauer argues that "[i]n the early 1970s, defence planners emphasized the need for a persistent presence in the North, arguing that surveillance was integral to affirming Canada's legal claims over the area" but that while surveillance "may well be a necessary function of sovereignty, [it] could not be considered a basis for a *sine qua non* of sovereignty" (2011, pp. 96-97, my emphasis). However, surveillance may prove important for future legal considerations over the Arctic in the international context as international law may be insufficient to mediate future conflicts over sovereignty, such as those that may involve melting ice sheets and what constitutes 'effective occupation' (Kikkert, 2021). Regardless of surveillance's role in legal discussions now or in the

future, Canada's emphasis on technological innovation for Arctic surveillance serves as a critical policy are for security development while symbolically and materially transforming sovereignty's application as a technique of state power.

2.4. Conclusion

The Arctic remains a vestige of our past as one of the last frontiers of exploration and Development. While the Arctic has served as a brave new world for some time, current trends suggest that there is something indeed *new* about the Arctic, especially as a harbinger of the planet's environmental and perhaps political future. Whether this future is contoured by interstate rivalry that will resemble the great power conflicts of the 20th century is a different matter. For the time being, it appears that the Arctic will remain a region somewhat disconnected from conflicts in the broader geopolitical environment by virtue of its institutionalization. The Arctic remains in some ways a separate world, but one that is being shaped by (and not immune from) the forces of global geopolitics. The trends identified in the major security paradigms surveyed share a common view that the Arctic is being ushered into the future as a national and regional theatre with global importance.

Both state-centric and critical security approaches have contributed to important discussions concerning the Arctic and its future. However, both frameworks, including the analytical focus on the potential for interstate conflict and the use of securitization theory, have left a significant gap concerning how surveillance factors into Arctic security and how surveillance practices navigate the tensions between the forces of conflict and cooperation. Regional cooperation and confrontation in the Arctic are not mutually exclusive, such that it is not a matter of cooperation *or* conflict, but how both are practiced simultaneously in patterns of

fractured or partial interdependence (see Keohane & Nye, 1998). Thus, introducing critical surveillance studies to the field of Arctic security bridges a significant yet underutilized area of research into current discussions and supports a unique analytical framework for discussing the role of surveillance in Canada's Arctic security policy.

The next chapter explores Arctic surveillance in its concrete manifestation by teasing out the linkages between contemporary technological developments and policy programs, and historical concerns for sovereignty. Specifically, the chapter considers the Arctic's historical role in 20th-century conflicts and considers the importance of air and sub-surface surveillance to Canada's Arctic sovereignty, both in the past and the future.

CHAPTER 3: CANADA'S ARCTIC SURVEILLANCE

> The future world traveller will not go to Manilla via San Francisco, Honolulu, Wake and Guam, but over Hudson Bay, the Arctic islands of Canada 100 miles north of North-eastern Siberia and along the coast of China to the Philippines.
>
> The Globe and Mail, "Canada, Crossroads of the Air, Both in War and Postwar World," 14 October 1943

> We believe it self-evident that the world of the not-too distant tomorrow being forged today in the flames of desperate battles, will be an aerial world […] Aircraft will safely and rapidly carry freight, passengers and the mail from country to country, across mountains and oceans, desert sands and Arctic ice. The very concept of distance will have altered […].
>
> This world of tomorrow will seize advantage of the fact that in flight an arc and not a straight line is the shortest distance between two points and that the Great Circle, one fourth of it in Canada, is the world's best travelling route.
>
> Raymond Arthur Davies, "Arctic Eldorado," p. 40, 1944.

3. INTRODUCTION

The Arctic has returned as a regional focus for Canada with increasing saliency in public discourse, especially as climate change is expected to transform the North into a competitive zone and a potential battlespace over resources and transport routes (Tamnes & Offerdal, 2014). While there has been a surge in academic literature on the Arctic and issues related to Arctic defence and security, there has been minimal effort to capture Canada's current Arctic policy related to its focus on situational awareness within the state's historical context. Canada is bolstering investments and directing efforts at enhancing its situational awareness in the Arctic, specifically through increasing the state's surveillance capabilities through technological development.

The link between surveillance practices and security in the Arctic, along with the development of technology to perform surveillance functions, can be situated historically to at least WWII but became especially pronounced during the Cold War (see LCol. Horn, 2011; Heidt, 2011; Herd, 2011). This chapter considers Canada's interest in Arctic surveillance and endeavours to demonstrate the historical linkages to current surveillance efforts by examining the state imperatives for situational awareness regarding sovereignty and control over the Arctic. Conceptually, this historical trajectory is examined through the relationship between surveillance, situational awareness, and sovereignty. These three elements exist in a mutually constitutive relationship as surveillance is a material and symbolic expression of state sovereignty and reinforces state power through situational awareness. More pointedly, there are clear similarities between current technological development efforts and earlier ones, demonstrating a consistent logic of state control. However, while the logic of surveillance demonstrates continuity with earlier periods, the state's specific interest in surveillance technology is unique and, in some ways, reactionary to the era. To illustrate both the consistency and novelty between earlier and contemporary developments, this chapter examines how the Arctic transformed into a geostrategic theatre of interest in the early to the mid-20th century. Notably, earlier discourses centred on establishing control, extracting resources, and transforming the Arctic into a space of modernity demonstrate remarkable consistency with current discourses.

Further, the surveillance technologies developed with the political context of their time reflect a similar logic of expanding *de facto* state control over the state's sovereign territory in the Arctic. However, these technological developments also mark themselves as unique through their reactionary tendency to the novel structures of each time. The chapter exemplifies this by

tracing significant technological developments in the air and maritime sub-surface domains in the early 20th century and linking those developments to current policy and technological efforts.

This chapter proceeds as follows. It begins with discussing the Arctic's relationship to the 20th century's major power conflicts, namely World Wars I and II and the Cold War. Moreover, this section also examines the Arctic's broader cultural, political, and economic relevance within Canada in the early to late 20th century, including Canada's interest in establishing surveillance and control over its northern territory. Methodologically, the chapter accomplishes this through a systematic review of select media articles from the Globe and Mail between 1937 to 1996.[25] The Globe and Mail was selected due to its national content and distribution, its history as a major Canadian newspaper, and the availability of digitized archives. While media coverage cannot substitute for actual policy and official documents that are not available, they provide a window into the broader discussions and political sensibilities of each time, allowing me to tease out some general lines of historical trajectory. Following this section, the chapter engages with contemporary technological developments focused on building a robust surveillance capacity through research and development. Specifically, the chapter considers the Government of Canada's All Domain Situational Awareness Program and examines two specific sites of development: air and surface and sub-surface marine surveillance. The chapter concludes with an analysis of the material, semiotic, and discursive characteristics embodied by Canada's long-running interest in establishing greater sovereignty and control over the Arctic, followed by a brief conclusion.

[25] I often include the full title of the article in the in-text citation throughout this dissertation because the title itself contributes to the narrative and illustrates the discourses and themes discussed.

3.1. The Battle of the Arctic

The political, geographic, and environmental characteristics of Canada's northern region, including the 3.9 million square km of the Northern Territories and 162,000 km of coastline (see figure 3.1.), have made the need for increased surveillance capabilities a repeated goal of Canada's Arctic defence policy since at least World War II (Arctic Institute, 2020; Dean, Lackenbauer and Lajeunesse, 2014).

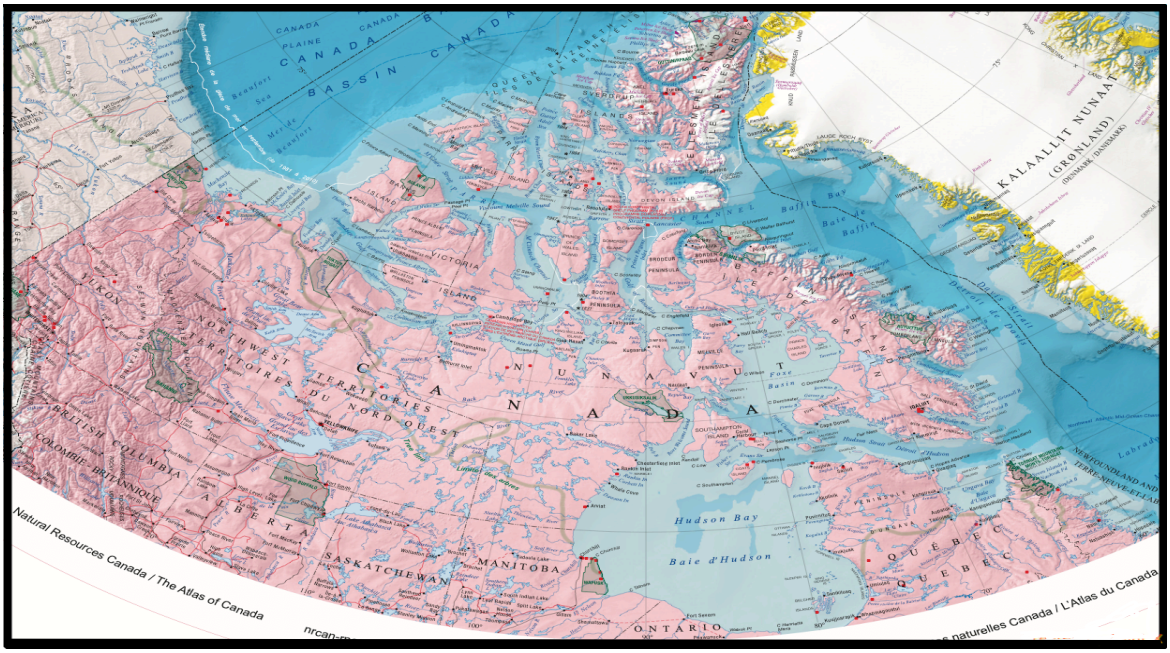


Figure 3.1. Canada's Northern territory (Polar Knowledge Canada, 2017).

However, Canada's concern for Arctic sovereignty and its "symbiotic" relationship to the nation originated before confederation in the latter half of the 19th century as Britain formally transferred the remainder of its Arctic possessions, a process that began in 1870 with the transfer of the Hudson Bay Company's territories (Grant, 1988, p. 3-4; Smith, 1961; see also Caldwell, 1990). The Arctic was an important site of naval operations during World War I as it was the

only way to send supplies to support the Russian war effort outside of German and Ottoman-controlled areas around the Baltic and Black Seas. It was during this time that the Arctic port of Murmansk was built adjacent to the Barents Sea, a region that would become a critical site for Germany during World War II and which remains strategically important for Russia and Norway as the ports provide ice-free access to the Atlantic year-round (see Globe and Mail, "Arctic Bases Ready in War," February 11, 1937). The Arctic's importance to naval operations would only increase in World War II as German U-Boats terrorized the seas and hammered allied vessels on route to the European theatre. While history conventionally remembers the *Battle of the Atlantic* as a decisive victory for the allies, the *Battle of the Arctic* also proved essential to their efforts. Writing in London in May of 1944, Leo S. Disher stated in the Globe and Mail ("Battle of Arctic Won; Convoys Move Freely Over Route to Russia," May 30, 1944) that

> The Royal Navy has gunned and bombed its way to what appears to be hands down mastery of the Arctic Ocean dear to Russia and for more than 100 days has been sweeping free from enemy attack, into the very shadows of the Norwegian coast as prelude to invasion.
>
> I have just returned from four months with the fleet and have seen that the Allies have won the Battle of the Arctic as conclusively as that in the Atlantic.

World War II's battle in the Arctic would continue on land in Norway's northernmost county of Finnmark, located near Murmansk, as the joint Soviet-Norwegian offensive began to free the region from German occupation in 1944. This joint offensive began with the Soviet liberation of Kirkenes, a small Arctic town that continues to hold strong communal bonds with its Russian neighbours through this event (see figure 3.2. below). The Globe and Mail reported at the time that

> The Red Army invaded Norway today and captured the prize Arctic port of Kirkenes and 30 other communities at the northern end of the front, completed the conquest of Transylvania in the south, and won 13 strongpoints in East Prussia in head-on collisions with the desperately counter-attacking Germans […] In Norway the Germans themselves

announced first the evacuation of Kirkenes. Marshal Stalin's subsequent order credited its seizure along with 30 other towns around Varangefjord, to the Arctic Army of Gen. K.A. Meretskov and the Red Fleet ("Russia Enters Norway; New Drive on Prussia," Oct. 26, 1944).

Figure 3.2. A monument was erected in Kirkenes, Norway, following the Soviet liberation from Nazi occupation (photo credit: author).

Perhaps more importantly, the Arctic's transformation into a *geo*-strategic theatre became more pronounced after 1945, and the Cold War transformed east-west relations more broadly. Several important and international trends intersected during this time to envelop Canada's Arctic territory into the global affairs of war and peace. The rapid growth in air travel represented one of the most significant technological developments to affect the Arctic. Indeed,

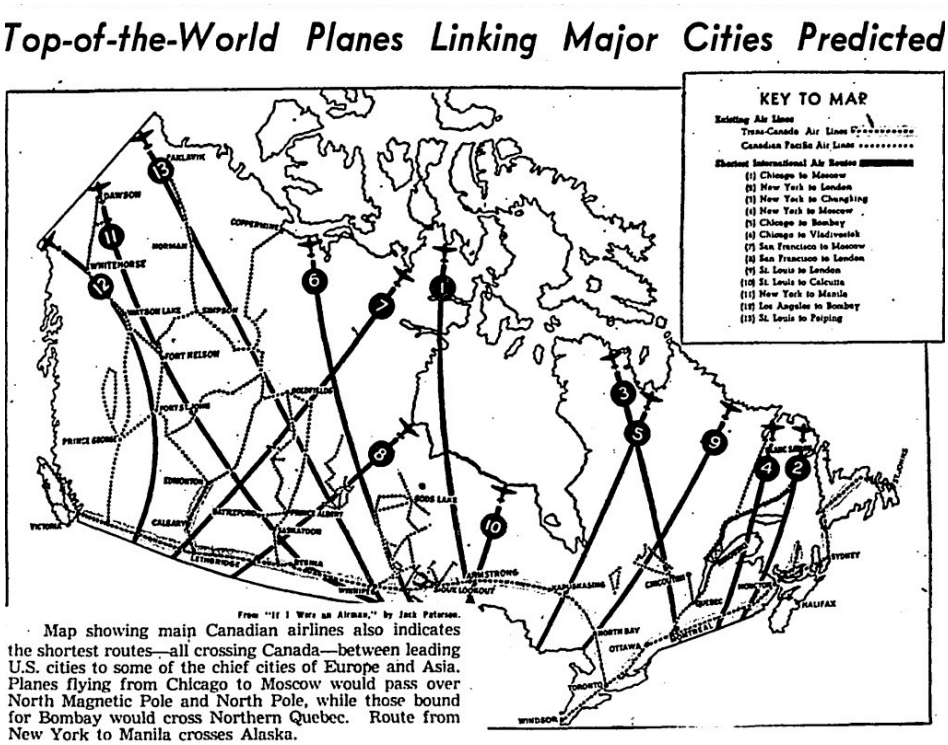
airplanes or the "Wings of the North" were symbolic of the dominance of science over nature and, according to Ken MacTaggart, "opened a new world that is waiting to pour a vast flood of new wealth into old Canada" (Globe and Mail, "Nature Bows to Science When Planes Invade Arctic," February 9, 1937). MacTaggart would remark barely a week later that "The conquest of the North by air is an accomplished fact" and that this represents "an amazing transition from a decade or so ago" (Globe and Mail, "Aerial Conquest of the North," February 16, 1937). Airplane travel over the Arctic was primarily limited to small military and government expeditions before the late 1930s, especially as they facilitated adventure and pioneering expeditions for resources and acclaim. For example, airplane travel was expected to help solve the great "Arctic mystery" of the Franklin expedition's disappearance nearly a century earlier) (Globe and Mail, "Arctic Mystery Solution Sought," January 1, 1937). Indeed, the Soviet Union's interest in Arctic air travel prior to the War formed an avenue of public support between the East and West against Fascism. As the Globe and Mail reported on June 22, 1937,

> Russia's foremost Arctic authority today urged North America to establish wireless stations and air bases on the North American side of the North Pole to help make regular transpolar air services a reality […] "'In a few years, airplanes will not be rarities in northern latitudes' said the Red Star organ of the army. 'Dozens of planes will cross the pole and help enlarge the economic and cultural ties between the two greatest powers on earth' […] Izvestia, organ of the Government, drew a moral from [a transpolar flight] by comparing it with the activities of 'Fascist aviators who spend their time destroying defenseless cities in Spain'" ("Pole Bases in America are Sough: Soviet Action Must be Duplicated, Arctic Expert Says").

The Soviet record-making non-stop transpolar flight between Moscow and San Francisco even drew acclaim from C.D. Howe, who called it "A wonderful piece of navigation" (ibid.).

Air travel would quickly become more commercialized after 1940 with the introduction of the Boeing 307. This airplane model was the first to have a pressurized cabin, which allowed it to travel at an altitude of 20,000 feet and circumvent many weather disturbances. Importantly,

this feature also allowed for greater travel lengths and rapid growth in the number of commercial airlines in operation. As World War II came to a close, the New York Times in a Special to the Globe cited the Society of Automotive Engineers, who predicted that "As a result of wartime technical advances in the aviation industry, the world will see a vast expansion in air travel at the end of the war, with new routes across the Arctic linking many of the large cities of the earth" (Globe and Mail, "Top-of-the-World Planes Linking Major Cities Predicted," April 7, 1944) (see figures 3.3. and 3.4.). Even prior to the end of the War, discussions were being held regarding a "postwar civil aviation policy for the Empire" that focused on Canada's Arctic geography as an occupying a "pre-eminent" position to facilitate global economic trade between North America, Asia, and Europe while linking Toronto to Moscow and Tokyo (The Globe and Mail, "Canada, Crossroads of the Air, Both in War and Postwar World," 14 October 1943; The Globe and Mail, "Arctic is Short Way," 13 May 1943).



ARCTIC IS SHORT WAY—Canadians must revise their ideas of geography to realize Canada's postwar place in the air. Note by the above map that peacetime services will start on a scale treble the prewar mileage. This map was published on April 19 and is republished here to illustrate points made in Finance at Large article today. Note that travel by Arctic shortens travel from Toronto to many world capitals. (Information shown on map was supplied by American Airlines, Inc.)

Figures 3.3. and 3.4. Geographic renditions of the Arctic's central place as a transitway for international air travel.

The potential for global air travel signalled the Arctic's transformation from a cultural imaginary infused with symbolic layers of mystery, adventure, and elemental bareness into an imaginary of modernity and a space that could finally be mastered through technological progress; a 20th- century conquest of nature. The advent of a civilian aviation sector would signal the potential for a new chapter in colonial enterprise in the Arctic and its growing symbolic importance to a post-war network linking the world's largest cities. The integration of the Canadian Arctic into these global circuits would also intersect with the emerging bipolar world order as the fragile alliance between the Soviet Union, and the US-led western bloc collapsed into the world's next great power confrontation. The introduction of nuclear weapons is, to varying theoretical degrees, argued to be the fundamental structural transformation of international relations during this period (Mearsheimer, 2007, p. 82; see Roth, 2007) and

implicated in the Arctic's transformation into a geostrategic theatre of importance for the defence of North America as any target in Canada or the United States would necessarily approach through the Arctic front.

The end of World War II and early post-war years would also see growing interest in the Arctic as an area ripe for exploiting mineral and other natural resource deposits while Canada continued to vocalize its sovereignty in the Arctic against the influence of US military presence and financial interests (Globe and Mail, "To Reveal Arctic Secrets," Sept. 26, 1944). Historically, these concerns were also made apparent in the early 20th century, for example, during the construction of Arctic weather stations in support of continental defence throughout World War II and the Cold War (Smith, 2009). With support from the United States in terms of funding and the operation of the weather stations, Canadians "were anxious to protect and preserve Canada's position in any and all matters relating to sovereignty" (Smith, 2009, p. 62). These same weather stations were also expected to (paradoxically) demonstrate Canada's Arctic sovereignty. Within comments made to the Interdepartmental Meteorological Committee on January 15, 1945, J.G. Wright stated that "apart from value for weather forecasting and biological and other studies it would seem that the installation of suitably located weather stations on these islands, perhaps in connection with research stations, would be a valuable contribution towards recognized occupation of these regions" (Smith, 2009, p. 20). However, Smith (2009) notes that these weather stations instilled a level of insecurity in Canadian policymakers and politicians, who were wary of their potential use by the United States as part of a broadened military presence in Canada, thereby threatening Canadian autonomy and sovereignty.

However, Canada also demonstrated a broader concern for its Arctic sovereignty outside of US influence and presence. Indeed, the resource narrative possessed at least some currency in the pre and early post-war years. There were media-fuelled warnings that portrayed the Arctic as under threat and requiring control by Canada to guarantee its claim to those resources and secure Canada's national interest. For example, the Globe and Mail reported that

> Very little is known of the geology of the Arctic islands […] The wastes now inhabited chiefly by Eskimos may some day yield wealth comparable to that of Northern Ontario […] Interest in the Arctic has been quickened by developments made necessary by the exigencies of war […] Canada, of course, claims jurisdiction over all the lands lying between the settled parts of the Dominion and the North Pole. These claims have been fully recognized. The influx of United States capital for investment in Canadian industry would have no effect on Dominion sovereignty (Globe and Mail, "To Reveal Arctic Secrets," Sept. 26, 1944).

In a similar spirit, during a dinner meeting of the "young men's section" of the Toronto Board of Trade in 1946, a Dr. J. Tuzo Wilson was reported as asking that "If the United States can send Admiral Byrd on a lengthy expedition to the Antarctic, why can't Canada take similar steps to open up and develop her vast Arctic territories?" Dr. Wilson also reportedly argued that "foreign countries had done more to develop Canada's north than Canada had herself" and that "there are definite prospecting possibilities in our extreme north, and if we don't do something ourselves some other nation may beat us" (The Globe and Mail, "Develop Arctic, Canada Advised," December 4, 1946). 'Doing something' also included experimenting with defence operations and technologies in "ceiling zero" conditions to improve "methods of radar detection apparatus" (Globe and Mail, "New Arctic Exercises Needed, Canadian Army Planners Feel," Apri 25, 1946). Likewise, there were additional calls to "control" the Arctic in the ensuing years, specifically in the "rich areas" (e.g., The Globe and Mail, "Controls Advised In Rich Areas of Canada's Arctic," January 13, 1947). The symbolic and material dimensions of scientific research to Canada's defence and national ambitions in the Arctic also became apparent in the

post-war era. For instance, Raymond Arthur Davies is cited by the Globe in their review of his book *Arctic Eldorado* (1944) for arguing that Leningrad's significant population compared to Forth Smith (2.5 million and 250, respectively) despite their equal latitude was due to the fact that "the Russian Government opened its north scientifically, while ours was left to the private enterprise of trappers and prospectors" ("Opening Arctic," July 15, 1944). In a related fashion, Dr. O.M. Solandt, the Chairman of the Defense Research Board in 1949 was cited by the Globe for arguing in front of the Engineering Institute of Canada that "Canada is the only country besides Russia that has climatic and geographic problems as produced by the Arctic" and that the "Main reason for Canadian defense research […] was to give the country strength and to show that Canada is prepared for any eventuality" while potentially "[helping] Canada in an economic way, with the discovery of 'important deposits'" (Globe and Mail, "Arctic Research Preparedness Act," Feb. 25, 1949; see also Globe and Mail, "Controls Advised in Rich Areas Of Canada's Arctic," Jan. 13, 1947). Thus, the post-war period and the early Cold War years marked an important point in which discourses linked to sovereignty concerns began to intersect with the issue of de facto state control, including Canada's interest in resource exploitation and its relationship to the United States.

Further, the growth in air travel, combined with the Cold War, signalled that both the United States and Canada were vulnerable through the indivisibility of airspace via long-range bombers. During this period, Arctic surveillance became an acute concern, particularly within a securitized defence framework. While Ottawa was apprehensive of the potential impact on sovereignty by a US military presence in the Arctic and its potential to weaken ties to the British Commonwealth, the defence requirements of protecting North America necessitated US and Canadian cooperation. A proposal for joint defence cooperation was made in 1946 through the

recognition that "the two countries accept the geographical fact that they are part of the North American land mass, which is now within range of long-distance aircraft from all parts of the earth, and that they take technical steps in planning the future of their armed forced to deal with this fact" (Reston, 1946, p. 1-2). Scientific research was also understood to be a critical aspect of North American defence. The same Dr. O.M. Solandt cited by the Globe above argued previously that "A thorough knowledge of the Arctic and its problems is essential to both the regional defense of North America and to the normal…development of the Canadian North" (Globe and Mail, "Arctic Research Urged by Scientist as Vital to Canada's Defense," Jan. 20, 1947). The strategic reality created by long-range bombers capable of nuclear payloads required early warning capabilities in the Arctic to protect and defend southern targets in Canada and the United States. This reality, combined with financial constraints on the part of Canada, resulted in Canada's joint efforts with the United States to build the Distant Early Warning (DEW) Line (see Jockel, 1987 and Lajeunesse, 2007 for a discussion of the DEW line in the context of Canada-US relations and Naka and Ward, 2000 for a historical look at the rapid technological development undertaken to meet the DEW line's surveillance and warning needs regarding their technical requirements). As the Cold War evolved, so did technology, as long-range bombers were supported through the introduction of ballistic missiles and nuclear submarines. The combination of new delivery vehicles and the increasing reduction of space and time as barriers to attack shifted the offence-defence calculus for the North American alliance between Canada and the US (along with NATO allies) and the Soviet bloc.

Importantly, surveillance remained a critical part of the defensive calculus and technological development for Arctic surveillance was continuous throughout the Cold War. Indeed, as technology developed and transformed offensive capacity, reactionary efforts to

develop new defensive surveillance technologies that could neutralize competing offensive capabilities would ensue. For example, as Soviet submarines capable of carrying and deploying ballistic missiles began transiting the seas, surveillance efforts evolved within the NATO alliance to detect the movement of these submarines. Notably, western naval strategy focused on the Greenland-Iceland-UK (GIUK) gap (see fig. 7), where surveillance practices became a central component of that strategy. Within the GUIK area, a chain of underwater listening posts (known as the *Arctic Sound Surveillance System* [SOSUS]) was established and combined with investments directed towards the development of a chain of underwater listening posts and acoustic research in the areas between the Kara Sea and Greenland Seas (Tamnes, 1997, pg. 74 as cited in Tamnes & Holtsmark, 2014, p. 28). SOSUS represents for Gary Weir "[t]he most ambitious and effective project undertaken during the Cold War next to the hydrogen bomb" (Weir, 2006, p. 1). Within Canada, the threat of submarines and Canada's dependence on the United States for their naval capacity during the Cold War pushed the Canadian state to examine the feasibility of developing a "passive-sonar system" designed to monitor subsurface movement in the Canadian Arctic sometime in the 1980s as Russian submarines became quieter and more advanced (Dean, Lackenbauer & Lajeunesse, 2014, p. 9; Sutton, 2020). Sutton (2020) reports that

> To listen for them [Soviet submarines], a joint US and Canadian sonar array was to be placed several hundred miles north of the remote Canadian base at CFS Alert. The array was codenamed *Spinnaker,* in honor of the bar where scientists made many of the unclassified decisions in the project. This was similar to the now-famous SOSUS (Sound Surveillance System) but used classified technology to match its operational circumstances.

Figure 3.5. GUIK Gap (House of Commons Defence Committee, 2018, p. 13).

Sutton (2020) also suggests that *Spinnaker* was likely much more advanced than SOSUS. Importantly, Canada's efforts to develop surveillance technologies for the Arctic and this passive sonar system specifically were made in partnership with US efforts geared towards continental defence. The Soviet submarine threat continued to evolve and new developments in nuclear and conventional weapon delivery technologies emphasized the need to detect and counter fast-attack (SSN) and ballistic missile-equipped (SSBNs) submarines (Lajeunesse, 2016, p. 218).[26] In addition to the surveillance function provided by NORAD (see Charron, 2015; 2017), SOSUS and several experiments were pursued through various Canadian and US-based research labs

[26] SSN refers to Submersible Ship Nuclear whereas SSBN refers to Submersible Ship Ballistic Nuclear. The former are fast moving ships that can deliver attacks on land targets whereas the latter are a core part of a nation's nuclear arsenal.

with the primary goal of "these efforts [being] to improve northern antisubmarine capabilities and ultimately create an operational submarine detection network" (Lajenuesse, 2016, p. 219). While these surveillance efforts faced many technical difficulties, they laid the foundation for cooperation and research on naval detection and defence between Canada and the United States and potentially resulted in an advanced surveillance system by the 1980s. However, details of the system are sparse and largely remain classified, so it is not certain how advanced this underwater system's detection capabilities became (Lajeunesse, 2016, p. 222).

At the conceptual level, Lajeunesse argues that there is a great deal of historical consistency throughout Canada's leadership concerning the state's emphasis on Arctic security and sovereignty (2016, p. 4). What has changed over the last century, however, "is how the country's sovereignty has been perceived, justified, and exercised by successive governments" (Lajeunesse, 2016, p. 4). During the Cold War, Arctic sovereignty concerns were linked to Canada's relationship to the United States and Arctic security was more emphatically related to defending against Soviet weapons and assets. The Cold War would eventually transform the broader sovereignty narrative and link it explicitly to security within national defence concerns. However, Canada remained wary of US influence in its Arctic territory as the requirements of joint surveillance development progressed. While security and sovereignty have been central themes to Canada's Arctic policy since at least World War II, the two were essentially treated as separate during the Cold War. During this time, security was primarily understood in terms of continental defence, and sovereignty concerns continued to be linked to Canada's relationship with the United States (Huebert & Lackenbauer, 2016, p. 145; Lajeunesse, 2007, p. 51; see figures 3.5 and 3.6).

Figure 3.6. "Can't we form some sort of alliance?" Cartoon from January 26, 1960 in the Hamilton Spectator "depicting an Inuit in his igloo talking with a polar bear and a seal about the invasion of American defence forces in his backyard" (retrieved from Library and Archives Canada, item 2881178).

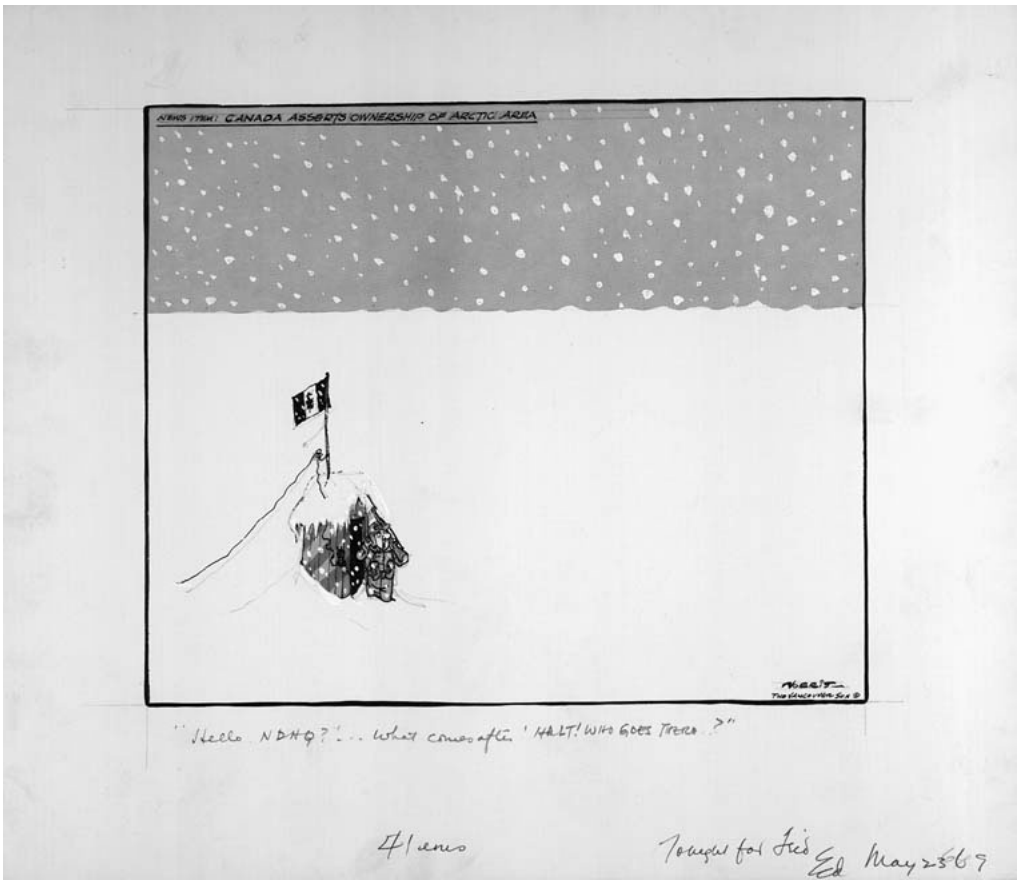


Figure 3.7. “"Hello NDHQ?... What comes after 'HALT! WHO GOES THERE...?" (Cartoon from the Vancouver Sun, May 23, 1969. Retrieved from Library and Archives Canada, item ID 2866718).

However, the Soviet security threat was also portrayed as a sovereignty crisis, reflecting the need for new technologies to defend Canada’s territorial sovereignty. Indeed, the need to develop Arctic surveillance as “an important new role for Canada’s armed forces” had already gained discursive traction (Sanger, 1969; see also Gellner, 1969; Sanger, 1970a, 1970b). Moreover, the development of an Arctic underwater sound monitoring system similar to SOSUS in the late 1980s had already been publicly discussed years prior. For example, at the time, Rear-Admiral Fred Crickard was quoted as stating that “If sovereignty means anything at all we should have a detection system for the Arctic Archipelago” (Sallot, “Sub monitoring needed next

to protect Arctic, experts say," September 12, 1985). There was a direct threat posed by Soviet submarines to the North Atlantic, making shipping routes and naval fleets of western allies vulnerable to attack (ibid.). Interestingly, calls for Canada to develop its own underwater detection system in the Arctic were also framed as reinforcing sovereignty by empowering Canada to be self-sufficient in its Arctic defence efforts rather than relying on US forces. The same *Globe* article quotes Dr. Harriet Critchley (then director of strategic studies at the University of Calgary), who stated that "It is important for sovereignty that Canada have a system of its own, rather than depending on the anti-submarine activity of the U.S. Navy" (ibid). The 'protecting sovereignty' framework continued to be reflected in media discourse through the mid-to late 1980s in relation to military activity by the Soviet Union and United States. For instance, Sallot (1985) cites a National Defence report on the Northern Patrol Program obtained through the Access to Information Act that indicated "a major shift in thinking about the treat to Canadian sovereignty in the North in 1978." Sallot states that "So, the threat to Canadian sovereignty in the Arctic was seen as 'non-military' until 1978 and was close related to possible oil spills and other environmental concerns" but that "Since 1978, however, the air crews of the norther patrol flights have been told their first job is to watch for military violations" ("Unknown in Arctic worries Ottawa," July 29, 1985). At one point, there was even a call for Canada to mine its Arctic water territory and construct a "keep-out zone" through unilateral measures to stop both U.S. and Soviet submarines from entering Canadian waters during peacetime (Sallot, "Mine Arctic waters to keep submarines out, report urges," February 4, 1987). The report was produced by David Cox for the Institute for International Peace and Security and argued that "the Canadian Government must resist U.S. military activity in the Canadian Arctic that might jeopardize Canadian claims to sovereignty" (ibid.). Thus, just as during the WWII era, Canada

was reliant on US cooperation to build its defensive capabilities but remained wary of that dependence and US influence, thereby demonstrating some contradictions in the link between sovereignty and security.

In contrast to the Cold War era, the immediate post-Cold War years witnessed a transition due to declining interest in Arctic security given the absence of an overt military threat, thus nullifying (for a time) the overt need to develop further anti-submarine warfare and air defence capabilities. Despite earlier efforts to create an underwater detection system similar to SOSUS, it appears that even that system was not advanced enough to effectively detect foreign submarines as Ottawa continued to at least passively search for proposals to build a system. In 1996, Defence Minister David Collenette quietly abandoned any plan to deploy such a system. While a detection gap in the Arctic Archipelago remained, Collenette stated that "there is at present no intention to deploy such a system," citing costs as the key reason (Koring, "Collenette drops plans to monitor Arctic," February 3, 1996). During this time, Arctic sovereignty and security became more interlinked conceptually as an overt security threat was not present, but the threat of the US military presence and concerns around the Northwest Passage continued to shape media and political commentaries (e.g., Fenge, 1996). Given the lack of a security threat similar to the Soviet Union, security would not require any added defence measures given the lack of a credible threat without an added layer of political importance attached. Sovereignty provides this layer by invoking the symbolism backing the inherent right of all states to their territorial possessions. As Koring reported,

> The longstanding and vexed question of Canadian sovereignty in Arctic waters remains, given Ottawa's limited ability to even know who is operating what under the ice…Despite a powerfully worded promise in the 1994 White Paper that said 'sovereignty is a vital attribute of a national-state' and pledged 'the government is determined to see…that Canadian law is respected and enforced,' the shelving of the

> undersea listening system represents, at least temporarily, the end to hopes for effective, year-round monitoring of Arctic waters (ibid.).

Enthusiastic predictions of perpetual peace and the end of history following the end of the Cold War was short-lived. While Ottawa appears to have continued its interest in developing Canada's Arctic surveillance capacity in the 1990s, the September 11, 2001, terrorist attacks would provide a new impetus to develop that capacity to defend Canada's territory and North America from a widened spectrum of threats.

3.2. Modern Arctic Surveillance

The immediate post-9/11 era witnessed a rapid acceleration of securitization across multiple sectors and renewed interest in building defence capabilities to meet the security demands of a new world, including in the Arctic. As Rob Hubert argues, "[t]he core issue of Canadian Arctic sovereignty is *control*; the core issue of Canadian Arctic security is about responding to threats. The threats to Canadian Arctic security are nebulous, multi-dimensional, and evolving" (2011, p. 21, original emphasis). This renewed and expanding emphasis on national security was reflected in ongoing technological development for Arctic surveillance. Following the apparent decline in state interest during the 1990s, the CAF and DND continued to pursue surveillance initiatives in the early 2000s with several technological projects, notable of which were the *Pacific Littoral ISR Experiment* (PLIX) and its follow up, the *Littoral Intelligence, Surveillance, and Reconnaissance Experiment* (ALIX) (Dittmann, 2009, pp. 53, footnote 198). The goal of these experiments is stated as being to

> [explore] the use of "uninhabited aerial vehicles" or UAVs (remote-controlled aircraft) and integrated "intelligence surveillance and reconnaissance" (ISR) architectures to correct deficiencies in CF operational capabilities [....] The primary objective of the concept development phase is to build an integrated ISR architecture – that is, a robust

> network of sensors and communication systems linked to decision-makers, in which information is collected and analyzed for its impact on the battlespace, decisions are made, and commands are issued for action to *control* the battlespace in accordance with the commander's intent (National Defence, 2004, my emphasis).

The notion of controlling the region in battle or peace was increasingly emphasized as a core feature of Canada's Arctic sovereignty. Canada's renewed attention on the Arctic would only accelerate during the Harper era, which appeared to focus more on the discursive and symbolic qualities of demonstrating sovereignty and security to the media in public-friendly forms. This focus included committing to assets like icebreakers, more military activities and exercises, and a repeated emphasis on protecting sovereignty against multiple types of actors.

Government interest in Arctic security appears to have also been reflected at the institutional level during the Harper Conservative era. For example, Brig. Gen. Meinzinger states, "When I first arrived at this headquarters [Tri-Command] about four years ago [2009], I think we had maybe one or two individuals that were delving into Arctic issues, and today we have as many-fold increase and a great deal of attention [...]" (Silva, 2013, p. 1). The government's renewed interest in Arctic surveillance accelerated towards the end of the Harper years and during the transition to the Trudeau Liberals in 2016, particularly on surveillance. For instance, Canada's core defence research lab, Defence Research & Development Canada (DRDC), released its report on the *Canadian Arctic Underwater Sentinel Experiment* (CAUSE), undertaken at the chokepoint of Gascoyne Inlet in the summer of 2017. CAUSE was part of the DRDC's larger five-year project titled the *Northern Watch Technology Demonstration Project* (NWTDP). The primary objective of Northern Watch, according to DRDC, was "[t]o identify and characterize combinations of systems for cost-effective surveillance of Canada's High Arctic" (Forand et al., 2007, p. 10; see MacLeod, McCallum, & Waller, 2009; Ocean's Network

Canada, 2011). The NWTDP was concerned with developing and installing a variety of sensor technologies in the Arctic around Gascoyne Inlet, which served as the site for Canada's earlier Cold War prototype detection system due to the Inlet's function as a natural chokepoint for ships and submarines into the region (Lackenbauer & Lajeunesse, 2016, p. 34-35; p. 53).

Figure 3.8. Gascoyne Inlet (CGNDP, Natural Resources Canada, 2021).

In turn, the objectives of CAUSE were to see if acoustic arrays deployed as part of the NWTDP in the summer of 2015 were working and to conduct various technological tests related to surveillance and measurement (Heard, 2018, p. 4). The details and results of the NWTDP and CAUSE remain classified.

Since the CAUSE project, the Canadian government has pursued many surveillance-related initiatives, especially initiatives focused on new technological development. The most prominent of these efforts is the *All Domain Situational Awareness* (ADSA) program, a broader funding initiative with private and public partners to develop Canada's surveillance capacity in the Arctic. The ADSA program was launched in 2015 and is designed to support the research and development of technologies "to produce innovative solutions to surveillance challenges in the North" (DRDC, 2018). Under the ADSA program, the federal government has recently announced the award of development contracts to several universities and private firms (DRDC, 2018; see appendix).

The ADSA program focuses on assessing and developing surveillance technologies for the future, especially those that can automatically detect and classify objects of interest while navigating environmental conditions. There is a need for Canada to classify and discriminate threatening from non-threatening objects in the Arctic's challenging environmental conditions and diverse landscape, including the additional sea vessel traffic that is expected in the coming decades. Increasing technological sophistication, along with the horizontal distribution of technology among states and non-state actors, is understood to create a set of vulnerabilities for states, particularly in border regions exposed to increasingly mobile threats, such as in the Arctic, given Canada’s extensive coastline. This vulnerability has created an overwhelming concern by the state with securing the "flow of goods and people at ports of entry" (Public Works, ND, p. 35). Surveillance technology is especially appealing through its dual-use capabilities where civilian and military applications are blurred and combined with an economic dimension in which these technologies are financially conservative and economically productive in their own right through the procurement of Canadian businesses and expertise. Modern surveillance

technologies, including satellites, underwater sensors, drones, radar, among many other platforms, enjoy substantially more potential in terms of their instrumental functions relative to the development of dedicated military systems alone and might be more palpable to a domestic audience. Perhaps more importantly, surveillance technologies theoretically allow the state to perform sovereignty remotely, digitally, and minimally while embodying a particular aesthetic category outside of traditional military instruments. Specifically, surveillance technologies that support both security and defence, including their relationship to sovereignty, satisfy the need to avoid escalation by occupying multiple aesthetics (military, civilian, commercial), whereas military systems alone could push the Arctic towards further militarization and introduce external tensions (Byers & Covey, 2019).

Following the Canadian government's recent focus on the Arctic through its *Arctic and Northern Policy Framework* and its defence strategy in *Strong, Secure, Engaged*, the DND has begun to engage in what is expected to be an extensive upgrade of Arctic monitoring systems. Current surveillance efforts embody a developmental logic similar to earlier projects, especially in their functional capacity to operate within a 'system-of-systems' architecture, which emphasizes cost-benefit analysis and open-source data integration with primary surveillance data. Given the range of security threats presented to the Arctic, combined with Canada's extensive territory and the logistical issues confronting state governance, a WoG approach supports burden-sharing and the flexible application of authority between multiple government departments, communities, and other actors, at least in principle (Everett & Yamashita, 2017, p. 295-307).

Indeed, understanding the Arctic's environmental dynamics was identified as crucial for for security interests in the Arctic during World War II and Cold War. For instance, the Globe and Mail reported in 1947 that "Complete scientific knowledge of the Arctic is essential to the defense of Canada and of North America, with director-general of defense research, Dr. O.M. Solandt stating that A thorough knowledge of the Arctic and its problems is essential both to regional defense of North America and to the normal […] development of the Canadian North" ("Arctic Research Urged By Scientist as Vital to Canada's Defense," Jan. 20, 1947). The intersection of scientific research with defence interests coincided with, for example, weather stations, which provided important security information for both Canada and the United States and from the early 20th century onward (Heidt, 2011; Lackenbauer, 2020; Smith, 2009). Likewise, there is a great deal of current interest in advancing Canada's scientific surveillance capacity to create more accurate prediction models of daily environmental patterns and the Arctic's broader ecological transformation through climate change. One of the most prominent examples is the International Polar Years (IPY), in which multiple nations coordinate their polar expeditions and scientific research for at least a year. Within this program and of particular interest to defence personnel is the *Polar Prediction* (YOPP) component, one part of the larger *Polar Prediction Project* (PPP). The YOPP is composed of a network of natural scientists from the World Meteorological Association (WMA), the World Weather Research Programme (WWRP), and the World Climate Research Programme (WCRP), along with a host of research centers, universities, and other institutions researching earth-based weather in the Arctic (see figure 3.9).

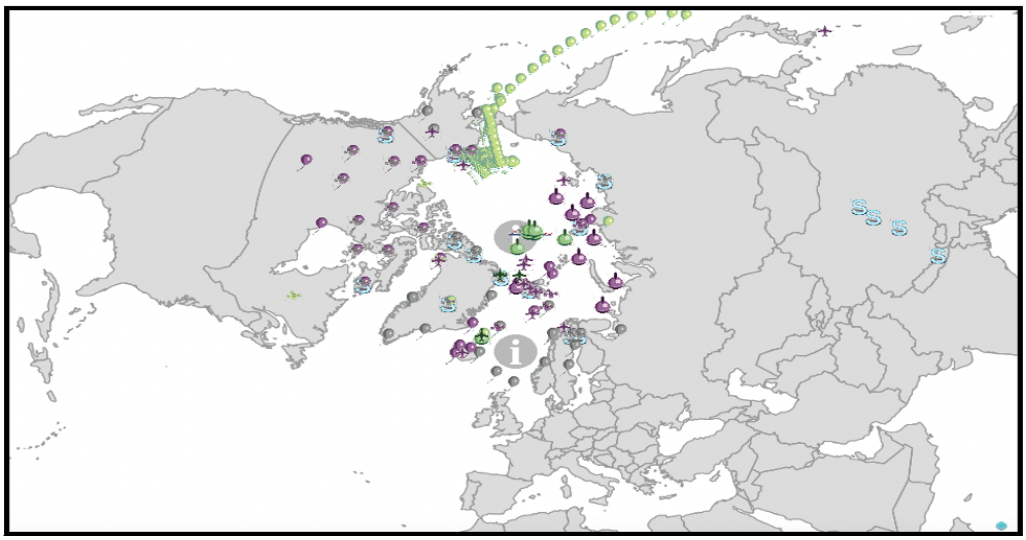


Figure 3.9. YOPP observation layer of existing sensors under continuous activity; those planned or under consideration, including airborne, buoys, automatic weather stations (AWS), radiosondes, other, and supersite weather sensors.

While the Arctic is often framed as a region of low infrastructural development and retaining a frontier quality, there has been less appreciation for how developed the region is in environmental and ecological surveillance coverage. While the observation layer of sensors and other surveillance platforms collated by the YOPP may appear extraneous to security concerns, environmental awareness and predictive capabilities support several governance efforts, including search and rescue (SAR) operations and other human activity in the Arctic (Dawson et al., 2017). Moreover, the YOPP data set is identified by DND within cooperation efforts under the International Cooperative Engagement Program for Polar Research (ICE-PPR), composed of member nations' defence departments and other government agencies engaged in polar research (see Reading, 2017). As the government of Canada states, “many safety, security and defence efforts in the Arctic and the North are reliant on sound weather, water, ice, and climate information, alerting and warning services to help mitigate operational risks” (Government of Canada, 2019). Likewise, the role of space weather is monitored by the Canadian High Arctic

Ionospheric Network (CHAIN) and has been identified as a critical issue of practical concern for DND as ionospheric disturbances can affect network communications and global positioning systems (GPS) (Boteler, 2018). Specifically, ionospheric scintillation in the Arctic can affect GPS and communications networks within C4I systems (command, control, communication, computers, intelligence). Consequently, modern defence efforts require a robust understanding of the solar-terrestrial system and scintillation patterns (see figure 3.10). As a whole, polar environmental research supports security and military operations because these operations will increasingly depend upon in-depth knowledge of the Arctic's unique environment to be successful (Pedersen, 2019).

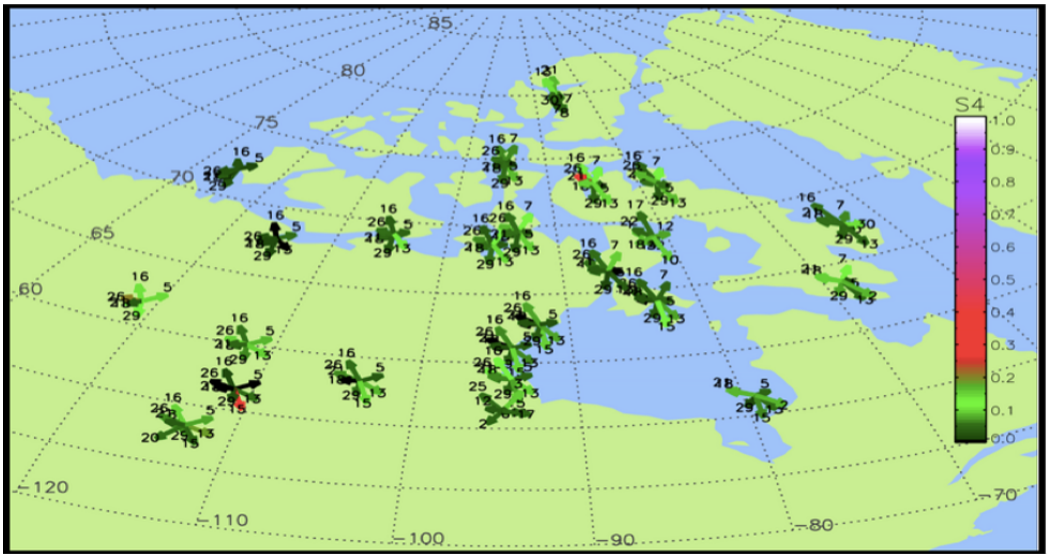


Figure 3.10. CHAIN real-time scintillation map; date captured: May 15, 2020.

In addition to the YOPP and CHAIN, Canada is pursuing several other surveillance-related efforts in the Arctic. Emblematic of these efforts is the Inuit Guardians Program, which includes projects that bridge Indigenous knowledge and experiences with modern technologies to monitor environmental trends and their effects on resources (such as fish and caribou) and

Indigenous lands.[27] Transport Canada's *Ocean Protection Plan* also provides environmental monitoring, which involves a $1.5 billion investment towards developing a marine safety system, including the ability to provide real-time awareness of environmental events (e.g., oil spills), emergencies, and marine traffic (Transport Canada, 2020). Canada expects these requirements to grow as the flow of Arctic traffic increases and melting sea ice creates additional safety issues for marine navigation, requiring a real-time awareness of daily ice flows. RADARSAT Constellation Mission (RCM), the most recent Radarsat satellite developed by MDA Inc. (formerly MacDonald, Dettwiler and Associates), provides this awareness. In contrast to its predecessor, RADARSAT-II (still in operation and owned by MDA Inc.), RCM and all of its sensor data are owned by the Government of Canada, while MDA served as the developer. This transfer of control is indicative of the federal government's efforts to consolidate its power over technologies and information that it understands to be essential for supporting the national interest and security (Government of Canada, 2021). In addition to RCM's various surveillance functions, the satellite is equipped with an Automatic Identification System (AIS) that can combine ship data with RCM surveillance and open-source data. RCM's AIS capabilities support the Canadian Coast Guard's own AIS infrastructure across the Canadian coastline and its Long Range Identification and Tracking (LRIT) capabilities provided by the Iridium satellite network for Arctic operating vessels. Importantly, Oceans and Fisheries Canada distribute AIS and LRIT data to other government departments interested in national security (Government of Canada, 2019a, 2019b).

[27] For example, the *Nahendeh Kehotsendi* project in Hay River, NWT, led by the Kátł'odeeche First Nation, "establishes a land monitoring project based on traditional knowledge and experience. However, it uses contemporary technology and techniques as required" (Government of Canada, 2020).

Arctic surveillance is also supported by the human element, as embodied by the Canadian Rangers. Historically, Ottawa considered the Rangers a valuable asset in contributing to ground surveillance efforts in the Arctic while supporting the state's legal claims in the region (Lackenbauer, 2013). Current discussions on implementing the priorities outlined in Canada's defence white paper, *Strong, Secure, Engaged,* indicate continuity with these historical efforts and position the Canadian Rangers in a supportive role within strategic efforts to monitor and defend the Arctic (National Defence, 2017, p. 80). Specifically, the Rangers are expected to "[a]ugment regional maritime domain awareness" by relaying "what is and what is not normal in their local areas, fostering a 'see something, say something culture'" and embodying their motto of *Vigilans* ('The Watchers') (Lackenbauer & Kikkert, 2021, p. 22).

Surveillance thus already represents a fundamental component of Canada's governance strategy in the Arctic and is a widely shared practice across multiple departments. Technology also enjoys a clear focus as a critical tool for enhancing the state's surveillance capacity and providing situational awareness. Anticipating the government's future needs, Canada is pursuing several research and development initiatives to build advanced sensing technologies. The *All Domain Situational Awareness* (ADSA) program is one such avenue of development and is expected to contribute to Canada's modernization efforts in NORAD and continental defence.

3.3. All Domain Situational Awareness

Defence Research and Development Canada has recently announced "an investment of up to $133M between 2015-2020 in *All Domain Situational Awareness* (ADSA) S&T [where the] DND will conduct research and analysis to support the development of options for enhanced

domain awareness of air, maritime surface and sub-surface approaches to Canada, and in particular those in the Arctic" (National Defence, 2017a). The general goals of this program are to "conduct research and development projects to reduce the risk of unproven technologies" and to ultimately "deliver advice to senior decision leaders of DND/CAF" (National Defence, 2019a). One of the critical areas of research and development will be an "analysis of sensor mixes and information integration and sharing for all domain awareness to enable detection of modern threats beyond the threshold of the current systems" (Public Works and Government Services Canada, 2016b). The ADSA research program is directly linked to the surveillance needs of the Arctic, which are part of a constantly evolving security governance architecture composed of conventional military and civilian forces, combined with developing surveillance technologies in all physical domains (land, air, sea, and space) as well as the electronic domain (especially cyber). The ADSA program represents a continuation of historical efforts by the Canadian government to enhance its surveillance capacity in the Arctic, particularly sub-surface monitoring, as the government has previously stated that "the need for an Arctic undersea surveillance capability remains, given that effective surveillance is an important component of sovereignty" (Dittmann, 2009, p. 54). The CAF and DND have taken a lead role in developing Canada's northern surveillance capacity, which must be situated relative to defence and security concerns. While the CAF and DND have taken a significant role in developing Canada's Arctic surveillance capacity, they do not present themselves as the principal security actor in the Arctic in terms of physical operations. In a presentation by the Canadian Joint Operations Command (CJOC) on maritime and Arctic security, the DND states that "CAF [is] not the lead for security threats but contribute to a whole-of-government approach to operating in this spectrum" and further that "CAF often play a supporting role to Canadian partners, such as by providing

logistical, intelligence, surveillance, and reconnaissance capabilities" (National Defence, 2016, p 26).

Technological developments geared towards Arctic security within Canada, historically and currently, are underpinned by the notion that defence institutions cannot be the sole investors in and beneficiaries of science and technology initiatives. Indeed, engaging industry in developing security technologies is a long-standing practice of states and has become more pronounced as private firms lead much of the development of novel surveillance technologies. Within the Arctic, the logic of risk and burden sharing has led the DND to investigate the possibility of using private civilian firms for surveillance functions such as routine overhead flights similar to those used on Canada's eastern and western coasts (Brookes, Scott, & Rudkin, 2013). Several private technology companies have also been employed in advancing Canada's surveillance capacity through experimental technologies that have been tested at various Arctic sites. These earlier projects have directly informed the direction of the *All Domain Situational Awareness* (ADSA) program and the tendering of contracts through that program. The stated goal of DND for the ADSA program is to build partnerships between industry, academia, allies, and the federal government that serves the need to research, develop, and build technologies geared towards Arctic surveillance, but which may also repurpose existing technologies or be repurposed towards other capacities in dual-use functions (Defence Research and Development Canada, 2017). Specifically,

> DRDC seeks to leverage the development of its technologies, whether developed in-house or via procurement processes, and enable technology transfer through licensing and other mechanisms. The goal of such technology transfer activity is to enhance Canada's Security and Defence industry, enabling economic development and ensuring Canadian industrial capabilities to meet supply chain requirements of the CAF (Defence Research and Development Canada, 2017, p. 4).

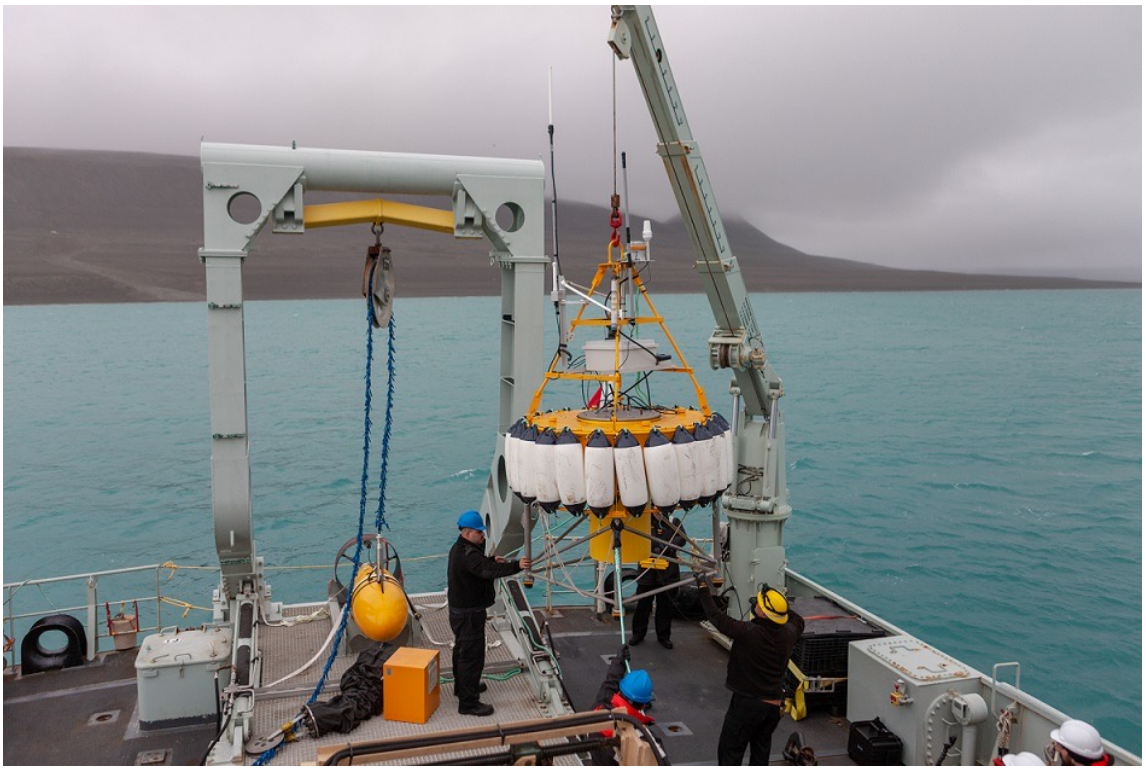


Figure 3.11. DRDC in the Arctic. Source: DRDC Twitter, December 16, 2019. The caption reads: @NationalDefence's All Domain Situational Awareness program allows us to develop and test various surveillance systems for underwater and under-ice surveillance in Canada's Arctic. #ArcticScience

The Life and Earth Sciences Division within Public Service Procurement Canada (PSPC) is also responsible for issuing procurement contracts advertised under the ADSA project. Along with Public Works Canada (PWC), these departments act as intermediaries through which other stakeholders (e.g., private firms, universities) are enrolled into the broader network of institutional associations where there is a translation of functional goals towards the sociotechnical ambitions of the ADSA program and the security field more widely. Stakeholders are enrolled within an expanding network of military and security actors (including civilian actors) through PSPC as an interlocutor. However, this is not a one-way relationship as the inclusion of these stakeholders has directly informed and transformed the actual call for

proposals and organizational structure of the ADSA program. More pointedly, the ADSA program was combined with another major initiative, the Canadian Safety and Security Program (CSSP), highlighting the multi-directionality of agency within networked assemblages (Public Works and Government Services Canada, 2017).

Under the ADSA project, Public Works Canada issued a Call for Proposals within two broad streams in 2016 that sought solutions for "Air, Surface, and Sub-Surface Surveillance, and Sensor/Information Mixes S&T" as well as "projects that improve understanding of critical infrastructure (CI) vulnerabilities" (Public Works and Government Services Canada, 2016, p. 33, 35). Former Liberal Defence Minister Harjit S. Sajjan captures the threat images driving the ADSA program in his remarks on the awarding of ADSA contracts:

> As the challenges along Canada's coasts increase, investments in programs, such as DND's All Domain Situational Awareness S&T program, contribute to ensuring that the Canadian Armed Forces, as well as our domestic and international partners, have the best tools at their disposal to respond to existing and emerging threats and risks. We look forward to the results of these studies for their potential inclusion in the modernization of the North Warning System and NORAD, and also for their potential to provide invaluable knowledge about Canada's coastal areas, especially in the Arctic (National Defence, 2017b).

As a technology program, there is an overwhelming focus on how the ADSA aligns with allied security concerns more broadly and frames the appropriate response to the perceived risks in terms of 'smart' technologies and sensor modernization to respond to future threats (Robinson, 2017, p. 8). Future threats are framed through the lens of technological advancement and proliferation, which are treated functionally as the key drivers of structural change in the international arena. Moreover, technology is understood to be especially useful for managing and monitoring shifting environmental patterns wrought by climate change, which are projected through the framework of “disaster risk reduction” for “extreme weather events and climate change” with an emphasis on “hazards monitoring and forecasting capabilities, early warning

systems, [and] emergency communication systems" (Public Works and Government Services Canada, 2016, p. 37). Thus, Arctic surveillance technology is broad in application to military and non-military threats within a securitized framework.

However, weapons do enjoy considerable attention from a defensive perspective. The initial call for proposals under the ADSA program materially sought out the "[i]dentification and assessment of future technologies and platforms" geared explicitly towards "long-range detection, tracking and cueing of air targets (with emphasis on the North, including technologies and signal processing techniques applicable to target detection such as bi-static Air Moving Target Indication (AMTI)" (Public Works and Government Services Canada, 2016, p. 33). Specifically, this call points towards the state's interest in countering the development of hypersonic weapons and other advanced delivery vehicles. Additionally, surface surveillance in the maritime domain is expected to draw on "space, air, land, surface and subsurface platforms as well as relevant information resources" to identify and create technologies for "detection, discrimination, localization, classification and tracking" of objects. The sum result is expected to be a "complementary" set of sensor systems and intelligence networks that create a multifaceted surveillance assemblage producing a coherent and streamlined intelligence image drawn from a heterogeneous network of sensors underlying a "joint strategic surveillance architecture" of the future (Public Works and Government Services Canada, 2016, p. 34).

To illustrate the logic underpinning current Arctic surveillance and technological development efforts, the chapter now turns to examine specific projects within three interrelated domains: land, air, and underwater.

3.4. Land and Air Surveillance

There are two significant avenues of development towards above surface surveillance in the Arctic. The first is the development of remote and (eventually) autonomous air vehicles (AAV) that can capture much more detailed surveillance images through synthetic aperture radar (SaR) combined with ground-based receiver stations. In principle, SAR is well-equipped to capture the Canadian Arctic's diverse landscapes because it can build two and three-dimensional reconstructions of material objects. This ability allows for imaging the Arctic's diverse physical topographies using the motion of a radar antenna mounted on an AAV to capture an exact resolution of spatial features. Recent efforts under the ADSA program have been undertaken by the firm C-Core, which is developing a "Bistatic High Elevation Long Endurance (HALE) Unmanned Air System [UAS]" that would be used "as a receiver in a bistate configuration with commercial [SAR] missions, both current and future." Specifically, C-Core's ADSA contract funds a study that "will look at how various configurations of transmitters and HALE UAS-mounted receivers can augment current detection and discrimination capabilities while providing a highly mobile, persistent, all-weather surveillance asset that does not exist" (National Defence, 2017a).

Further efforts by C-CORE under the *Integrated Remote Sensing for the Canadian Arctic* (IRSCA) project have reportedly resulted in the creation of an Arctic ground station capable of advanced "modelling and simulation techniques" of environmental phenomena, including greenhouse gas emissions from data received by satellite sensors, as well as building in "mission management and control functions for airborne and satellite platforms" through a partnership with Boeing (C-Core, 2019). As stated by Paul Adlakha in the joint press release with Boeing, "RSCA2 [the IRSCA follow-up] provides a critical path to grow C-CORE's capabilities from a single ground station in Inuvik into an international player" with Boeing acting "truly strategic

by building various industrial partnership programs internationally into a focused initiative that will collectively build a high-value system of systems for Arctic safety and security, and support for climate change resilience" (C-Core, 2019). Within these project initiatives, the integration of private firms within the Canadian state's desire to illuminate the Arctic's topography and northern approaches through a securitized logic is readily apparent, including reducing vulnerability through adaptation via 'resilience' building.

The second significant technological interest concerning air and surface surveillance is the development of over-the-horizon radar (OTHR), which allows for radar surveillance at much greater distances than typical radar systems. OTHR technology already exists and has been examined by the Canadian government as a possible surveillance solution in the Arctic since the 1970s with its *Polar Cap III* experiments (Thayaparan et al., 2018, p. 1700; see Yool, 1973). The Canadian Arctic is contoured by a vast cross-section of air space and land to monitor (particularly when concerned with sensing and targeting threats that may be launched well outside sovereign borders). Thus, R&D efforts are interested in OTHR technology to rectify conventional radar's inability to see over the Earth’s curvature by using the ionosphere to 'bounce' radar waves which can then locate a target (Defence Research and Development Canada, 2018). Existing OTHR systems cannot be used in mid-latitude regions in the Arctic due to the multiple unique environmental conditions found in the northern ionosphere, including solar wind, geomagnetic storms, and other phenomena that prevent accurate target detection (Thayaparan et al., 2020).

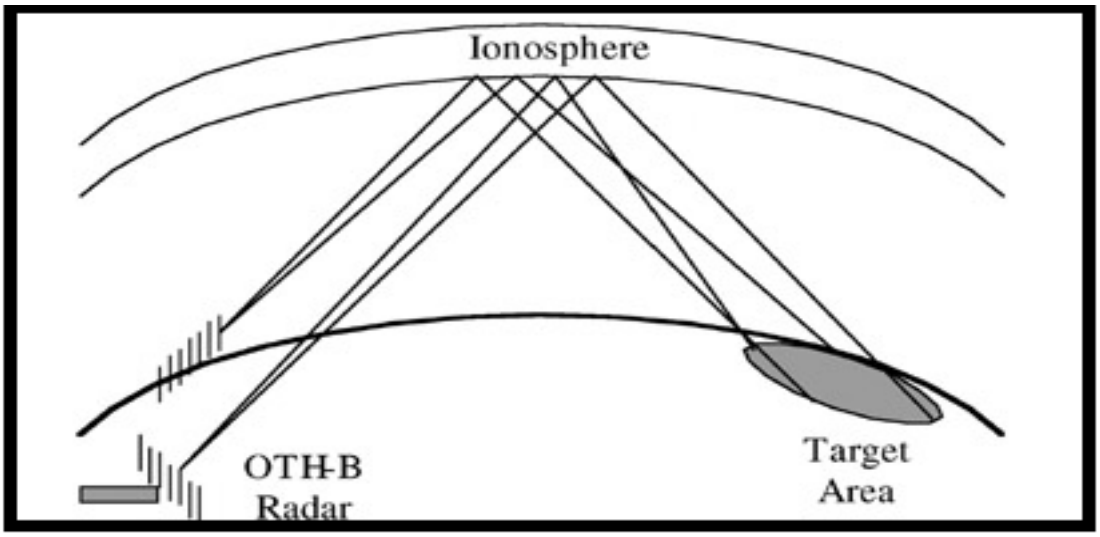


Figure 3.12. Concept of OTHR (Toomay & Hannen, 2004, p. 164).

Consequently, several contracts tendered under the ADSA program are developing an advanced OTHR system (Government of Canada, 2018b) that would contribute to the rationalization of the state's sovereign power of vision over the geospatial domain in the Arctic.

Figure 3.13. DRDC OTHR. Source: DRDC Twitter, December 9, 2019. The caption reads: Through @NationalDefence's All Domain Situational Awareness Program, the Over-the-Horizon Radar project studies ways to increase the performance of OTHR systems that are impacted by the #AuroraBorealis in Canada's Arctic. #ArcticScience (location is unknown).

For example, RF Microwave Ltd., a technological sales representation company based in Quebec, has been tasked with sourcing the development of a sensor transmitter for an OTHR system (National Defence, 2018a). Notably, DND's call for the development of a radio frequency (RF) sensor for OTHR requires that it have "robust construction" and an "operational temperature -40 to +70 degrees" (National Defence, 2018a). Similarly, Raytheon Canada Ltd.

has been awarded a contract worth $31.2 million to develop and construct transmitter and receiver products related to OTH radar waves (National Defence, 2019b).

3.5. Underwater Surveillance

Marine technologies and capabilities have long shaped the strength of the state in its historical form, and this continues as oceans become more populated and accessible. Historically, the need for underwater surveillance capacity in the Arctic was linked to strategic considerations that underpinned the framework of mutually assured destruction (MAD), itself a techno-fetishistic assemblage of technical discourse, hyper-positivist simulation models based on complex game-theoretic principles, and the evolving material technologies of the nuclear arms race, including ballistic missile submarines (SSBNs). Through the threat of nuclear submarines, in addition to the natural dangers posed by the open sea, knowing what lurked beneath the ocean became an important goal not just for states and militaries but also for private firms. As Shiga argues,

> underwater hazards had become increasingly high-consequence risks for nautical organizations since the destruction of massive, steel-clad ships, the *RMS Titanic* led to devastating losses of human life and property. The Twentieth-century struggle to control horizontal movement across the ocean, whether in the imperial contest or commercial conquest, came to depend on the vertical extension of perception into subsea space (2013, p. 358).

The development of underwater surveillance systems has become especially pronounced in recent years by several states (Parry, 2019). In particular, in recent technological developments and under the ADSA program, S&T efforts have focused on two broad sub-surface technologies. The first strategy is to develop and improve upon a stationary array of underwater sensors strategically located around Arctic chokepoints where submarines would likely or necessarily

have to travel using waterway passages. This line of development follows previous efforts during the Harper era that were premised on earlier Cold War strategies to build an underwater network array of sensors with later iterations designed to be combined with radar-based sensors and satellite overview awareness. Within Canada, Gascoyne Inlet and Devon Island have been and continue to be critical areas of sub-surface surveillance projects as they are critical strategic 'choke-point. The CAUSE project is the most recent sensory array and has integrated networks of civilian scientists from Oceans Network Canada, which operates the VENUS and NEPTUNE underwater monitoring arrays off the BC coast (Thomson, 2017). Earlier efforts include the surface level *Canadian Arctic Night and Day Imaging Surveillance System* [CANDISS] in 2008, which "combine[d] a laser, a thermal imager and two telescopic devices with wide-angle and telephoto capability" that was expected to provide all-weather and all-day/night surveillance of Barrow Straight in combination with sub-surface microphones that were possibly remnants of the Cold War era (CBC, 2008; Zellen, 2009, p. 96). CANDISS was part of the larger *Northern Watch* project, which ultimately fed into current sub-surface surveillance developments, including CAUSE. *Northern Watch* is a clear example of the logic borne out by the state's interests in establishing sovereign control via an enhanced technical capacity allowing for the de-territorializing of that control away from the Arctic itself, where the broad assemblage of sensors is partially controlled from and ultimately disseminates information to southern control sites.

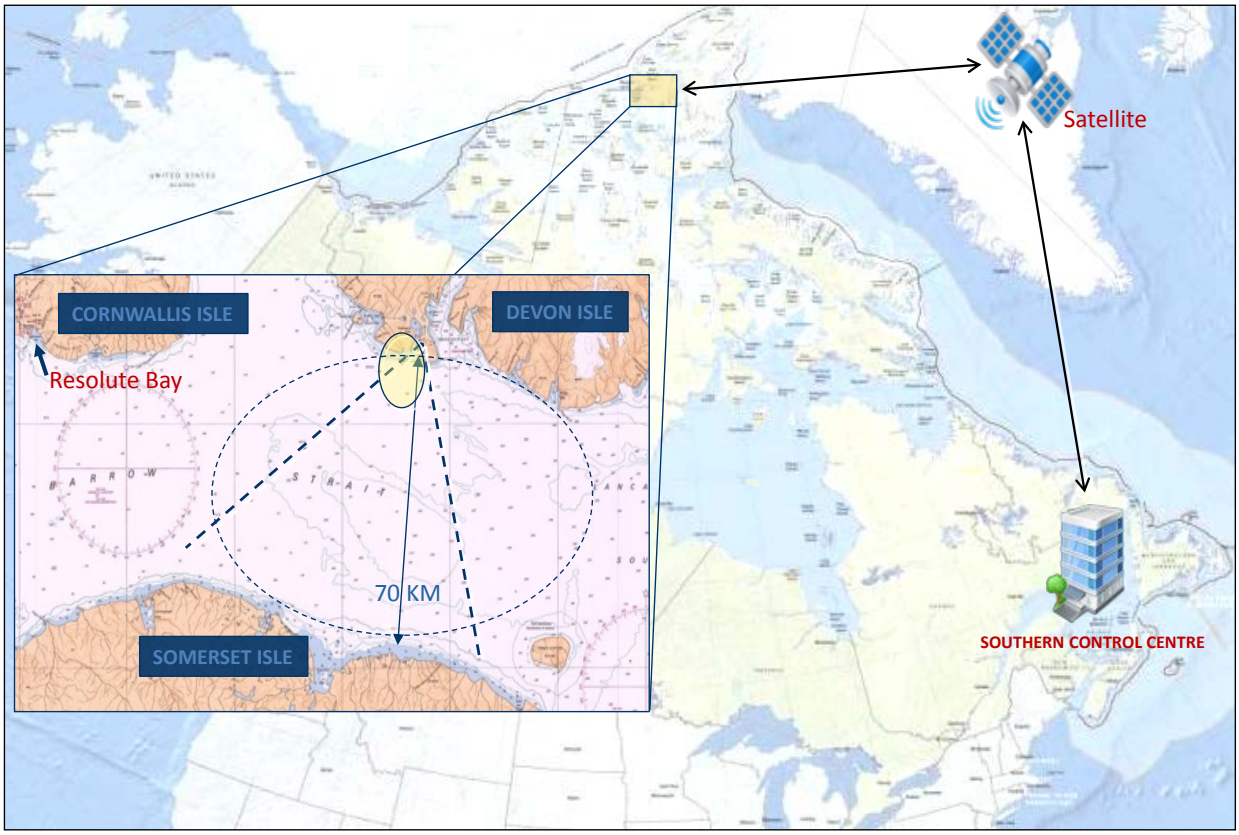


Figure 3.14. Satellite relay feed to southern control site of Gascoyne Inlet (Reading, 2017, p. 3).

The second area of technological focus is developing crewless underwater vehicles (typically called unmanned underwater vehicles - UUV's) that could be outfitted with modern sensors and communications platforms, including sonar arrays. The theoretical, ethical, and legal issues surrounding the use of aerial drones, particularly the armed variants that now populate the US war machine, have found a prominent place in the field of security studies (e.g., Benjamin, 2013; Parks & Kaplan, 2017; Shaw, 2016). In contrast, the development of marine capable UUV's has found comparatively little attention among security scholars. Canada has experimented with the use of submarines for military and scientific surveillance in the Arctic decades prior as well as allowing the "the federal Government to make its presence more visible in these offshore waters" (Sanger, 1970). UUVs capable of persistent underwater and under-ice

activity within the Arctic are expected to contribute to the Canadian state's Arctic defence initiatives. The leading firm in charge of this development is Cellula Robotics, which has been awarded several successive ADSA contracts in a three-phase development plan to manufacture and test a UUV capable of continuous use in the Arctic. Under these contracts, Cellula developing multi-domain robotics in conjunction with the Integrated Systems Laboratory from Dalhousie University at the Aquatron pool facility in Halifax (Cellula Robotics, 2019b). In the first phase, Cellula developed and tested a new fuel cell within a laboratory setting that would allow for the use of a long-range autonomous underwater vehicle (AUV) capable of remaining submerged for long enough stretches of time to navigate and surveil the Arctic's extensive coastline (Cellula Robotics, 2018; National Defence, 2018c). According to Cellula (2018), the lab demonstration included the supply of "several hundred kilowatt-hours of energy" in a "simulated deep-water environment" using a "novel Hydrogen Peroxide Oxygen delivery system" in which hydrogen peroxide is used as a reactant allowing for greater energy density and application for an AUV than current conventional systems would allow. The development of this new power cell was necessary in order to allow for an AUV to operate in the Arctic environment for upwards of a month at a time, which would be crucial for autonomous missions (including exploration, observation, and mapping practices) and would "[eliminate] the necessity and cost of surface launch/retrieval vessels or manned submarines" (Cellula Robotics, 2018). A related effort by Cellula involves the development of a deployable battery station that could be used to charge an AUV while in-mission underwater or under-ice, which according to Cellula, "serves as an important enabling technology for reducing the risks to personnel conducting maritime monitoring operations along Canada's diverse coastline" (Cellula Robotics Ltd., 2019a).

Stages two and three of Cellula's contracts under the ADSA involve the development and testing of a suction anchor that would allow an AUV to hold a position in a "lower power, quiet mode for extended duration missions" (Cellula Robotics Ltd., 2019b) and eventually combining both its fuel cell and that anchor into an actual long-range persistent AUV capable of operating in the Arctic (Robotics Tomorrow, 2018). The AUV, named Solus-LR, was built with a target range of 2000 km and multi-month submersion that would allow for "port-to-port" missions (Robotics Tomorrow, 2018). The Solus-LR has recently completed its first set of sea trials, which focused on "validating basic autonomous behaviour including surface and submerged missions in Port Moody off Burrard Inlet," with follow-up sea trials scheduled in February and April 2020. These follow-up trials will include both the suction anchor and fuel cell integrated into the AUV, and a final test is scheduled in summer 2020 that will see the Solus-LR complete 2000 km worth of 10 km laps between navigation and communication buoys in the Indian Arm, British Columbia to allow for monitoring and communication updates to a remote mission control centre (Cellula Robotics Ltd., 2019b).

The development of an AUV capable of persistent underwater and under-ice surveillance and communication in the Arctic is only one part of the technological puzzle being assembled concerning sub-surface capabilities. In addition to Cellula Robotics, another of the leading firms behind this development within the ADSA program is GeoSpectrum Technologies Inc. (GTI), which has been awarded two contracts to develop underwater sensor and communications systems. The first ADSA contract to GTI procures the company to "build and field-demonstrate a Very Low Frequency (VLF) acoustic source for long-distance underwater detection and potentially basin-scale (1000km) communications" (GeoSpectrum Technologies Inc., 2017). The second contract concerns the development, construction, and testing of a low frequency towed

array, which is a "passive-horizontal thin line array suitable for towing from a persistent UUV" with the thin line design enabling "year-round underwater and under-ice Arctic operations" (GeoSpectrum Technologies Inc., 2017). The combined goal of these projects is to enable an AUV to surveil the underwater Arctic months at a time and to transmit communications of surveillance data over long-distance ranges within the Arctic's "hostile and acoustically challenging waters" (GeoSpectrum Technologies Inc., 2017). Low-frequency acoustic sources have been in existence for decades and were developed to locate oil and gas deposits and include those technologies that can provide long-range communications and surveillance ability. However, until recently, GTI (2017) states that the hardware size and reliability have been prohibitive, suggesting that their application towards security technologies was equally limited. Recent advances in miniaturization have removed this limitation, hence the technological gap in which GTI's contribution to developing a mobile-towable array will reportedly fill (National Defence, 2017a). Geospectrum's efforts in developing a low-frequency acoustic source for a mobile underwater sonar array partially respond to the ecological ramifications that existing systems are thought to have on marine life. In particular, the US Navy has used a sonar system blamed for breaching whales and lost a court battle over its use as this system was found to violate marine law (BBC, 2016). Specific forms of low-frequency sonar, in contrast, can use coded pulses for object detection and is theoretically weak enough to prevent interference with the natural sonar communication between whales. GeoSpectrum's sonar development under the ADSA is stated as being "orders of magnitude" less noisy and is being designed with the "health of marine mammals as a top-of-mind concern," according to GeoSpectrum president, Paul Yeatman (Thompson, 2017). According to Yeatman, a great deal of GeoSpectrum's ADSA contract is not concerned with developing the technology itself but theoretically modelling sound

propagation under the ice to propose to the Canadian government a course for further development (Thompson, 2017). Overall, the combined efforts of Cellula Robotics and GeoSpectrum Technologies can be understood as the technological assemblage of both the UUV and underwater mobile sensor and communications technologies that are being developed as discrete projects, but which are ultimately understood and are being developed towards their potential as a unitary surveillance product.

3.6. Discussion

This section considers the preceding discussion within the material-semiotic framework outlined in chapter 1. Recall that the first point of triangulation in that framework examines the connection between semiotics and materials. Within this relationship, discourses centred on scientific progress and modernization are associated with and symbolized in technology and our ability as humans to control nature through its use. This symbolism is especially prominent in early 20th century depictions of the Arctic as a wild space to be tamed by overcoming its physical barriers, accessing its deep stores of wealth, and extracting that wealth to the south through air travel and other technologies. Therefore, the discourses and technological symbols of modernity are linked to development and are inseparable from capitalism as an imaginative and productive force. Technologies like the Boeing 307 and the acceleration of global air travel became representative of the state's ability to extend the nation through its material reach northward and further integrate Canada's Arctic into the globalizing circuits of the post-war world.

However, technology is also a source of threat as the material transformation underpinning the international structure through nuclear weapons and long-range bombers. Eventually, ICBMs and SSBMs exposed the Arctic as Canada's and North America's Achilles heel due to its geography and a lack of defensive and awareness capabilities. Hence, surveillance technology became a pronounced strategy for managing these threats. Securitization theory offers clear relevance as a framework for analysis. The ways in which non-security discourses intersect, overlap, and are reproduced between the late 19th century and the current era are as important as the language and semiotic structures of security. Discourses of scientific progress, modernity, and nationalism are interlaced with the securitization of the Arctic's particular geography and the production of surveillance technologies, which are designed to rationalize that geography as a materially enforceable claim to sovereignty in addition to the state's legal and symbolic claims. Technologies that overcome the material barriers of knowledge and control, whether on land or in the air and sea, act as quasi-agents of state authority through their material embodiment of sovereignty and their ability to extract a heightened awareness of the Arctic. In their idealized forms, these technologies do so by establishing boundaries and thresholds that transform and differentiate material objects according to pre-established criteria into threatening and non-threatening. For example, an object picked up by an automated underwater sensor may assume a detected object is threatening if it is located in territorial waters until it can be proved otherwise.

Technology and geography are materially entwined forces that interact through practices, specifically in applying technology to rationalizing the Arctic's territory by the state. Technologically mediated surveillance is designed to increase the knowledge and awareness of the Arctic in every domain, particularly in the air and marine domains, as they are the most

difficult to observe in any conventional sense. The design, production, and use of surveillance technologies are practices that blur the distinction between scientific research and militarism. This blurring is not a new phenomenon as military technologies have relied more broadly on scientific and technological advancement. Technological advances in World War II allowed the state to materially extend its reach into the Arctic through increased access and awareness. This process builds on the Arctic as an imaginative construct (including through scientific practices like cartography) and reproduces but extends and transforms those images by advancing the state's spatial and territorial awareness of the Arctic. The Arctic's material forces interact with and resist the state's rationalization practices and Canada's ambition to *know* the Arctic in a much more intimate and granular sense. Indeed, the material 'noise' produced by the Arctic's diverse landscape remains a critical issue for military and other state practitioners involved with security and defence as moving icebergs, atmospheric disturbances, extensive landmasses, and all of the Arctic's other unique characteristics continue to resist specific practices of modernization, including surveillance. Technology, research, development, and other practices interact to make surveillance an increasingly remote, distant, and organized series of practices that interact through multi-domain awareness. Land, air, and underwater surveillance practices are not treated as discrete but instead are being advanced through a holistic lens that understands these domains as inherently indivisible and as a series of networked and integrated practices that will, eventually, produce a whole-of-Arctic image in dynamic real-time; a living, adapting, evolving, and in some ways, metastasizing polar panopticon.

The language and state representations of sovereignty are also linked to surveillance as a practice in that the possession of a heightened surveillance capacity is itself representative of state power as, in Foucault's words, "a perfect sovereign." If the panopticon represents a

localized, technical artifact that directs state power like a laser (over specific geographies, populations, or other discrete units), the ambitions of modern surveillance in the Arctic and elsewhere represent the dilation of that power outwards. Historically, the state's sovereignty (as an abstract political unit) was materially consolidated through the intersection of scientific and cultural representations (such as in maps delineating boundaries and images on postage stamps and money) with their material practices and blunt occupation by state forces, including or even primarily through warfare. Sovereignty in this context is mainly imaginative and projected through material artifacts, but the application of material power remains limited and unnecessary given that sovereignty claims are not challenged. Such was the case for much of the Arctic's history in Canada, as the state's claims to its northern territories were primarily supported by sovereignty's *de jure* quality as a legal entitlement despite the state's weak presence compared to its southern territory. Canada's Arctic strategy would change in the early 20th century as technological advancements in aviation and marine technologies reduced the Arctic's 'splendid isolation' and transformed Canada's relationship to its Arctic territory. This transformation resulted in the state using surveillance as an acute representation and practice of state power over the Arctic as Canada's sovereign territory. The state's focus on research and technological development does not mean that Canada or any other state has actually achieved full-surveillance power of the sort that Foucault and others have described, but rather, illustrates a consistent ambition to "shore up state power" horizontally (over greater distances) and vertically (in the substratum of vision and space). Technologies like radar, drones, and materials that are less technological but no less *technical* through their articulation as agents of sovereign power, like soldiers (e.g., the Canadian Rangers) and scientists, are all symbolic of state presence and power.

Their articulations and behaviours become *sovereign* practices under their authorization and augmentation by the state.

The material, symbolic, and practice-based elements of surveillance concerning state power and sovereignty are encoded over time and shaped by the wider geopolitical environment of that time. However, these elements demonstrate a consistent ethos of development and ambition by the state to control and tame the Arctic as a wild space. State and economy are constantly enmeshed through discourses and symbols of development, modernization, nation-building, and security in evolving forms that echo previous iterations and eras. Canada's interest in developing its Arctic surveillance capacity and the ethos of expanding state power through surveillance is materially represented by current research and development efforts linked to surveillance technologies, much of which embody or are directly linked to previous efforts in an iterative fashion. In particular, the air and marine domains demonstrate the indivisibility of space when the symbolic elements of sovereignty break down against the increasingly technical and material abilities of actors to disrupt those spaces as homogenized sovereign territories. The air and marine domains represent the absence of clear and neatly defined boundaries with obvious control points. More pointedly, as technology evolves to navigate these domains in more complex ways, those domains also continue to resist state efforts of consolidation and rationalization into precise geographies of sovereignty.

The sum effect of these efforts is the rationalization of Canada's Arctic territory through sovereign practices of surveillance and occupation. Surveillance practices and symbolic occupation also enable a pathway for strategic signalling to other states and potential competitors without risking escalation (Byers & Covey, 2019; National Defence, 2019a). However, the institutional overview discussed demonstrates that security, as a field of practice, rhetoric and

material expression, includes more than the sum demonstration and effects of militarization. Notably, the notion of dual-use technologies that straddle the boundaries between militarized, securitized, and civilian uses indicate the degree to which security as a social field of action is increasingly blurred with other social fields and the degree to which a technology's capacities (as opposed to properties) are determined by a social assemblage (DeLanda, 2016, p. 79). The field of Arctic security, in particular, is an assemblage populated by communities of practitioners (for example, scientists and bureaucrats), their formalized and informalized interactions, specific discourses and languages, the materials these communities use and produce (technology, laboratories, offices, etc.), and ultimately the social-technical imaginaries on which these actions and materials are refracted through and reflected upon, which are intimately linked to ideas of modernization. Notably, while the field of Arctic security is not characterized solely by what would typically be considered as militarization or securitization, there is an explicitly securitized character of the Arctic that informs and conditions the actions and material developments expected to contribute to state sovereignty in the region, as demonstrated through the leading role played by DND and DRDC.

3.7. Conclusion

Following limited naval activity as a theatre of conflict during World War II along with other vectors of national interest (especially within the rhetoric of modernization, state control, and economic development), Canada’s Arctic surveillance capabilities became a significant facet of state policy and discourse during the Cold War. Following a drop in that interest when the Iron Curtain fell, the post-Cold War world marked a shift towards a focus on "new domestic realities and new geostrategic conditions" (Government of Canada, 1992 as cited in Dean, Lackenbauer & Lajeunesse, 2014, p. 22). Despite this transition, the Canadian military's

surveillance objectives in the Arctic have not deviated far from previous policy rhetoric concerning the need for enhanced Arctic awareness capabilities. Indeed, Canada's surveillance goals have only become more emphatic about demonstrating control and authority in order "to uphold Canadian sovereignty by exercising surveillance, demonstrating presence, helping civilian agencies cope with non-military contingencies" and to advise government when faced with "new challenges" (Dean, Lackenbauer & Lajeunesse, 2014, p. 22).

The current Arctic environment and its projected climatic transformation indicate that the ecological structures of the natural environment, including its atmosphere, temperature, and geomagnetic conditions, enjoy an agentic capacity that, when combined with the discursive and material components of language and practice, dictate the trajectory of security initiatives required to 'defend' sovereign power and expand its reach. Historical and current efforts related to the development of surveillance technologies indicate the state's strategy for rationalizing its borders and territory in the Arctic. The language of sovereignty and the technical requirements of the ADSA program are indicative of how language and scientific practices related to technological development are oriented towards a coherent logic of security that is enveloped in broader social and historical fields. More recently, R&D efforts, including those within the ADSA program, also demonstrate Canada's ambition for developing and branding itself as a source of "internationally recognized expertise in remote sensing" (C-CORE, 2020) in order to capitalize on those efforts through the commodification of security technologies and data assemblages as finished products for sale to governments and private organizations. This ambition echoes Hilde, who notes that the distinction between state and societal security is often blurry and argues "[s]urveillance and intelligence sensors, for example, are capabilities that clearly have dual uses" (Hilde, 2014, p. 148). Hence, the focus under the ADSA is on

'leveraging' and creating dual-use technologies that blur security and economy in ways that are not always obvious. Indeed, In reference to the ADSA program, Dr. Marc Fortin, ADM (Science and Technology) and Chief Executive Officer for DRDC states that "ADSA is really a *scientific project*. We are not building the capabilities for just surveillance; we are doing scientific studies that will inform the decisions of what technologies will be deployed" and that "Commanders want to have situational awareness of all domains. I state plural because we need to look at under water, above water, air, ice and space, and it all has to work" (Government of Canada, 2018c, my emphasis). Notably,

> DRDC is working closely with the United States and the Five Eyes community which includes Canada and the United States, as well as Australia, New Zealand, and the United Kingdom. Using some of the best minds, DRDC has brought together a dedicated team of scientists from across different domains: maritime, space, land, radar, and air, because the objective is a complete holistic picture. Having this new technology will allow Defence to detect threats with more accuracy and speed, giving the commanders more information and more advanced warning (Government of Canada, 2018).

This blurring is also related to a consideration of *what* must be surveilled. Typically, Sociology and International Relations have been most concerned with surveillance practices in terms of monitoring and controlling bodies as subjects. Research has, therefore, primarily ignored how surveillance practices are being applied to non-anthropomorphic objects and how those objects may relate to humans (Donaldson, 2012), including their securitized relation. While the monitoring of people is undoubtedly an essential consideration for Arctic security, surveillance initiatives also include the goal of monitoring environmental phenomena and nonhuman objects, such as animal migration, weather patterns, iceberg movement, ice density, and to be able to differentiate between those objects in the natural environment and objects that are immediate threats to the state (such as differentiating between a whale and a submarine). Making these types of nuanced distinctions without the labour of human senses has only become potentially

possible through several recent trends. These practices would not be readily thinkable without the algorithmic turn in surveillance practices enabled by artificial intelligence. Nor would they be possible without the support of an econometric logic of cost and risk sharing combined with the securitized logic that requires an expanded repertoire of data and technologies, including those developed for purposes outside of the military-security-industrial complex but which may be repurposed or absorbed wholly into that complex.

The next chapter examines the discourses and representations of threats that drive current research development efforts for Arctic surveillance technologies. More specifically, it builds on what has been discussed in this and previous chapters by focusing on the intersection of threat *imaginaries* in the Arctic with the economies and logics of modern state surveillance practices as the dilation of state sovereignty outward.

CHAPTER 4: THE ARCTIC IMAGINARY

It is not unreasonable, for example, to imagine that the decreasing territorial sovereignty of states may be accompanied by increasingly intense applications of the modern principle of sovereignty and even more intense concerns about the problem of sovereignty.

R.B.J. Walker, 1999 p. 439.

Still, does this mean that this time we are really to discover the North? The trouble with the pioneering spirit is that it convinces the man who goes first that all others, in spirit at least, will follow. So it was with the first Governor-General who donned parka and mukluks to visit the Eskimos, Vincent Massey, in a speech to the Canadian Press in April, 1956, described how he had found the spirit of "a unique community" in a million and a half square miles of "strange and mysterious beauties".

" 'The North' has been rather a vague term to many of us…but we have all had some ideas about it […].

" 'To most of us, the Arctic seemed until recent years almost 'no-man's land'. Its only inhabitants, the Eskimos, were very nearly as remote as the reindeers of Santa Claus…All these conceptions are changing. First, we are learning to think of our North as Canadian, just as Canadian as the East or the West or the South […]"'

Globe and Mail, "Once more – Northward Ho!" April 23, 1969

[The Arctic] can come alive with mining and water transportation. The truism must be accepted that the Arctic is far from "lifeless" and can be made to serve.

Raymond Arthur Davies, "Arctic Eldorado," p. 82, 1944

Here is the hopping-off place for the most unusual fleet of aircraft the world has ever seen. Here is the gateway to vast riches that aviation has made available to Canada at a time when Canadians need all that natural wealth can give them.

Here, at the threshold of the land of the midnight sun, *time and distance no longer exist*.

Ken MacTaggart, Globe and Mail, "Nature Bows to Science when Planes Invade Arctic," February 9, 1937, my emphasis and sentence order

4. INTRODUCTION

The previous chapter demonstrated the continuity between Canada's current Arctic surveillance strategy with previous eras, particularly as surveillance relates to the marine and aerospace domains. Broadly, Canada is focused on technological advancement designed to enhance the state's surveillance capacity by expanding that capacity towards the country's cartographic borders. More pointedly, as technological advancement and processes associated with globalization increasingly nullity time and space as practical barriers to the Arctic's remote geography, Canada has increasingly focused on rationalizing the Arctic *through* time and space (i.e., state control over them) to defend its *de facto* sovereignty. Time and space are the twin axes of sovereign control for which the state is working to develop in more networked, layered, and technologically intensive ways.

A conventional view of technological development suggests a linear evolution of technology based on scientific discovery and instrumental need. For instance, the traditional lifecycle of technology as rendered in business and management studies is often understood in four phases: research and development, ascent, maturity, and decline, emphasizing a technology's functional and economic viability within a competitive and market-based ecosystem. While helpful, this linear account does not capture the interlocution of political, historical, and cultural factors that shape the development and adoption of specific technologies, in addition to their instrumental function. The over-instrumentalization of technology is especially prominent concerning military and security technologies, which are often framed within defence thinking as reactionary to exogenous threats to the state (Bousquet, 2014, p. 92). Put otherwise, there is a tendency to adopt a dehumanized view of security and defence technologies that mimics a market logic of linear development. Within

this logic, threats in the international environment stimulate demand for solutions, which fuel technological innovation within a competitive ecosystem that choses winners based on several factors, including price. The social is completely abstracted from the materiality of a technology's supply and demand as the international security environment is economized and *marketized* in the sense of being thought of as natural and irreducibly complex. For the Arctic, thinking about technological development strictly in these conventional terms does not offer a complete account for how and why sensing technology has become a key focus by Canada within its approach to Arctic security.

In contrast to a deterministic account of technology, in which technology is created through scientific advances and instrumental need (and thereby shapes the future), this chapter demonstrates how imaginaries, which are constructed through layers of meaning and representation found in discourse and other semiotic structures, shape technological forms of development and intervention. Specifically, this chapter considers how social imaginaries structure the development and use of sensing technology in the Canadian Arctic within the field of security. The central claim is that these technological developments are grounded in a particular sociotechnical imaginary centred on futurity. Notably, how the Arctic is understood and rationalized as a space of social and political life is dependent on a unique image of the future. This image can be characterized as a securitized imaginary mediated by the thematic assemblage of risk, possibility, and vulnerability, which frames the Arctic as a space threatened by a myriad of future dangers. Within this imaginary, the Canadian state's security and sovereignty are threatened by the potential for competing expressions of power enabled by climate change, technological diffusion, and other trends at the international scale. Consequently, Canada has prioritized technological innovation as a defence strategy designed

to rationalize and consolidate its power over its Arctic territory through strategies of pre-emption, which acts to control time and space by shaping their environmental conditions of emergence and activity.

Research considering the imaginative quality of the Arctic, while fruitful, has critically focused on the Arctic as a de-historicized space of colonial intervention and representation. In contrast, this chapter considers the productive force of imaginaries in terms of Arctic futures. While others like Salter (2019) and Dittmer et al. (2011) note the role played by the future in security-oriented practices in the Arctic, these practices have also escaped more detailed theorization. I address this gap by detailing how space and temporality intersect in their future-oriented conditions and materialize through the assemblage of scientific and security discourses, practices, and representations while circumscribing the dominant forms of intervention and governance in the Arctic. Broadly, this chapter demonstrates that the 'new Arctic' functions as a productive imaginary concerning the innovation of security technologies that are designed to make a spectrum of future threats visible and manageable in the present. As a set of symbolic, discursive, and material expressions, the new Arctic acts dialectally with the world in these capacities and is, therefore, world-shaping in an equally symbolic and material sense.

This chapter is organized as follows. It begins with a conceptual discussion of imaginaries as social fields of representation and power. This section highlights the work of Daniel Chartier and his conceptualization of the *imagined North.* The chapter builds on the imagined Arctic by demonstrating how the Arctic is imagined as a futurized space vulnerable to a complex network of global forces within the *new Arctic*. Subsequently, the chapter discusses how the new Arctic is premised on a specific world view based on deterritorialization, relationality, and complexity. This world view is primarily approached within security practices

through the framework of risk and probability, which are directly linked to sensing practices. This section draws on Government of Canada documents and policy to illustrate how Canada frames the Arctic as a vulnerable space. Specifically, it emphasizes five sources that outline Canada's Arctic security interests within official policy and defence considerations: the *Arctic and Northern Policy Framework* (ANPF); Canada's defence strategy outlined in the white paper *Strong, Secure, Engaged* (SSE); the earlier (2010) *Arctic Integrating Framework* (AIF); Defence Research and Development Canada's (DRDC) Science and Technology (S&T) Strategy, and a defence presentation by Lieutenant Colonel Bielby of Joint Task Force North (JTFN) on security concerns in the Arctic. The third section details how technology is being used and developed to attend to these threats to Canada's Arctic territory. More pointedly, it examines technology by empirically locating techniques of state power premised on sensing within space-based surveillance and marine intelligence practices. To illustrate how Canada and industry are approaching the problem of Arctic sovereignty and security, this section examines technologies developed and employed by the firm, MDA Inc., demonstrating how the company has engaged with state security practices to produce particular technological solutions to pre-emptively defend the state against future threats.

4.1. Imaginaries

The dominant cultural, social, and political understandings of the Arctic are more than superficial and are part of a broader set of discourses and epistemic practices that shape the region as a material space. Thus, imaginaries must be understood as the sum product of political efforts, and their role must likewise be understood as embodying a particular aesthetic and political valence. Within this context, *imaginaries* are assemblages of interpretation and

perception of a given space produced through intersubjective relations and embodied interactions with that space (see Dawney 2011; Elliot 2002; McCarthy, 2021; Strauss 2006, Vonderau, 2017). Further, imaginaries are reproduced through the circulation of discourses, practices, and material iterations by multiple actors (including individuals, institutions, and regimes), resulting in an imaginary that is always semi-stable but always in production. An imaginary in this sense is similar to Bourdieu's understanding of a *field* of social activity, in which objective positions of meaning are organized in such a way that they exhibit structural qualities that are imposed on actors within their environments, thereby indicating specific distributions of power within that field (see Bigo 2011, p. 239). In short, imaginaries are produced through the efforts of political labour and epistemologically bounded by that labour as a scientific imaginary, a cultural imaginary, a security imaginary, among countless variations. The various imaginaries in play are not discrete as they are co-constituted and overlap with each other within a hierarchical fashion, meaning that particular imaginaries are often assembled and assimilated within a dominant imaginary of understanding. As a specialized social imaginary, the *security* imaginary is explicitly invoked as a threat to the wellbeing of the state and (often implicitly) the wellbeing of its communities. Thus, the security imaginary can be understood as a specifically securitized understanding of the world mediated by threat and vulnerability. Stockdale argues inasmuch by noting that it is imagination that underpins the logic of pre-emptive security and states, "that any pre-emptive decision will be premised to a significant degree upon the exercise of the imagination" (2013, p. 146). The specific iterations of that vulnerability are interlaced with social and material relations over time - historically, the present, and in the expected future. Like all social imaginaries, they are embodied by and circulated through discourse, symbols, practices,

and materials. The security imaginary is a social and material expression of an insecure world and conditions the actual elements, including policy, that partially make up that world.

As social fields of representation and power, imaginaries are important for technology in that technology is a socially produced artefact rather than a tool strictly determined by instrumental need and reason (Müller 2015, p. 34). A specific technology's relationship to a field at the level of materiality is not pre-given, meaning that technology results from a particular technological imperative produced through specific meanings and practices (Davidshofer, Jeandesboz, and Ragazzi 2017, p. 207). Within security considerations, the development of technology is grounded in particular social, political, economic, and normative ideas that are embedded within frameworks of understanding linked to the state interests and ways of *being* secure in the world (e.g., see McCarthy 2021).

4.2. Threatening the Imagined North

The Arctic is a site of significant interest given its potential for generating a great deal of the earth's remaining extractive resources and the way it invokes a sense of wonder through its natural and atmospheric distinctiveness. Indeed, the Arctic is often remarked upon as a 'brave new world' in its frontier quality as *terra nullius* for human exploration, which has long been captured in adventure stories and has served as a metaphor to illustrate struggles of the human condition.

Likewise, the Arctic is often presented as a homogenized space divorced from history and the lived experiences of those who call the North home. Rather than serving the transition of space to *place*, these symbolic interventions reduce the Arctic from place to *space*, facilitating the conditions necessary for material exploitation by multiple and often competing interests

within struggles of meaning. This reductionist understanding of the Arctic is captured by Daniel Chartier concept of the "imagined North." The imagined North

> falls into differentiated imaginaries – the "North," Scandinavia, Greenland, the Arctic, the poles, even the winter – that are presented often as an amalgam supported by a simplification of forms – horizontality – and colours – white, pale blue, pink hues -, by the presence of ice, snow, and the complete range of cold, by moral and ethical values – solidarity -, but also, by its connection with a "beyond" where the Arctic begins, at the end of the European ecumene and the beginning of a "natural," unknown, empty, uninhabited, and remote world: the Far North. The entirety of these representations forms a system of signs, what I call here out of convenience "the imagined North" (Chartier 2018, p. 9-10).

For Chartier, the two dominant forces shaping the imagined North are Indigenous colonialism and the Arctic's administration by governments with capitals in the "South, who administrate according to their knowledge (seldom based on experience) and the circumstances of their own needs" (Chartier 2018, p. 11). However, a more robust conceptualization of the imagined North must also account for the significant changes enabled by climate change that mobilize specific forms of intervention (scientific, policy, military, and others) as a functional response to those changes. While the imagined North is de-historicized and defined through the intersection of "emptiness, immensity, and whiteness" that strips "the human experience of the territory" (Chartier 2018, p. 15), the Arctic in particular is also *futurized* through the fusion of these characteristics with vulnerability, specifically to the proliferation of global forces, including climate change (Dittmer et al. 2011, p. 2012). Futurizing the Arctic's as a social and political imaginary is not completely new as colonialist adventure narratives have fuelled the settler imagination since at least the late 19th but especially since early 20th century (see chapter 3). Indeed, the Arctic was imagined as the future home for settler expansion due to its array of natural resources and wealth. For example, Edward Shackleton, an explorer and son of another explorer, Ernest Shackleton, organized the 1934-35 Oxford University Ellesmere Island Expedition and stated to the Canadian Club in 1937 that Canada must ensure its possession over

the Arctic islands due to that mineral wealth ("North's Value is Stressed: Canada Urged to Make Sure of Possession of Arctic Islands," Globe and Mail, Oct. 26, 1937). Shackleton was further quoted as stating that

> Discoveries have been made of minerals like pitchblende […].[28] These could be worked by air, and the time will come – perhaps in 100 years – when it is only a few hours' flight from civilization.
>
> Therefore it is important Canada should own the land and these expeditions must go there to keep it warm for the future (ibid).

The colonial-future imaginary was deployed more bluntly in another Globe and Mail article published in the same year. As that piece argued,

> Millions of the white race some day will find an invigorating home in the Far North, a scientist about to embark on his fourth Arctic research trip predicted today.
>
> […] The vast expanse of the Arctic can and will in the future be occupied by millions of white people living in health and comfort ("Arctic Seen as Home for Future Millions," July 20, 1937).

Likewise, the Arctic was principally framed through this colonial imaginary towards the end of World War II as the source of Canada's future wealth and expansion as a nation, an *Arctic Eldorado* that was mischaracterized as a "'frozen waste' [and] useless and conquerable" (Davies, 1944, p. 79). As Davies further argued, "that the Arctic is difficult to win is granted. But not impossible" (1944, p. 79). Moreover, science is a key narrative vector of this imaginary insofar as it is understood to be the tool of conquest. On this point, Davies argued that "Science must be called upon to uncover the secrets of the Arctic. There is no financial profit here for individuals. But there is a challenge to the explorer, the scientist. Canada must stand the expense. The Northwest Passage will only be opened by science" (1944, p. 81). These excerpts are notable not

[28] Pitchblende (now called Uraninite) is a major ore of uranium and traces of other elements, including lead and helium. Historically, pitchblende was used in colouring ceramics into the mid-20th century, but is now mainly used for extracting uranium used in atomic weapons and the nuclear energy.

only for the obvious racist-colonial imagery merged with futurized notions of what the Arctic is (a 'vast expanse') and what it will become ('home for future white people'), but also for how epistemic actors (scientists) are deployed as voices of authority and who shape imaginaries through that authority.

Within a security lens, this futurized imaginary is defined by overlapping discourses and semiotic layers that produce the Arctic as a space requiring securitized forms of intervention and "structure the conditions of possibility for the management of future uncertain events, and the limits of potential intervention in the alleviation of future threats and dangers" (Salter 2019, p. 4-5). The Arctic's natural, unknown, and empty qualities as the imagined North lend themselves to a securitized understanding of space by which the Canadian state must respond given that its *de facto* sovereignty is threatened.

Consequently, the Arctic imaginary is produced through and relationally shapes the primary forms of governance and intervention practiced by states according to the 'circumstances of their own need.' The imaginary is therefore more than imaginative in a figurative sense; it is a knowledge matrix that forms a system of meaning that contours the parameters of sovereign control and intervention through the affective investment by various actors (Latham and Williams 2013, p. 13, 27). Indeed, in contrast to other scientific projects in the Arctic involving data, intelligence and technological development, the ADSA program and Canada's wider Arctic surveillance initiatives represent a more totalizing project, echoing Latham and William's argument that there is an "ambition to integrate and draw into its network *all* information and knowledge about the Arctic region in order to generate a totalized field of social power, or totalistic information and knowledge matrix over this space" (Latham & Williams, 2013, p. 13). The totalizing field of social power (according to Tester and Irniq,

following Sartre [1991]) is "in reference to a process whereby attempts are made to bring all aspects of life (spatial, temporal, social, and economic) into line with a dominant or overarching logic: in the case of Canada, that of a modern capitalist state committed to 'the idea of progress'" (as cited in Latham & Williams, 2013, p 27). Thus, while there are multiple semiotic systems of representation that mobilize a core set of symbols and signs towards different imaginaries, not all imaginaries are equal. Because these representations are invested with and through relations of power, imaginaries embody that power. Within security considerations, perceptions of threat occupy a defining line of imaginative intervention because they specifically allude to the future. Within a securitized imaginary, threats are constructed and mobilized through core thematic drivers of representation and understanding, where space is rendered in terms of its vulnerability. In turn, the future is *made* insecure through specific systems of meaning that directly condition the logic of sovereign intervention.

Current discourses and representations of the Arctic are overwhelmingly defined by the issue of climate change, which acts as a cognitive shortcut for region's transformation and our planet's environmental transformation more widely. Climate change is treated as a crucial, if not the first-order, source of *insecurity* in the Arctic (Greaves, 2016). Within the overall parameters of the state security framework, climate change features prominently in the general narrative as a driver of emergent security concerns given that the Arctic is warming at a rate faster than other areas of the planet (Richter-Menge, Druckenmiller, & Jeffries, 2019, p. 6). Rising temperatures resulting from anthropogenic climate change open travel routes and resource areas covered by thick layers of ice for a greater part of the year or are expected to in the not-too-distant future. Thus, global climate change is considered important insofar as it creates the conditions for potential exploitation by various national, sub-national, and international actors within state-

centric discourses and therefore threatens Canada's *de facto* sovereignty. Climate change is treated as an independent and exogenous variable that affects a host of dependent and interlinked Arctic-specific factors (such as temperature, ice density, and weather events) that, in turn, are precipitating new security threats to the state. Within the realm of 'high politics,' climate change acts as a mediating structural condition interlinked with the emerging international order, which support the potential return of great power rivalry in the region.

Apart from traditional security concerns involving military build-up and defence systems, other issues relevant towards Arctic security (and policy overall) are branded by the interaction of environmental and human protection and considerations for resource and infrastructural development, including trade routes. While climate change has been on the radar of the environmental movement for some time, it has only recently been employed as a *human* security issue (Cameron, 2012). Climate change is often evoked as a threat to human security in terms of the traditional livelihoods of Indigenous communities in the Arctic. Alternatively, climate change is also posited as an opportunity for Indigenous communities to include traditional knowledge in scientific research and decision-making while creating new economic opportunities to fuel social development through resource extraction. The seemingly contradictory possibilities stemming from climate change indicate the conflicting approaches towards Indigenous peoples in Canada as they become *objects* of security and *subjects* for development, both of which are controlled by the state. Within this policy framework, global warming is treated as having a direct but still exogenous relationship with human wellbeing and security. In particular, the state often reframes the link between human and environmental security as one of managing the more deleterious effects of climate change on northern communities in terms of their traditional lifestyles while at the same time attempting to balance

the goal of economic development through resource exploitation. Climate change occupies a paradoxical position as potentially *disabling* and *enabling* to human beings in general and northern Indigenous communities in particular. As a region, the "post-Arctic world" is conceptualized as a site of opportunity where the North emerges as a new centre of the globe, becoming "a literal '*medi*a-terranean' or an unfolding tragedy; an ominous '*end* of the Arctic'" (Zellen, 2013, pp. 342-343).

4.3. Securing the New Arctic

The Government of Canada recognizes the changes occurring in the Arctic and has contoured a securitized understanding of those changes. The Arctic's "splendid isolation" is currently threatened by centuries of anthropogenic industrial activity, producing a myriad of cascading effects centred on the rise of global average temperatures (Perkins 2013; Struzik 2020). As such, the Arctic has become a signifier for the deleterious effects of climate change, captured in the public imagination by melting ice caps and the suffering of ecologically displaced animals such as the polar bear. Indeed, within Oreskes and Conway's speculative account of the future, the polar bear may very well be the "dodo-bird of the twenty-first century" (2013, p. 47). This imaginary was recently deployed through a photograph of an emaciated polar bear seemingly wandering in starvation and despair across an "iceless land." Circulated by *National Geographic,* the *World Wildlife Fund* (WWF), and countless media outlets, the video and imagery quickly became viral in its reproduction. National Geographic evoked the threat of climate change as an imperilling force by stating that "this is what climate change looks like" (National Geographic, 2017). Here, the underlying values of the Arctic as pristine, untouched, and sacred are contrasted with the destructive forces of industrial exploitation; a lonely place of dying in a melting world.

The reality of this particular polar bear's tragic appearance was probably less to do with climate change directly and likely the result of her age and possibly cancer.[29] This example highlights the dominant representations codified within systems of meaning that are often divorced from reality and produced by and service the interests of those outside the Arctic region. Our dominant short hand for thinking about the Arctic is codified through layers of representation rooted in affect rather than necessarily being grounded in a purely objective and empirical structure like climate change, even when that structure partially elicits the affective response. By this, I am not suggesting that climate change is fictitious. From the perspective of climate science, anthropogenic climate change represents the potential for a radical climatic transformation in the Arctic and the rest of the world. Indeed, this change is characterized by the significant difference between the Arctic's pre-industrial form and what it will resemble in the future as predicted by current climatic trends, eventually culminating in the 'new Arctic.' The new Arctic is "a term used to capture the view that large changes observed in the Arctic climate system in recent decades are both dramatic and unlikely to reverse in the foreseeable future" (Dr. Christopher Fairall, Former PPP Steering Group Member, part of Year of Polar Prediction project [YOPP n.d.]). Within a security-based perspective, the new Arctic serves as an imaginary that represents a series of ongoing physical transformations that yield potential threats that may emerge in the near to distant future.

The ANPF (Government of Canada, 2019d) represents Canada's governance-oriented approach to defence and security that is often rhetorically practiced by the Trudeau Liberals, in which the concepts of building 'resilient' communities, 'robust' economies, and a 'sustainable'

[29] National Geographic updated the original article to reflect that it was impossible to ascertain that climate change was responsible for that particular bear's plight (Gibbens, 2017).

environment in the face of future challenges factor heavily into the overarching narrative of cooperation with local, regional, and international partners of the state. These narratives and partnerships are used to facilitate investment into technologies geared towards non-military security issues like search and rescue (SAR) operations, including surveillance technology.

In contrast, SSE (National Defence, 2017) and DRDC's S&T strategy interpret the risks posed by a dynamic international environment through the lens of defence and emphasize the need to enhance the state's adaptive capabilities to the global security environment while also building on the theme of resilience. DRDC in particular focuses on the role that technological innovation must play in preparing Canada for an uncertain future and highlights the Arctic and Canada's northern approaches as core operating environments and area of attention (2014, p. 13, 16).

The ANPF, DND and DRDC share a foundational understanding of the Arctic's ontological status but accentuate different aspects of the state's strategic outlook regarding Canada's interests. For example, the new Arctic imaginary is invoked within the ANPF's safety, security, and defence chapter, which characterizes the new Arctic in the following way:

> There is growing international interest and competition in the Canadian Arctic from state and non-state actors who seek to share in the region's rich natural resources and strategic position. This comes at a time where climate change, combined with advancements in technology, has made access to the region easier. While the Canadian Arctic has historically been — and continues to be — a region of stability and peace, growing competition and increased access brings safety and security challenges to which Canada must be ready to respond (Government of Canada, 2019d).

Similarly, SSE states that

> Climate change, combined with advancements in technology, is leading to an increasingly accessible Arctic. A decade ago, few states or firms had the ability to operate in the Arctic. Today, state and commercial actors from around the world seek to share in the longer-term benefits of an accessible Arctic. Over time, this interest is expected to generate a corresponding rise in commercial interest, research and tourism in and around Canada's northern territory. This rise in activity will also bring increased safety and

> security demands related to search and rescue and natural or man-made disasters to which Canada must be ready to respond (National Defence 2017, p. 51).

Climate change is presented as a threat multiplier in a quantitative sense in that it increases the scale of potentialities for the Arctic's exploitation in multiple capacities against Canada's interests and sovereignty. Lieutenant Colonel Mike Bielby, head of *J3 North America Surveillance and Control, Canadian Joint Operations Command,* is direct on the security issues understood to be pressing for Canada in the Arctic (Bielby 2019).[30] Building on the new Arctic's ontological foundation as an imaginary, maritime surveillance of these actors and the expected increase in Arctic traffic are of particular concern for Canada and especially the DND and CAF. LCol. Bielby argues that one of the critical challenges currently facing the successful monitoring of this traffic is the lack of diversity in the number and types of sensors in the region. Currently, the automatic identification system (AIS) for monitoring marine vessels, coupled with radar and satellite linkage (Satlink), can monitor vessels that conform to broadcasting an AIS signature. However, there are several gaps in current surveillance capabilities. Of particular note is that LCol. Bielby invokes the language of former US Secretary of Defense Donald Rumsfeld, where Canada is confronted with "known knowns," "known unknowns," and the most problematic, "unknown unknowns," due to the lack of sensors, sensor diversity, and weak surveillance capability in the Arctic more widely. Within this framework, "dark targets" constitute the most urgent threat to the DND and CAF in the region because they "are not picked up on sensors or cannot be identified" (Lackenbauer and Kikkert 2018, p. 25; see Bielby 2019, time 6:23).

[30] The conference was held on April 24, 2019, at the Royal Canadian Military Institute in Toronto, ON, in which I was an attendant. The conference programme can be found here: https://www.rcmi.org/Conference_flyer_P2.aspx. Quotations cited here are from my transcriptions of the presentation made from public uploads of the conference presentations on the RCMI's YouTube page found here: https://www.youtube.com/watch?v=UlWlmXQuI78.

Consequently, defence specialists and practitioners argue that there is a clear need to develop new technologies and methods that can locate and identify these objects, including combining sensor platforms through a system of systems approach into a "multi-sensor maritime domain awareness picture" (Lackenbauer and Kikkert 2018, p. 25). The threats associated with ‘unknown unknowns’ invoke a methodological need for mapping behaviours in terms of an actor's ‘patterns of life’ when individual events are disparate, unremarkable, and difficult to link with one another. This behaviour exists as below threshold activity or noise that may be otherwise treated as discrete and unimportant. However, when analyzed holistically, this series of behaviours may demonstrate an explicit security threat. An example presented in the proceedings of a defence roundtable on implementing Canada's Arctic priorities under SSE is illustrative of this securitized logic: "a small fishing vessel could be carrying a cruise missile or bringing in illegal foreign fighters" (Lackenbauer and Kikkert 2018, p. 25). The potential infiltration of overt security threats via these dark targets represents a Trojan Horse analogue made more dangerous through its decentralization into sub-components, which can infiltrate the state's sovereign space at different nodal points. Individual events may appear unexceptional when viewed independently but become more concerning from a risk-based perspective when examined holistically and relationally.

Strategically, this mode of securitized logic suggests that the state must extend its sovereign reach to anticipate and identify potential threats outside of its territorial borders. The extension of border practices is a crucial aspect of achieving Canada's Arctic goals identified within SSE. Lackenbauer and Kikkert state that Canada needs to be "pushing the borders outward" and that "[d]efence, safety, and security requirements dictate that Canada and its allies must detect, track, and identify vessels when they leave a foreign port and operate in Canada's

EEZ, not just when they enter into Canada's territorial sea (12 nautical miles from the cost or our straight baselines)" (2018, p. 21, 24). The notion of pushing borders outward highlights the dual process of rationalization by the state towards sovereign control over its northern boundaries. The state is simultaneously trying to consolidate its capacity and powers of regulation over its territorial boundaries while expanding and 'pushing out' its sovereign power through security practices. DRDC emphasises a similar theme and the role of technological development in their S&T strategy, which states that "the CAF also require additional time and space to react to threats, for example by extending sensor coverage as far away as possible from our forces and leveraging automation and stand-off capacity of CAF weapon systems" (2014, p. 15). Pushing sovereignty outward therefore embodies both spatial and temporal characteristics via technologically mediated practices of surveillance and intelligence, which are combined to form techniques of sensing. Sensing is a crucial state-led technique of sovereign power for providing situational awareness (SA), which according to the Canadian Government's *Arctic Integrating Concept,*

> provides the Government with the ability to perceive the physical (maritime, land, air, and space) and non-physical (cyber and human) domains. It also allows for the fusion, evaluation, and dissemination of that information. In the Defence context, SA capabilities are associated with the *Sense function*, which includes surveillance, reconnaissance, and monitoring. Combined, their products are processes to provide intelligence, which can be used to inform decision-making (Government of Canada 2010b, p. 30, my emphasis).

The federal government is not explicit in its conceptualization of the *sense function*. However, we can extrapolate its meaning in spirit by the government's emphasis on surveillance and intelligence as a by-product of that surveillance. For the modern context, sensing alludes to the need for a fluid combination of surveillance information with other data sets and the ability to translate that data assemblage into a coherent intelligence picture suitable for human decision-

making. Surveillance technology is especially appealing through its dual-use capabilities, which involve applying technology to civilian and military goals. Additionally, technological development embodies an economic dimension in which these technologies are both fiscally conservative and economically productive in their own right through the procurement of Canadian businesses and expertise. Modern surveillance technologies, including satellites, underwater sensors, drones, radar, among other platforms embody more potential in terms of their productivity relative to the development of militarized systems exclusively. Moreover, surveillance and intelligence systems may be more acceptable to a domestic audience in that the benefits of their security function do not provoke political resistance the way that kinetic military systems might, especially if they are deployed on domestic soil. Perhaps more importantly, surveillance technologies theoretically allow the state to perform security remotely, digitally, and minimally across a spectrum of requirements while reducing the risk of provoking escalation (see Byers & Covey, 2019).

Table 4.1. Sensing for dynamic situational awareness

Sensing	**Spatial**	**Temporal**
SURVEILLANCE	Illumination (visible, non-visible) of environments, objects	Historical data, persistent coverage
INTELLIGENCE	Data on events, objects, making correlations	'Patterns of life' analysis, predicting behaviour, generating 'heat maps’

Thus, technology-enabled surveillance and imaging are envisioned as core features of expanding and consolidating the state's sovereign power in the Arctic. In particular, "as globalization erased traditional concepts of time and space, making borders porous and encouraging continental integration, *national sovereignty was reshaped* and the power of

national governments to control events reduced" (Dean, Lackenbauer & Lajeunesse 2014, p. 24, my emphasis). The growing porousness of borders renders states vulnerable to several emerging threats, including the smuggling of goods (drugs, humans, and even freshwater); the spread of new and exotic diseases (biothreats); and ecological disasters related to the extraction of natural resources (mainly hydrocarbons) (Huebert, Lackenbauer, & Ferris 2012, 396). Projecting security through a risk framework socially "preoccupied [with] the future" (Beck, 1992, p. 21) creates the potential for a much more comprehensive range and volume of threats in the form of *potentialities* (Amoore 2013; Coker 2009), especially as national sovereignty is reshaped and the state's control over its borders and territories are challenged.

The increasing salience of risk as a framing mechanism for security practices is a more recent thematic turn and signals the influence of actuarial management and insurance schematics on security, the unknown unknowns of the more *distant* future, which is amply demonstrated for policy concern in the Arctic as a security theatre. Commenting on the post-9/11 security environment, Lackenbauer argues that "recent laments reflect a new alarmism: urgent action is again necessary because Canada's paltry capabilities are insufficient to project control over Arctic lands and waters at a time when our sovereignty is *likely* to be challenged. In a break with past practice, this latest sovereignty crisis is in anticipation of what *may* lie ahead" (Lackenbauer 2011, p. 80, original emphasis). Likewise, Grant argues that in the future, "increasing competition for the region's resources *could* become a divisive factor if accompanied by a threat to authority over adjacent waters" (Grant 2016, p. 29, my emphasis). This potential future, enabled by climate change and melting ice, makes Canada vulnerable to loss of *de facto* control over its territorial borders and the adjacent waters (Grant 2016, p. 30).

Arctic security in the modern era is bound with futurity because threats that undermine the state's sovereignty are considered as potentialities rather than clear and present dangers. While the term 'threat' already implies that which *may* happen rather than what *will*, the nature of those threats as potentialities are spatially and temporally expanded. However, in order to counter them, the state must pre-emptively act in the present. Beck's risk society is intimately bound with climate change as rising temperatures are producing, in literal terms, uninsurable risks (e.g., see Armstrong 2019). The risk associated with these multifaceted threats to materialize is projected farther into the future, but the threat to the state's sovereignty offers a sense of immediacy to the Arctic's security in the present. For instance, former Prime Minister Stephen Harper drew explicitly from this Arctic imaginary by insisting that, in an often-cited passage, Canadians in the 22nd - century demand action in the 21st and that Canada was at risk of "losing" the Arctic if it did not "use" it (Dodds 2012, p. 994).

4.4. Pre-emption, threat, sensing

Imaginaries are symbolic and representational iterations of space that also embrace particular ontological foundations. For instance, Arctic imaginaries are often shaped by positivist interpretations of a world that can be rationalized through processes of knowledge creation and control imposed from the outside. However, the new Arctic imaginary is more than a system of semiotic representation and is directly contoured by an understanding of the world through the framework of risk, which is shaping security-oriented discourse and policy decisions. Hence, these foundations inform the ontological nature of threat within the Arctic's future. The ontological foundation of the world has been modified within a risk-based framework from an ontology of 'what is' to an ontology of 'what could be.' Framing the Arctic as a vulnerable site threatened by actors in the future has become a central focus for the DND and CAF in

combination with other defence analysts. For example, analysts have considered Arctic security through the Canada-US (CANUS) *Security Threat Matrix* (see fig. 4.1.). Importantly, this framework is not representative of official Canadian policy and may be misleading to the degree that it prioritizes conventional security threats. However, it remains essential as an example of risk-based security thinking reproduced and circulated within Canada and the United States in recent years.[31] This framework was developed out of a CANUS conference in 2017 led by the Centre for Resilient Communities at the University of Idaho, the National Maritime Integration Office, and DND/CAF personnel (Bielby 2019, 5:13; see Alesssa et al. 2017, 2018). The CANUS Threat Matrix is similar to the CANUS Combined Threat Assessment 2011-2031 framework, which is intended to "[highlight' for decision-makers the CANSUS [...] security environment that may emerge during the next 20 years" (Government of Canada 2017a; see fig. 4.2.). Within the CANUS matrix, threats exist on a continuum of danger in which the riskiest of threats are those "unknown unknowns" that have yet to be conceived or anticipated in any coherent way.

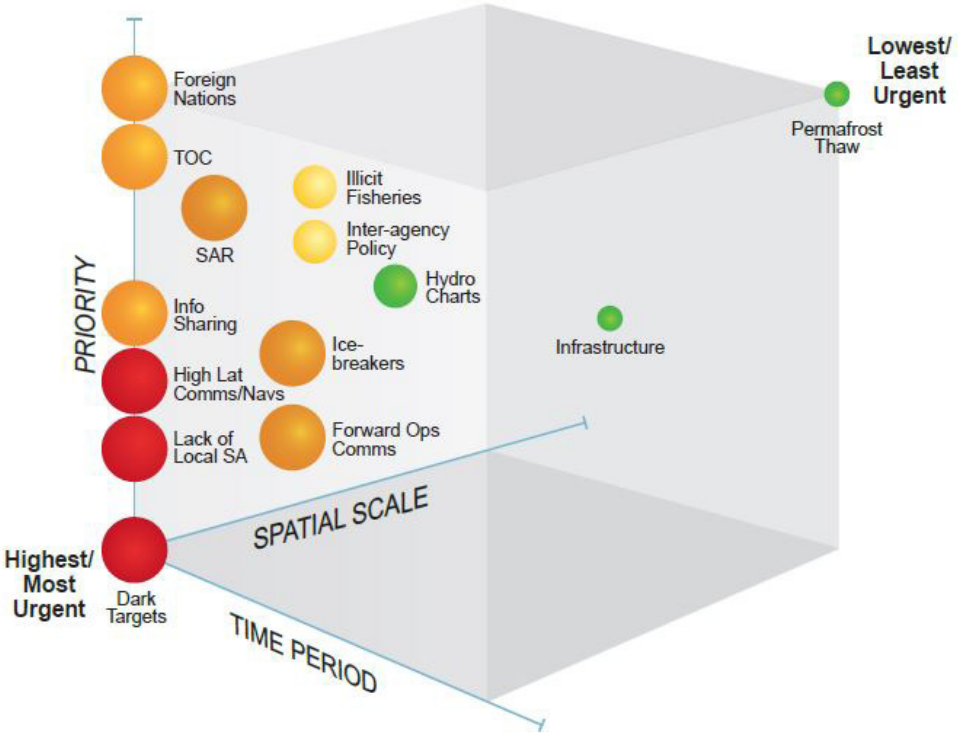


Figure 4.1. CANUS Security Threats Matrix – Arctic; Cube framework for representing Emerging Arctic Threats from the EyesNorth QED Workshop held in 2017 (Alessa et al. 2017 cited in Bielby, 2019, time: 5:14; and in Alessa et al., 2018).

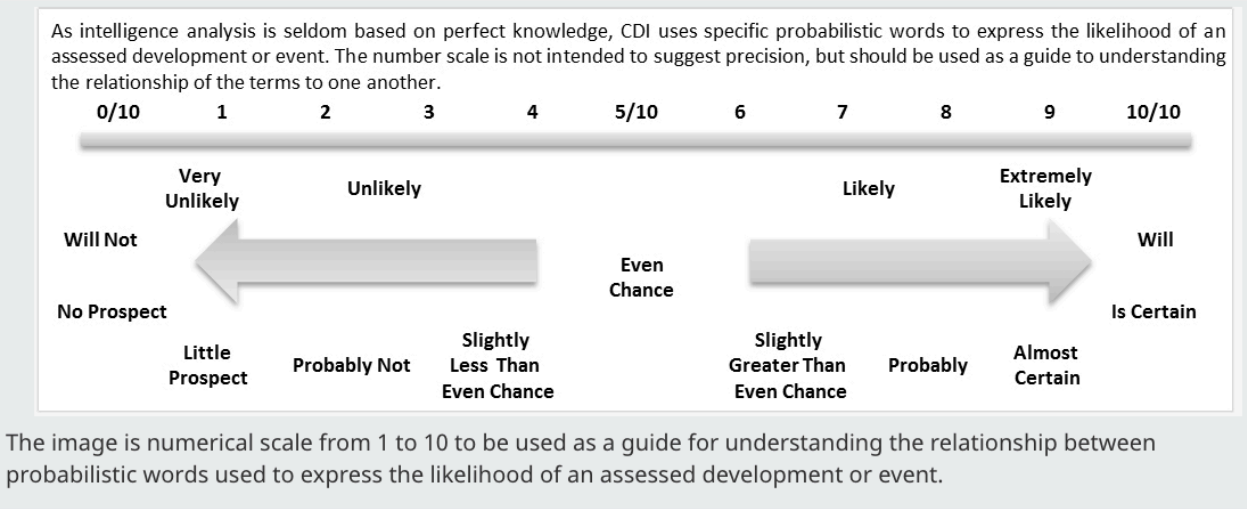


Figure 4.2. Threat Probability Scale (Government of Canada, 2017)

Conceptualizing threats and combatting them in this way lends themselves to a pre-emptive strategy of governance. Importantly, this strategy shares a Cold War logic of anticipation supported by game-theoretic analysis, despite the failure of that logic and international relations more generally to anticipate the dissolution of the Soviet Union and other radical shifts in the international system at the time (Gaddis 1992; see Belletto 2009; and Erickson 2010 for discussions on the cultural and ideological role of game theory, rationalist analysis, and scientists/mathematicians during the Cold War). In simple terms, the goal of pre-emptive security using game theory and risk analysis is to capture disparate data points across time and space in order to anticipate offensive movements increasingly farther into the future (e.g., see Bier & Azaiez 2008; Cox 2009). However, subtle differences exist between mobilizing anticipatory practices towards *prevention* and *pre-emption*. According to Merriam-Webster, pre-empting is to "seize upon to the exclusion of others" and "to prevent from happening or taking place." Specifically, pre-empting involves displacing or taking precedence over something before someone else does, whereas preventing is to stop that something from happening at all. As Massumi explains, prevention "assumes an ability to assess threats empirically and identify their causes" whereas pre-emption is an epistemology "of *uncertainty*" in which "threat is still indeterminately in potential" (2015, p. 5, 9, original emphasis). Accordingly, there is an important distinction between the two, especially in their verb forms. Whereas prevention as an activity aims to stop something from occurring, pre-emption is an activity that is about control and appropriates that something *before* other actors do. This distinction has significant implications for the practice of state power as an expression of sovereignty. For Massumi, while prevention and pre-emption are related because they both "[operate] in the present on a future

threat" (2015, p. 9), they differ ontologically. Preventative thinking is ontologically rooted in "an objectively knowable world in which uncertainty is a function of a lack of information, and in which events run a predictable, linear course from cause to effect" (2015, 5). In contrast, the ontology of pre-emption indicates that threats "cannot be specified" as a consequence of their *being* within a limitless pre-existence (Massumi 2015, p. 9).

In an objectively knowable world, where threats are understood through linear cause and effect relationships within a bounded system, perfect information is theoretically achievable, and therefore prevention is possible. Conceptualizing and preventing threats is reductionist and mechanistic within a Newtonian worldview. In contrast, the new Arctic imaginary is characteristic of a world within an *unbounded* system (spatially and temporally) of relationality that cannot be reduced to individual components because there is an underlying affective quality to these relationships (demonstrating a certain resonance with assemblage thinking), indicating that they are always in flux, including their potential. Prevention becomes difficult, if not impossible because prevention's practical application depends on objective knowledge that can only be obtained through complete information, which cannot be obtained in the context of a distant future populated by endless variables. Consequently, this information can only be obtained once a threat has revealed itself in full force as a present-time object or event, at which point it is too late. The consequence of this inability to prevent threats from emergence is a reliance on techniques of sensing to pre-emptively halt their emergence into a fully formed threat or to mitigate threat effects by controlling the environment. Theoretically, the state seeks to (re)assert its *de facto* sovereignty by monopolizing situational awareness through sensing – to know everything that can be known and to make empirical predictions about that which cannot, i.e., the future.

The state's reliance on sensing as a mode of sovereign pre-emption resembles David Chandler's argument concerning the Anthropocene, where "Anthropocene ontopolitics seeks to govern in the face of the loss of modernist epistemological assumptions: governing thereby seeks to adapt or respond to the world rather than seeking to control or direct it" (2018, p. 21).[32] According to Chandler, modernization is no longer concerned with increasing our control over the world (as was the mastery of nature with industrial power). Rather, modernization is now about increasing our knowledge of the world to adapt to the conditions of the Anthropocene itself. As Chandler states, climate change has "removed humans from the centre of [our] conceptual world [...] "The Anthropocene thus entails us to think 'after failure,' 'after progress,' 'after the end of the world'" (2018, p. 12-13). The transition to sensing as a mode of governance is the preferred method of adaptation and, according to Chandler, represents a transition from strategies of *Mapping* because the ontology of sensing is flatter, meaning that it is not concerned with causation so much as it is concerned with *correlation*. Sensing as a practice is related to the rise of the "resilience" discourses in that "Sensing accepts that little can be done to prevent problems" (Chandler, 2018, p. 88), indicating that states and communities must learn to deal with those problems. For problems that seem increasingly complex and unavoidable, "Sensing seeks to work on how relational understandings can help in the present" (Chandler 2018, 89), including in terms of eliciting a governance strategy of security against the future.

The loss of control over our world, and the struggle to reassert the state's dominance in it, is why surveillance practices are so intimately bound up with contemporary understandings of security. Increasingly sophisticated sensing technologies are necessary to capture large data sets

[32] The themes of adaptation and resilience to environmental change within the status quo of capitalist development are readily apparent in current research on geoengineering as a form of 'climate intervention.'

and to rationalize of them into comprehensible notions of the world and to understand what they may say about our current vulnerabilities to future conditions. The ontology of pre-emption requires thinking outside linear relationships because of the nature of future threats, which escape clear pathways of emergence.

Consequently, to take concrete steps towards providing security in the present against future threats, defence practitioners must account for aspects outside of an objective, knowable world since the future is inherently unknowable. Accounting for the possible future is where the role of imagination comes into play, not as an unrestricted foray outside of an objective world, but one in which that world is uncoupled from both spatial and temporal linearity and reassembled into an unlimited set of potentialities. The objective qualities gleaned from the world (or 'data points') act as limiters to those potentialities in terms of their *probabilities* (what is likely to happen, rendered as a rationalized numeric figure) but do not limit possibility in an absolute sense as a potentiality that *cannot* happen.

Indeed, 9/11 pointed for many a ‘failure of imagination’ by the US intelligence community as the reason for their inability to anticipate the terrorist attacks. However, evidence produced in the 9/11 post-mortem suggests that ample signs indicated the potential for a terrorist attack of this scale had the national security institutions looked in the right places and made the right connections (Atran 2013; Hoover 2013). Following the 'failure of imagination' to prevent disasters like 9/11, surveillance has become an essential practice for collecting data points about the objective world and reassembling them into creative projections about the future. Hence, providing situational awareness is a critical strategic concern of defence practitioners and part of Canada's *Arctic Integrating Concept* because the number of variables in play, including the number of actors, Canada’s extensive geography, and the Arctic’s natural environment, “makes

it difficult to anticipate *what* events are going to happen – and, equally important, *when*" (Huebert and Lackenbauer 2016, 155).

Having outlined how the new Arctic is shaped by an understanding of the world rooted in a particular ontological foundation of relationality and complexity, this chapter now considers particular technologies designed to rationalize this complexity into actionable intelligence for decision making. Specifically, I examine the two relational practices associated with sensing, namely surveillance and intelligence, by illustrating their logic within current space-based and intelligence technologies designed to enhance Arctic situational awareness.

4.5. Sensing Technology

As chapter 3 demonstrated, there are multiple large-scale Arctic surveillance programs and projects currently in practice or under development within Canada. The role of technologically mediated sensing practices within a governance strategy of pre-emption is illustrated by focusing on two interrelated areas of policy and technological development: space-based surveillance and maritime intelligence.

Space is a critical domain for surveillance and communications satellites, especially as the internet of things (IoT) grows and the number of networked technologies increases several-fold. Consequently, it is not surprising that there are several satellite projects in development for surveillance-based purposes (e.g., see Boucher 2018, 2019; LeBlanc 2018; National Defence 2019b; SpaceWatch Global 2019). Satellite imagery is also a key source of information concerning environmental phenomena, such as ice density and iceberg movements, and for measuring broader environmental trends occurring in the Arctic due to climate change (e.g., see figure 4.3). However, just as the Arctic has been portrayed as a space requiring state control to protect Canada's sovereignty for decades, satellites have been understood to form a core aspect

of any potential surveillance network for some time. For instance, discussions in the 1980s reflected the often-repeated worry of relying on US capabilities to control Canada's air space. As argued at the time, "In the era of ballistic missiles and supersonic jets, military satellites would improve the Forces' ability to communicate with units in the field" and that while partnerships with allies were important, Liberal Defence Minister Jean-Jacques Blais stated that "we must identify special areas of expertise we can control…so we can ensure Canadian sovereignty" (Globe and Mail, July 31, 1984). Accordingly, the themes of awareness, sovereignty, control, and supporting the Arctic's integration into contemporary channels of communication and access through technological development demonstrate a particular consistency with current iterations.

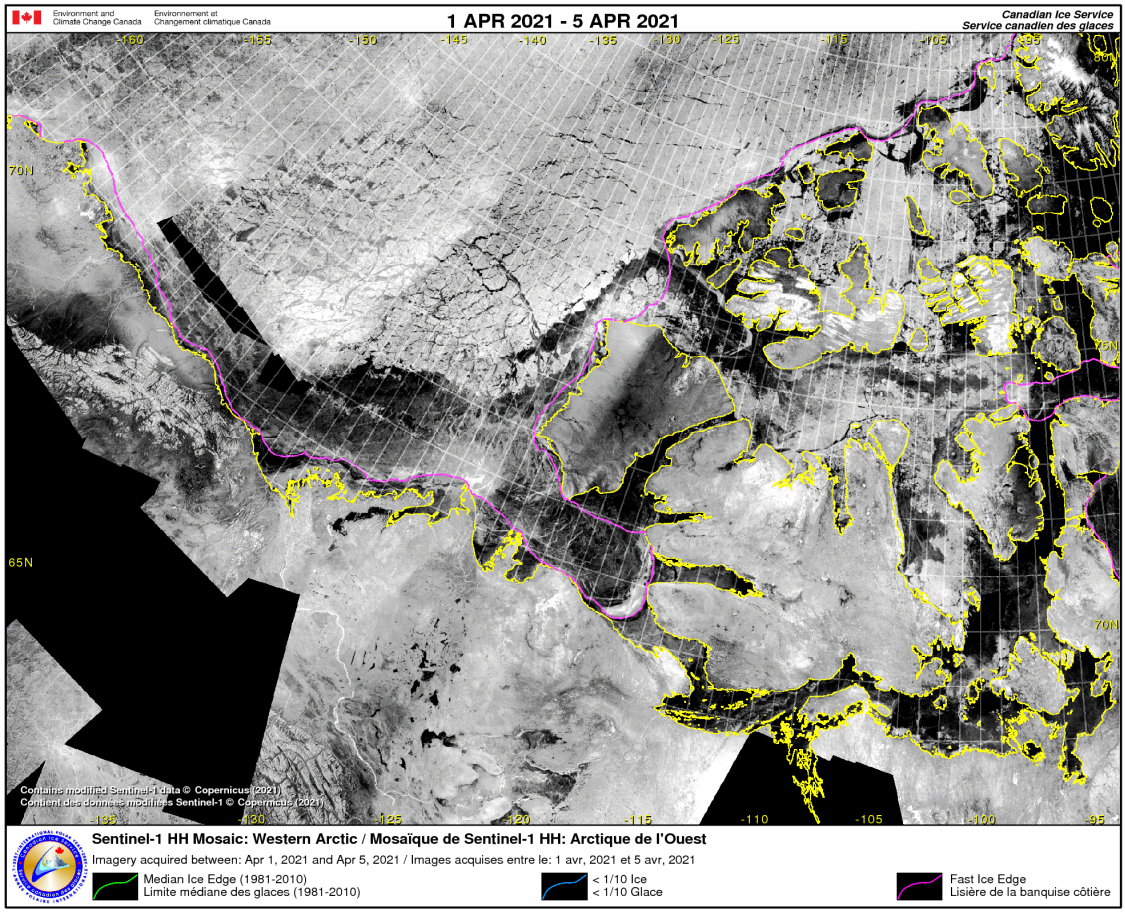


Figure 4.3.RADARSAT Mosaic Western Arctic, Imagery acquired between 1 April and 5 April 2021 (at least partially composed of Sentinel-1 data due to the transition from RADARSAT-II to RCM (Government of Canada, *RADARSAT Mosaics,* April 2021).

While supporting ecological and environmental monitoring from a scientific perspective, these surveillance functions also support monitoring human-made infrastructure and activities in the Arctic, such as fishing and ports of entry. For instance, the RADARSAT series of satellites are produced through Government, academic and industry partnerships. The original RADARSAT was envisioned as an environmental surveillance satellite for the Arctic rather than strictly military, although "Because of its technical parameters, Mr. Oberle [then federal Science and Technology Minister] stressed that Radarsat is not a spy satellite. But he didn't rule out the possibility that data collected on ships in Arctic waters would be passed on to the military" (Surtees, 1987). The current RADARSAT satellite, Constellation Mission (RCM), can capture global imagery, day or night, in all weather conditions and allow for the rapid generation of image-based products (Canadian Space Agency 2013, 2014).[33] The monitoring of ecological phenomena, such as ice-sheet flows, has important practical uses given the navigational requirements of marine travel. The most direct security-related function of RCM is the active sensing of the Arctic's marine traffic. Active sensing is defined by DND as "a capability which can detect non-cooperative or non-emitting vessels" (Horn 2018, p. 3) and is different from passive sensing insofar as it is designed to detect vessels which do not broadcast an AIS signature and who may be attempting to "evade detection for illicit purposes" (Horn 2018, p. 3).

[33] RADARSAT-1 was launched in 1995, and the most recent satellite is RADARSAT-constellation [RCM], launched in 2019 as the successor to RADARSAT-2. The RADARSAT series of satellites is arguably the most prominent Canadian-owned satellites being used for Arctic surveillance, but the use of RCM and its predecessors has not been limited to the Arctic region and have formed part of the EU's own marine and border surveillance regimes (Boscila, 2016; MDA, 2016). Like the reproduction and deployment of the specific logics and technologies that underpin current Arctic surveillance initiatives across broader border management practices.

Enhancing surveillance capacity is only one aspect of sensing as a practice for building a complete situational awareness picture in the Arctic. The ability to visually represent space offers a partial resolution and is useful insofar as it can guide actual decision-making through intelligence analysis. Consequently, as a practice of pre-emption, sensing involves the assemblage of visualization with other data that enables the production of a dynamic situational awareness picture of space. Sensor platforms are increasingly able to both sense and *identify* matter in a discriminatory fashion and predict an object's "pattern of life" through algorithmic modelling. Pattern of life modelling theoretically analyzes an actor's behaviour and combines it with identifying characteristics such as a ship's automatic identifying signature, or lack thereof, and collates this data using artificial intelligence (AI) and machine learning.[34] This awareness can then be used to make predictions about an actor's future behaviour within a risk-based perspective attuned to the emergence of threats (see Kim et al. 2020; and Yuan and Nara 2015 for technical discussion on pattern of life modelling).

Canada's ultimate goal through Arctic-based technological research is to develop "tools and advice for improved effectiveness and greater situational awareness through integrated

[34] While often used interchangeably in popular discourse, AI and machine learning are related but not the same thing. Machine learning is a branch of AI that Tom M. Mitchell (Professor at the Machine Learning Department at Carnegie Mellon University) defines as striving to answer the following question: "How can we build computer systems that automatically improve with experience, and what are the fundamental laws that govern all learning processes?" (Iriondo, 2018). Simply, machine learning is one of the multiple possible ways to improve AI and is routinely used in commercial applications (such as in media streaming recommendations and targeted advertisements). Machine learning has several potential applications to security practices that are being actively explored by defence agencies, with the automation of weapons systems arguably being the most prominent in policy and academic debate. In contrast to both, deep learning may be generally described as an evolved form of machine learning where an algorithm can autonomously change to improve its performance without any human intervention and is modelled after biological neural networks within the brain. Google's DeepMind *AlphaGo* program is one of the most widely cited examples of a functional deep learning algorithm in which the program was designed and then continuously learned to play the abstract game Go. Go is a simple game in terms of rules but highly complex in terms of nuanced strategies that (like chess) lends itself well to human strategic reasoning. However, Google's DeepMind beat a professional Go player in 2016 and is now, according to Google parent company Alphabet, "arguably the strongest Go player in history" (DeepMind, N.D.).

intelligence, surveillance and reconnaissance (ISR) capabilities, including networked sensors with a shared operational picture" (National Defence 2019a, p. 7). Within maritime security, this means, according to Horn, that “it is not sufficient to just develop and employ additional sensing capabilities. Future maritime Command and Control (C2) systems will have to support the processing and exploitation of greater quantities, varieties, and more complex information” (Horn, 2018, p. 4). Information exploitation will include the integration of a greater range and quantity of official ship-based information, including the *Long-Range Identification Tracking* (LRIT) and *Automatic Identification System* (AIS) data, which is automatically detected, integrated and disseminated by satellite and land-based transponders operated by the Canadian Coast Guard (Government of Canada 2019). The LRIT and AIS were designed by the International Maritime Organization (IMO) and are governed by the IMO’s *International Convention for the Safety of Life at Sea*. Ship identification markers are being combined with global positioning data housed by the Royal Canadian Navy (RCN) within the Global Position Warehouse (GPW), "a database which archives ship position reports which were processed by the Navy command and control system" (Horn 2018, p. 5). These data points are then further assembled with other data sets from multiple sensing platforms in creative and complex ways to understand the patterns of life displayed by ship behaviour. Patterns of life analysis, for example, can theoretically be used to predict ship transportation routes and predictively model ship locations using automated machine learning algorithms that include historical fishing, geographic, transportation, among other data sets (Horn 2018, p. 8-10).

A more concrete example is provided by RADARSAT developer MDL, Inc., which is responsible for an algorithmic intelligence tool used for marine awareness and developed for the *Arctic Maritime Awareness for Safety and Security* (AMASS) program. This tool, named

BlueHawk, is a threat-intelligence product that uses surveillance data of the maritime domain from multiple land, sea, and space-based sensors to create an intelligence picture that identifies threatening objects, ranging from ships to environmental disasters. BlueHawk attempts to answer the following questions for a user: “Where are the vessels in my area of interest? Which vessels don’t want to be seen? Which vessels are potential threats? Have there been any oil spills in my area of interest? What else is happening in my area of interest?” (Buffet et al. 2017).

BlueHawk is explicitly marketed towards "sovereignty protection," with MDA stating that

> BlueHawk™ detects naval vessels encroaching on or transiting Exclusive Economic Zones, territorial waters, or controlled areas. Satellite radar detects *dark targets* (vessels operating with all electronics and self-reporting turned off), which may be indicative of illegal activities or threats. Operating far beyond the range of patrol aircraft, MDA BlueHawk™ can detect dark targets *globally* (MDA 2020a, my emphasis; see figures 4.4 and 4.5).

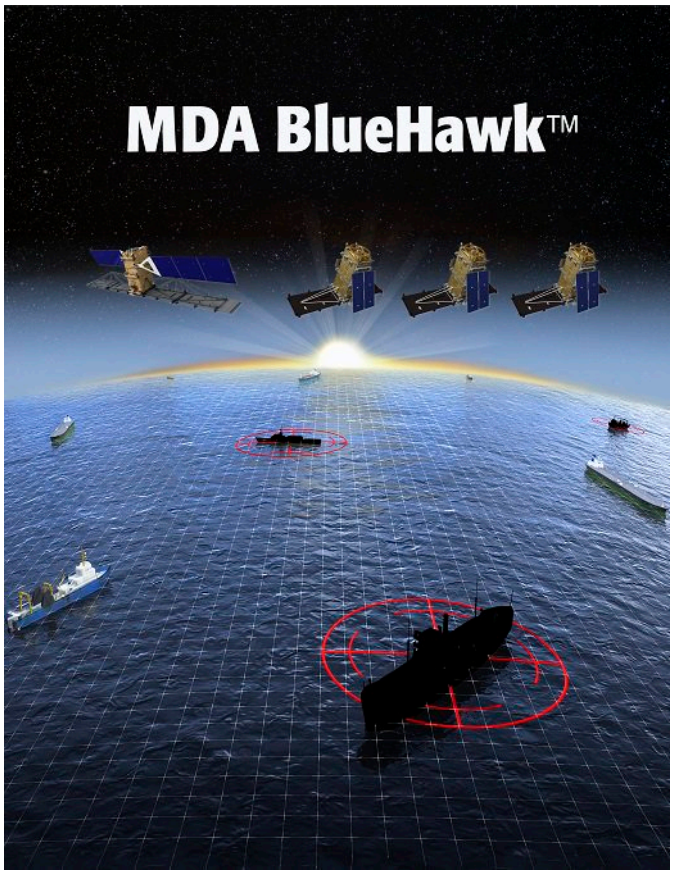


Figure 4.4. MDA BlueHawk advertisement (Twitter: https://twitter.com/MDA_space/status/1067182750833278982/photo/1)

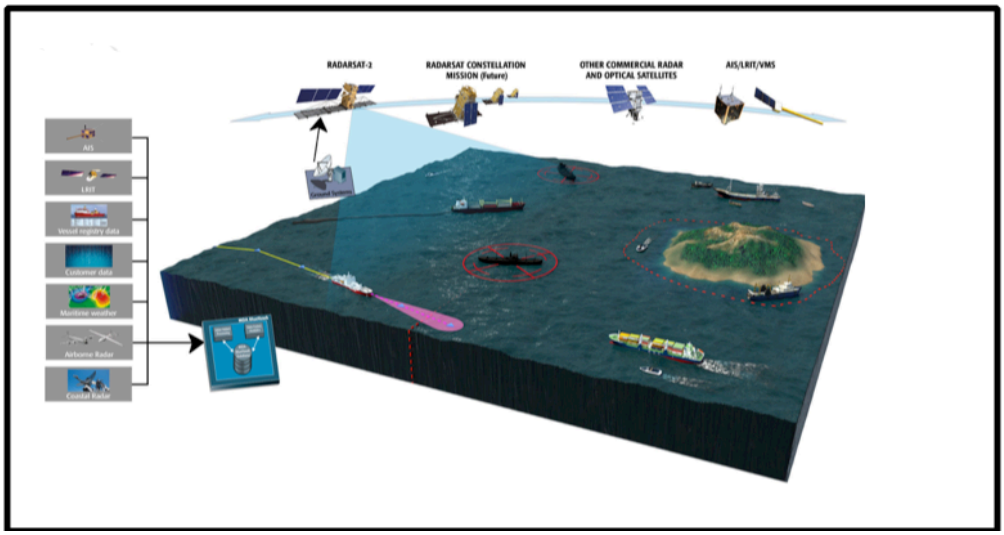


Figure 4.5. MDA BlueHawk Interactive Map (MDA, 2020b).

Figure 4.4. embodies much of the same imagery which McTaggart spoke of in 1937 (see the opening quotation of this chapter). The 'midnight' or rising sun figures prominently in the image's centre as time and space are collapsed through MDA's very literal surveillance assemblage of satellite and ship-based sensors (figure 4.5). BlueHawk's marketing use of dark targets (again, literally portrayed as dark with beaming read crosshairs overlayed) indicates how threat images are shaped and reproduced across multiple fields and how their symbolic features shape the actual development of technologically mediated security practices. Dark targets are the conceptual embodiment of threats within an unbounded system stripped of spatial and temporal limitations as they can emerge anywhere and anytime. Within the AMASS program, MDA has been developing an interface designed to augment BlueHawk that allows for the automated 'scraping' of publicly available data, which can be interlaced with BlueHawk data created from the MDA developed RADARSAT Constellation Mission satellites. MDA's algorithmic scraper

is named "Kiliutaq" (ᑭᓪᓗᐅᑕᖅ), a traditional Inuit name meaning “woman's instrument in the form of a bowl for scraping and softening skins and removing dirt from clothes; *scraper*; grater” (Nunavimmiut Collections Institute, n.d., my emphasis). Rather than a traditional tool, Kiliutaq is a digital scraper that enables the creation of data cards for individual ships that can be augmented using scraped data from the internet and linking that data to geographic positions using open-source resources, like the GeoNames database (Buffet et al. 2017, 15).[35]

The combination of space-based surveillance and marine intelligence technologies can be understood as an example of how security, as an expression of sovereign power, is assembled digitally and materially via diffuse systems. Further, this combination demonstrates how state power is dilated outward by drawing from the global assemblage of data information that, according to the MDA product description for BlueHawk, allows states to “[detect] maritime threats as far from shore as possible” (MDA 2020). Global threats to the Arctic and the state more broadly are deployed as an affective force requiring the expansion of security outward (spatially and temporally) to mitigate and adapt to those threats. Conceptually, this points to the notion of pushing sovereignty outward as a sovereign technique of pre-emptive power. Research and development efforts focused on the innovation of technology are oriented towards modernizing the Arctic through the state's ability to watch over and enforce its sovereign power at the 'gaps and seams’ of its northern territory, which include an awareness of threats emerging outside of Canada’s national borders. The notion of states extending their power beyond the limits of their territories is clearly not new, but the idea of ‘pushing out’ sovereignty does indicate novel forms and techniques of state power in the form of defence and security efforts.

[35] The GeoNames database is a free downloadable database of geographic data for over 25 million geographical names (available at https://www.geonames.org/).

As the next chapter will demonstrate, these efforts strive to go beyond the ‘edge of awareness’ on a global scale.

4.6. Conclusion

Imaginaries are produced by the discursive and symbolic signifiers that contour our perception of the world and are world-making as political fields of action. In the case of the Arctic, its imaginative quality is shaped explicitly as a colonial space of representation and intervention. While other research demonstrates the Arctic's characterization as a de-historicized space that is often reduced to essentialist portrayals of those symbolic qualities, these accounts have not considered in detail the Arctic as a futurized imaginary. The 'new Arctic' builds on the region's essentialist qualities and reformats our understanding of the Arctic in its political orientation. Within the new Arctic imaginary, various discourses and representations are mobilized to indicate the Arctic's significance under rising global temperatures and how a lack of de facto state authority is combined with these changes to produce several security challenges for Canada in the future. The 'new Arctic,' as defined through layers of epistemic practices, discourses, and other symbolic indicators, enjoys an instrumental relation to technological development in that changes within the Arctic are incentivizing new technologies premised on specific forms of governance and intervention. However, while technological development for Arctic surveillance and security must be historically situated within a long line of efforts spanning the 20th century, current efforts are only possible within the broader social and political context of the security landscape. This landscape may be characterized as a political moment underpinned by a risk-based future that defines the post-9/11 imagination and is supported by the state's broader shift in strategic thinking. Importantly, this shift in strategic thinking indicates the need to create and integrate as many sensors as possible for all domain awareness and

information dominance, where the Arctic is but one regional theatre within a connected and globalized battlefield environment (see Budning, Wilner and Cote 2021). In light of these issues, a strictly instrumental and linear account of technology offers a one-sided understanding of the current focus on Arctic sensing capabilities. While scientific advancement shapes new technologies and, in turn, may transform the social and institutional logic (including of security and warfare) by which states produce their policies, they have never done so unilaterally or unidirectionally. Instead, as the new Arctic demonstrates, technology results from relational processes made up of instrumental and ideational qualities, indicating that technology's relationship to the world is as much political as it is material.

Imaginaries also amount to more than representation and reproduce relations of power that circumscribe dominant understandings of the world. Consequently, the new Arctic is shaping the forms of state intervention and governance being considered by the Canadian government. Building on Massumi, Chandler, and others, this chapter has argued that the Arctic is a region considered within a relational worldview premised on complexity and risk, which makes future threats increasingly challenging to predict. Consequently, the Arctic as a futurized imaginary requires techniques of sovereign power and governance that can make sense of this environment. These techniques are dependent on technological innovation related to advances in sensing capability predicated on artificial intelligence applications because the sheer complexity of this environment overwhelms human cognition. This chapter demonstrates how the new Arctic is shaping the development of sensing technologies designed for sovereign enforcement through the example of space-based surveillance capabilities and the use of intelligence applications like the BlueHawk product. These offer only a minor example of a much larger trend in defence thinking and technological development centred on the integration of sensor

architectures across the globe within an explicit concern for pre-emptively governing against the future.

Further, this chapter demonstrates how imaginaries embody creative thinking as a productive force and shape material developments. Imaginaries are not neutral or objective qualities of a world external to our own understanding and relationship to it. Importantly, how we understand the world often comes at the expense of other considerations and ways of knowing outside of dominant ontological assumptions and epistemological practices. In turn, this may limit the ability of those who call the North home to shape their emerging realities and build a more sustainable, resilient, and secure Arctic future. The next chapter engages with the world-spanning component of Arctic surveillance efforts in greater detail and theorizes these efforts in relation to their desired outcome for the future of Arctic security.

CHAPTER 5: THE FUTURE OF ARCTIC SECURITY

> War contracts all the more into the cut, even as the power intensity of its machinery increases with growing connectedness, and the scale of its potential battlespace integrations tends to planetary dimensions (Massumi, 2015, p.147).

5. INTRODUCTION

The previous chapter examined how the Arctic is constructed as a vulnerable space requiring securitized intervention to defend Canada's sovereign claims in the region. Within this imaginary, the Arctic is increasingly exposed to a network of cascading threats emanating on a global scale. Drawing on earlier technological efforts to increase the state's surveillance capacity, Canada is pursuing a research and development strategy that will support its ability to pre-emptively extend its sovereign power through the assemblage of layered surveillance and intelligence networks. Broadly, these acts of sensing are designed to collapse space and time and manipulate the environmental conditions of threat emergence or, in military parlance, to control the theatre conditions of a battlefield environment. The Arctic is, of course, not a literal battlefield. However, the Arctic is being approached within a securitized lens that increasingly frames the nature of threat in the future tense (the new Arctic). Constructing threats of the immediate and distant future is an imaginative and political endeavour as the new Arctic partly shapes research and procurement initiatives for technological development.

Given the importance of the future Arctic to current defence and security thinking, this chapter engages with contemporary discussions and considers the theoretical, political, and ethical dimensions of this framework. Broadly, the chapter seeks to advance these discussions beyond the conventional military-strategic framework by focusing more emphatically on the philosophical and ethical dimensions of these issues and their policy implications. Specifically,

contemporary military-strategic arguments often promote the need for a systematic and globalized sensing grid based on algorithmic technology to pre-emptively neutralize threats of various states of development (from those that already exist to those that may exist in the future) in the gaps and seams of activity. The gaps and seams of activity refer to the ephemeral nodes of shape-shifting networks and the environments those shifting networks occupy and interact with to produce actual lifeworld conditions (as Massumi states, "War contracts all the more into the cut"). Gridding is necessary to create a homogenized view of space and time to produce a standardized situational awareness of territory in the same way cartography homogenizes the planet's curvature through mathematical superimposition onto flat planes for navigation. Situational awareness of the Arctic may be understood as the result of surveillance and intelligence practices, which are not discrete actions. Instead, surveillance and intelligence practices are integrated and indivisible through their material connections and reciprocity as mutually constitutive actions by the state. Situational awareness is accomplished through sensing, which broadly concerns the detection and perception of actors and their environments, including an actor's anticipated behaviour within that environment. Thus, sensing as a technique of state power involves both a spatial and temporal dimension.

I argue that gridding the Arctic (and indeed, the planet) in these homogenized spatial terms for situational awareness and securing territory represents a radical reorientation of state sovereignty as a practice of state power. Moreover, *globalizing* sensing technologies (in the sense that they actively contribute to the expansion and datafication of the planet rather than simply reflecting trends in globalization in a passive sense) represent a radical political reorientation of the world. While research within globalization and security studies have repeatedly noted the increasingly expansive scope of security practices towards "planetary

dimension" (Massumi, 2015, p. 147), current state-led efforts represent the potential for transforming these abilities and practices as epitomized by research in quantum mechanics.

More pointedly, this chapter considers how the physical and electronic domains are enveloped in Canada's Arctic sovereignty concerns through sensing technologies and practices. Canada's efforts towards pushing the boundaries of technological development for sensing can be understood as the desire to achieve *full-spectral dominance* and reflects the state's desire to rationalize and consolidate its power over the Arctic's expansive territory and forms of life (as sensing is acutely more biopolitical than surveillance alone). Spectral dominance refers to the state's desire to control environments and manipulate the conditions of emergence at the ephemeral nodes of intersection in the "cuts" of those environments in as much as it refers to the ability to produce a complete image of a territory's spectral composition. Thus, full-spectral dominance conceptually refers to the strategic and material dimension of situational awareness as a tool and practice of sovereign power.

This chapter proceeds as follows. It begins with an overview of recent federal interest in technological development for sensing capabilities. Notably, these capabilities are not limited to military systems and capture the true dynamism of dual-use technologies, especially for environmental monitoring. The chapter then reviews the current strategic emphasis by Canada and other states on the global security environment's complexity and the globalization of pre-emptive warfare as a response to this complexity. Following Massumi, the potentially 'planetary dimensions' of the battle space are made relevant to the Arctic through a discussion of the region's relevance to North American defence and the need for NORAD modernization given the advancement of weapons delivery systems. Thus, the Arctic's system complexity is rendered through the intersection of its natural and dynamically changing environment with the shifting

nature of geopolitical conflict and war-making capacities among non-traditional actors, such as terrorists and criminals. This chapter argues that this complexity is a political orientation to the world, an orientation that quantum sensing technology may be uniquely responsive towards in a practical sense. Hence, the chapter offers a discussion of Canada's emphasis on quantum R&D for defensive and economic reasons, which are not mutually exclusive, and warns that framing the Arctic in terms of systems complexity and responding to it through the management of complex systems using sensing and AI-based technologies (perhaps eventually enhanced through quantum R&D) is itself a form of world-building, and thus privileges some worlds at the expense of others.[36]

5.1. Making *sense* of the Arctic

Canada's interest in leveraging technological development toward consolidating its sovereign power in the Arctic has waxed and waned since at least the early 20th century. The most recent episode of this interest began in the mid-2000s, but particularly around the turn of the decade as Canada's concern for sovereignty was emphasized through a framework of advancing defence through scientific research and technological innovation. Importantly, in this era, the issue of 'situational awareness' found a more emphatic connection to Arctic security and governance. As the Harper government then stated:

> The Government of Canada and Defence require an accurate and timely security picture and comprehensive situational awareness and threat knowledge for Canada and abroad. This program will provide credible, reliable, and sustained intelligence services to Defence in support of decision making and military operations, as well as support to

[36] This observation on world-building follows Gordon's insight that "The AI technology at work here, subsymbolic AI, works by processing signal strength and by pattern recognition, recursively parsing data for multiple possible realities with multiple possible futures, to foreclose some futures and privilege others" (2021, p. 582).

> other government departments (OGD) in the defence and security of Canada (Treasury Board of Canada Secretariat, 2009).

An explicit focus is on securing the national interest through situational awareness, optimally pursued through technological investment and advantage, "particularly in the security realm" (Treasury Board of Canada Secretariat, 2009). There is also a clear continuity between the Harper era and current Arctic surveillance initiatives pursued through the ADSA and other programs, particularly as technological innovation relates to intelligence products that contribute toward the visualization and rationalization of Canada's Arctic territory. Scientific practices of imaging, mapping, and charting are designed to illuminate the full range of spectrums and sub-spectrums, which are also productive in delineating the state's territorial boundaries through these visual products. These boundaries are technical and material in that they encompass the Arctic's diverse physical geography, but they also overlap with other state objectives pursued within regional governance and international legal regimes. For example, a key technological project to come out of the Harper era was project *Cornerstone*, which procured the development and utilization of autonomous underwater vehicles (AUV) and localized sensors through the Canadian firm *Omnitech Electronics.* The purpose of this AUV was to contribute to the surveying and mapping under-ice territory within Canada's extended economic zone (EEZ), which was included in the state's submission to UNCLOS (Treasury Board of Canada Secretariat, 2009; Omnitech Electronics, 2012). As Powell points out, "[m]aping territory allows for the completion of the epistemic project of the nation" (2017, p. 28). Project *Cornerstone* demonstrates how the security field is not only contoured by explicit defence concerns but is co-constituted through economic considerations and legal regimes that holistically make up the complex of sovereignty, in addition to sovereignty's epistemic production through technical and scientific practices. Sensing technologies and the mediated practices they support are developed through the complex of

sovereignty but also support the completion of that complex as a material artifact; sovereignty and nationhood are never-ending and co-constituted projects with their own gravity. The protection of state sovereignty invokes a rhetorical link to security, where technological development and techno-mediated practices of sovereignty like imaging, mapping, and charting support the state's ability to *know* and control its territory. These practices are a functional expression of sovereignty, but scientific and other epistemic practices are also symbolically enveloped in the production of sovereignty and mediate the state's functional relationship to its territory. Indeed, scientific practices have significantly influenced Canada's historical claims to the Arctic (Sowards, 2017). Sowards points to the Canadian Arctic Expedition of 1913-1918 in expanding "Canadian territory and remov[ing] ignorance and thus "[s]cience had served the state beneficently" (2017, p. 165). The use of scientific practices by the state to expand its knowledge of and claims to territory continues to be used, including for military purposes that may be hindered by the Arctic's unique environmental and atmospheric conditions (see earlier chapters). For example, if ionospheric scintillation in the Arctic can affect GPS and communications networks, then understanding the solar-terrestrial system and mapping pockets of scintillation have direct implications for the use and development of C4I (command, control, communication, computers, intelligence) systems. Notably, Canadian and other modern militaries rely upon C4 systems for operation, especially under the networked organizational logic within 'dispersed' battlespaces (Couillard et al., 2016; Niva, 2013).

DND's interest in environmental sensor data indicates one component of Canada's Arctic surveillance and intelligence strategy. This strategy directly engages with civilian actors in both commercial and public institutions to partially source the development of new technologies and leverage civilian data networks, thereby supporting the production of an all-domain image of the

Arctic composed of layered sensor data. Accordingly, the private sector is a "key partner," along with other government departments (OGDs) and academic institutions for developing "[s]urveillance solutions." According to the federal government, these surveillance solutions "will support the Government of Canada's ability to exercise sovereignty in the North and will provide a greater whole-of-government awareness of safety and security issues, transportation and commercial activity in Canada's Arctic" (Defence Research and Development Canada, 2017, p. 2). Departments such as the Natural Science and Engineering Research Council (NSERC) are critical actors in delivering research grants that aim to

> capitalize on the complementary research and development capacity existing in the universities and in DND in order to generate new knowledge and support the development and application of dual-use technologies in selected areas of interest to both DND and NSERC; build strong two-and three-way linkages and create synergy between researchers in DND and universities and the private sector; achieve the efficient and effective transfer of research results and technology to identified receptors in the public and the private sector (Defence Research and Development Canada, 2017, p. 3).

The marketized vocabulary of 'synergy,' 'efficiency,' and technological 'transfer points' underpin the growing salience of 'dual-use' technologies as a logic of development. Developing new dual-use technologies (generally meaning to encompass civilian and military uses) and repurposing existing technologies for defence use are concurrent goals. Under the ADSA program, Canada, through DRDC

> seeks to leverage the development of its technologies, whether developed in-house or via procurement processes, and enable technology transfer through licensing and other mechanisms. Such technology transfer activity aims to enhance Canada's Security and Defence industry, enabling economic development and ensuring Canadian industrial capabilities to meet the supply chain requirements of the CAF (Defence Research and Development Canada, 2017, p. 4).

The integration of private and public research institutions through procurement into the ADSA program, along with the development of novel forms of security technologies, underscores Canada's Arctic security strategy and its relationship to sovereignty. This strategy employs

specific techniques of state power premised on extending state authority outward spatially and temporally through webs of actors and technologies. There are two broad pathways identified for technological development under Arctic surveillance initiatives: evolutionary and those that are *revolutionary* (McKinnon, 2016). The former build on existing surveillance technologies (such as radar) while adapting them to the specific technical needs of the Arctic environment within the state's security requirements. The latter stream finds symmetries with wider revolutionary gaps demonstrated through advances in economic production systems and their organizational logic, specifically in their post-industrial networked 'system of systems' character (McKinnon, 2016, p. 13). Within the ADSA program and other state-led efforts, there is an interest in developing technologies that can manipulate and 'peer through the fog' of space and time using the widest range of visible (the three wavelengths captured by traditional cameras as red (R)-green (G)-blue (B) assemblages) and spectral (electromagnetic spectrums outside of R-G-B wavelengths) imaging technologies. Ultimately, the goal is to combine these technologies through multiple surveillance capacities into a layered 'system of systems.' In principle, networked 'system of systems' layering can eliminate the 'gaps and seams' of existing surveillance capacities that a threatening actor could exploit. In terms of sensing, there is an explicit effort to utilize and develop technologies related to hyperspectral identification (the ability to identify objects, specific materials, and practices) that are currently used to identify natural resource deposits such as oil and certain minerals. Overall, the 'systems of systems' surveillance and intelligence network envisioned in the Arctic has the twin goals of monitoring and predicting the 'patterns of life' of various actors (including individuals, groups, ships, and weapons systems) to allocate state resources efficiently. Assembling disparate sensors and data sets into a networked system of imaging and intelligence production resembles the 'just in time'

methods of post-Fordist production chains that enable the mapping of production against demand indicators, coalescing into a final commodity unit that is comparatively cost-effective, efficient, and adaptable to change relative to a centralized production structure. The surveillance supply chain is produced through a decentralized network of suppliers and other actors while producing a near real-time image of the Arctic and its dynamic conditions. For example, sensing practices relay the sovereign eye through a human-machine interface found on board any number of stations, including on ships within and outside the Arctic space. This interface is being developed through Lockheed Martin's work towards building 'command and surveillance system integrator capability' through its *Combat Management System 330* (CMS 330) onboard the new Irving-built Arctic and Offshore Patrol Ships (AOPS) (see figures 21 and 22). The AOPS are important for integrating with recent techno-surveillance efforts, where Lockheed Martin is responsible for surveillance, and intelligence platform (the CMS 330) and Irving is responsible for the actual construction of the ice-capable ships. The CMS includes a Human-Machine Interface, Sensor adaptation, and Information System Access to the Defence Wide Area Network and Consolidated Secret Network Infrastructure, which enable data collection, storage, processing, and ultimately 'situational awareness' through data fusion regimes relayed through command stations (see figure 5.5 below). Under these conditions, surveillance nodal points are collated and layered in different ways over different points in time and space, allowing Canada to consolidate its power through the state's control of these practices and the assembled surveillance product, thereby *producing* the Arctic as secure and sovereign.

Figure 5.5. Lockheed Martin CMS 330 (Lockheed Martin, 2020b).

5.2. Towards Planetary Awareness

The acceleration of globalization may be the defining characteristic of international politics in the post-Cold War world as information and communications technologies, along with an increase in migratory practices and networks of capital and trade, became more pronounced. Indeed, Manuel Castells' (1999) famous conceptualization of the 'space of flows' captures the spirit of space and time as entangled and dynamic entities that abstract the dependence of social practice on territorial contiguity through material infrastructures and electronic systems. This deterritorialization of social activity creates several implications for state sovereignty as a social practice and material artifact of state power (especially regarding the materiality of borders and state practices that partially define those borders). As Sassen (1996, p. 29-30) argues forcefully, while "[s]overeignty and territory […] remain key features of the international system […] they have been reconstituted and partly displaced onto other institutional arenas outside the state and outside the framework of nationalized territory" (as cited in Sassen, 2012, p. 118). For Wendy Brown (2010), the proliferation of border walls with similar attributes across the world signals

the tension between globalization and the *raison d'état* of Westphalian sovereignty. Brown argues that

> What we have come to call a globalized world harbors fundamental tensions between opening and barricading, fusion and partition, erasure and reinscription. These tensions materialize as increasingly liberalized borders, on the one hand, and the devolution of unprecedented funds, energies, and technologies to border fortification, on the other (2010, p. 7-8).

While sympathetic to Brown's argument that states are struggling to assert sovereignty in a globalized, post-territorial world, Jones and Johnson (2016) are skeptical of the implications for sovereignty. Instead, this re-articulation emphasizes expanding sovereign power, including but outside of "crossing-points" into the "in-between" spaces (Jones and Johnson, 2016, p.188). In their view, border technologies are being expanded towards the effect of reaching *total* awareness rather than limiting that awareness to specific border sites, thereby approximating more closely Foucault's notion of the *perfect* sovereign. These in-between spaces are horizontally and vertically oriented, with the latter particularly important to current security technologies. As Jones and Johnson argue, "[w]ith the advent of drones, ground-penetrating radar deployed to detect tunnels and other technologies that extend the state's border gaze vertically, the territoriality of borders is now more than ever a question of *volume* rather than area or point (Elden 2013b as cited in 2016, p. 188, original emphasis). Likewise, this volumetric quality is represented in the strategic goal of projecting a battlefield vertically through aerial technologies like drones (Kendall, 2017, p. 93). The horizontal and vertical spread of sovereignty through the magnitude increase in the availability and use of security and surveillance technologies fuels and is fuelled by the closer integration of military, civilian, and policy spheres. The security-defensive sphere, in particular, frames itself as needing to adequately react to the proliferation of security threats inherent to globalization. Thus, the vertical and horizontal

spread of sovereignty is partly a defensive reaction to these threats, which has taken on a militarized-civilian character that is difficult to parse.

Much research and literature have examined the increasingly globalized nature of security and warfare from different perspectives. From a military-strategic standpoint, globalization has wrought a multitude of complex forces that escape easy encapsulation and are advancing at an increasingly rapid scale, resulting in the increased prevalence of 'grey zone' and 'hybrid' conflicts (National Defence, 2017, p. 52).[37] National security strategies, including Canada's, have adopted this globalized and de-territorialized view of complexity in the strategic environment, in many ways replicating the flat ontology of assemblage and actor-network theory (see chapter 1). As Canada's defence strategy white paper, *Strong, Secure, Engaged* states, "[t]he characteristics of conflict have changed significantly over the last 10 years – from the underlying causes to the actors involved and their methods of warfare" (2017, p. 52; see pp. 52-57). In the

[37] Characterizing modern conflict as hybridized is a catch-all that differentiates these conflicts from those of the past. Hybrid threats, war and warfare, often used interchangeably (Mälksoo 2018), are discussed primarily in policy and military-strategic-based pieces of literature while only recently becoming a focus of attention for academic theorization within International Relations and security studies. The policy and military-strategy-based literature consider hybridity as an evolving form of conflict that takes on particular qualities depending on its use in time and space. Consequently, defining hybrid threats and conflict is problematic as hybrid threats, war and warfare are conceptually ambiguous. Oğuz identifies Robert G. Walker as the first author to use the term 'hybrid warfare' in 1998, who defined it as "lying in the interstices between special and conventional warfare" (2016: 166). While there are multiple and sometimes conflicting definitions, hybrid threats and war/fare are generally characterized by the combination of regular or conventional capabilities with irregular techniques, such as criminal and guerilla tactics within a coordinated field of activity (Maj. Davis Jr., 2013). Threats and war fighting are considered 'hybrid' because they do not employ one capability or strategy in lieu of another but combine them as 'force multipliers' that create asymmetric and multimodal campaigns. Overall, the policy and military works of literature treat hybrid warfare in a technical-instrumental manner that implicitly or explicitly understands hybridity in a functionalist sense, i.e., as an evolutionary step in war fighting predicated on technological development and the redistribution of capabilities (the evolution from 4th generation war to hybrid war, for example). These evolutionary steps are considered "warfare points" that are inflection points predicated on technological leaps, changing the structural reality of war fighting capabilities and possibilities. The replacement of horses with tanks and the introduction of nuclear weapons are examples of these warfare points. In this sense, the literature is essentially realist in that the game (or structure) has not changed, only who gets to play and how the game is played. Along with this theme of understanding war as constantly superficially changing within a stable environment (anarchy), some authors critique the 'newness' of hybridity and note that war fighting has always been composed of hybridized capabilities and approaches (Wilkie 2009). In addition, its analytical value has been called into question due to its broad and ill-defined usage as a term that can seemingly describe any set of practices as potentially in service of war-fighting efforts.

words of National Defence, this “complexity and unpredictability” also “puts a premium on deep knowledge and understanding,” creating a need to “develop sophisticated awareness of the information and operating environment and the human dimension of conflict to better predict and respond to crises” (2017, p. 57).

From a more critical angle, the internationalization of security and warfare takes on a particular character in the post-Cold War world, especially as economic and political liberalism was advanced as a global project, in many cases by force. Indeed, for Dillon and Reid (2009), it is the particular ethos of the liberal way of war pursued through biopolitical acts designed to protect specific forms of life and, in their terms, makes those forms of life *live* that distinguishes the liberal way of war form earlier eras and from conventional interpretations of geopolitical struggle. Equally, the global effort of US-led western powers to control emergent forms of political, social, and economic life is reflected in the material deployment of novel security technologies, including those that emphasize the biopolitical management of populations.

From the first Gulf War onward, global security embraced a hyper-stylized, media-saturated, and techno-fetishistic character centred on collapsing the proximity of distance and time for how states practice warfare and interpret its effects (see Baudrillard, 1995; Der Derian, 2009). Of great contemporary interest, the ethos and practices of pre-emptive security and their technological form are acutely represented in the visage of drone warfare (Stockdale, 2013). As Bousquet forcefully shows through his scientific and technological genealogy, the computer vision that makes drone warfare possible historically emerged through "the Renaissance's invention of linear perspective [which] laid the foundations of a new architecture of control" (2018, p. 191). Moreover, the militarized nature of this computer vision has become global in its assemblage and orientation such that "A martial gaze roams our planet, from the watchful

satellites peering down from their silent orbits to the infrasonic sensors probits its subterranean and subaquatic depths. Our contemporary condition is rapidly converging on a globalized targeting capable of tracking and eliminating an entity wherever it is found" (Bousquet, 2018, p. 191). In many ways, this global targeting system is the material representation of the totalizing ethos that became more emphatically embraced by the United States and other militaries in the late 20th and early 21st centuries. Specifically, full-*spectrum* dominance was the much-vaunted terminology promoted by the United States' overwhelming military superiority across the range of physical and electromagnetic domains relative to existing and potential adversaries, aptly displayed during the first Gulf War between 1990 and 1991. This superiority and its production achieved through the "revolution in military affairs" were somewhat undermined in actual 21st-century theatres of conflict.[38] However, in principle, full-spectrum dominance as a strategic rationale is concerned with the integration of military operations in order to 'overwhelm' and 'deny' an enemy the opportunity to operate in a conflict.[39] From a more critical vantage point, full-spectrum dominance is an ideology that, in principle, is designed to project US power everywhere, or in Shaw's words, to transform the 'Predator Empire' into "a global condition" (2016, p. 23). Like Shaw, Gregory (2011) has encapsulated the planetary scale of modern conflict in his notion of the *everywhere war*. For Gregory, the post-9/11 preoccupation with

[38] The difference between the discourse and reality of the "revolution in military affairs" was revealed by journalistic accounts of the Iraq war. Gregory notes that "this triumphalist view looked very different to observers on the ground, where one reporter discovered that the image of techno-supremacy was replaced by 'an unsung corps of geeks improvising as they went, cobbling together a remarkable system from a hodgepodge of military-built networking technology, off the-shelf gear, miles of Ethernet cable, and commercial software.' During two weeks in the war zone, he added, 'I never heard anyone mention the Revolution in Military Affairs'" (Davis, 2003 as cited in 2010, p. 268).

[39] The US Department of Defence originally defined "full-spectrum superiority" as "[t]he cumulative effect of dominance in the air, land, maritime, and space domains and information environment that permits the conduct of joint operations without effective opposition or prohibitive interference" (Department of Defense, 2001, p. 220).

Afghanistan and Iraq as battlefronts minimizes the scale at which the United States and its allies engage in conflict across the planet in multiple domains and through multiple capacities (for instance, through air dominance and ground support using allied warlord militias in Afghanistan) (Gregory, 2011, p. 239). Gregory's everywhere war, following Duffield, is premised on "borderlands as 'imagined geographical space'" and "in mapping these borderlands – which are also shadowlands, spaces that enter European and American imaginaries in phantasmatic form, barely known but vividly imagined – we jibe against the limits of cartographic and so of geopolitical reason" (Gregory, 2011, p. 239). These borderlands are increasingly planetary in scope, and their categorization as places of security is blurred because the distinction between red and green zones becomes muted in a "thoroughly militarised landscape saturated in varying intensities of brown (khaki)" (Gregory, 2011, p 239). Late modern war's 'eventful' quality stems from the perpetual threat of violence as a punctuation of everyday existence and its ability to be practiced and experienced at any place and at any time through multiple means. Thus, the planetary integration of defensive capabilities is more than the extension of those capabilities outward through geographic amorphism. Instead, planetary integration is an imagined borderland saturated with securitized and militarized relationships mediated by particular technologies, practices, ideas, and aesthetics (see Ghertner, McFann and Goldstein, 2020).

Recent national defensive strategies reflect a reorientation to this blurriness and the realities of trying to isolate conflict and threats ‘over there’ away from the homeland. Full-spectrum dominance of these isolated battlespaces is not enough, nor is it possible when that battlespace becomes *environmental* on a global front (Massumi, 2015, p. 200). In contrast to earlier efforts, recent security strategies of the United States and its allies reflect a reorientation of their defensive-offensive calculus. Strategic vision has long understood a state’s defence as

supported by robust offensive capabilities, particularly as the logic of pre-emption became entangled with national defence.[40] However, recent strategic efforts among major states demonstrate a pronounced emphasis on building defensive capabilities through enhanced sensing technologies that rationalize space and time by monopolizing the power of awareness. Being aware is more than knowing the topographical characteristics of geography and extends to understanding the behaviour of that topography and its materials, their agencies (whether intentional or motivational – see chapter 1) and so forth. I deploy the term full-*spectral* dominance to signal this reorientation and its emphasis on developing imaging and intelligence technologies. Military and state interest in these types of technologies are not entirely new. However, given the complexity and difficulty of managing the proliferation of intersecting threats emerging in the world, there is a growing emphasis on leveraging and developing new technologies to strengthen state control over territory through the full exploitation of the visible and non-visible spectrum. Possessing this ability allows states to render space visible and knowable in real-time and *future* time through dynamic situational awareness.

Full-spectral dominance, conceptually, points towards Canada's goal of exploiting the full range of spectrums to intimately understand the Arctic's 'patterns of life,' which stands in contrast to a kinetically orientated notion of control (such as through advanced weapons systems underpinning a monopoly of force and legitimate violence). Again, emphasizing technological progress as a means of state control is not new, and states have always been concerned with

[40] Pre-emptive security challenges the notion of sovereignty as an inviolable right of *all* states if their ability to act as a power container is called into question; i.e., the ability to meet the *obligations* of sovereignty. Foreign intervention (whether humanitarian, military, or otherwise) is legitimated through the relatively novel lens of 'contingent sovereignty' (Kendall, 2017).

sensing borderland frontiers in times of war and peace. Nonetheless, the emphasis on surveillance and intelligence in late-modern war is uniquely linked to technologies produced through a specific biopolitical understanding of how to govern in a globalized world. There is a significant and expanded panoptic logic underpinning full-spectral dominance, particularly in its machinic and technologized form.

DeLanda identified this logic in other techno-mediated processes, such as machine vision (1991, p. 204). However, panopticism does not adequately capture the degree to which sensing is amplified and performed through modern technologies or envisioned as a practice. Whereas the panopticon as a metaphorical model of surveillance visualizes a lone perspective through a singular agent (human or otherwise) and point of observation (the guard tower) expanding outward like a cone (radially, horizontally, and vertically), full-spectral dominance alludes to much more because it magnifies the perspectives (and agents) *ad infinitum*. These multiple and potentially unlimited perspectives are collapsed into each other through a relation-less space since there is no perspective *per se*. Liljefor, following Paul Virilio, calls this *omnivoyance* and likens it to blindness because of the loss of perspective and horizon, thereby challenging the notion that techno-vision approaches 'god-like' powers because subject and object cannot be divided. As Liljefor argues, using the example of how military drones affect the behaviours of populations, "[t]he omnivoyant gaze […] shapes the world it examines, and, therefore, it will always observe a distorted world. This is in itself a form of blindness" (2019, p. 131). Omnivoyance captures the strategic rationale of full-spectral dominance, driving the current emphasis on sensing requirements and the need for augmented sensing capabilities through advanced technology. It is precisely the omnivoyant rationale driving military faith and interest in quantum (see below) for its potential to radically multiply these perspectives (including but

not limited to visualization) and the computing power needed to process and reassemble them into actionable views of the world.

This omnivoyant logic drives modern surveillance and intelligence practices and is framed through a lens of risk reduction and fiscal conservatism, given the limited budget of Canada's defence spending. The overall goal of Canada is to assert its northern sovereignty through territorial rationalization. The Arctic is illuminated and inscribed with meaning through economized and technologically mediated sensing practices. In turn, sensing produces sovereignty as an ontological reality of the state via its *de facto* control of those technologies and the potentially endless streams of sensing data. Moreover, this control is additive to the symbolic aspect of those practices (as a feature of sovereign authority and what states are expected to do – i.e., control). Concerning the use of technology, the simultaneous production and practice of sovereignty echo Benjamin Bratt's claim that "[s]ensing begets sovereignty" and that sensors are effective "agents of sovereignty at the same time that a state's sovereignty authorizes the sensor's agency. Today, a sensor senses on behalf of the state that it helps sense into being" (as cited by Parry, 2019, p. 896). In effect, sovereignty (in both a de facto and a signalling capacity) and state authority are rendered visible through sensing practices. Acts of sensing create a 'footprint' supporting normative claims to territory by the state and enable the simultaneous production and defence of Arctic sovereignty through the expression of sovereign power.

Full-spectral dominance should not be understood as an existing feature of state capacity or power (nor is it an official defence term embraced by the United States military, unlike full-spectrum dominance). Instead, full-spectral dominance is a strategic rationale motivating the defensive activities of Canada and its allies (particularly the United States), who want to develop and project this power in the future. As a technique of state power, the goal of full-spectral

dominance is to illuminate a space in order to deny unsanctioned activity in that space rather than the absolute control over a battle environment spanning the physical and electronic domains (see Shaw, 2016, p. 4 for a fuller discussion of full-spectrum dominance). As Shaw puts it, within the US military definition of full-spectrum dominance, security is provided by creating enclosures of control that buffer an inside (safe) space from the outside (dangerous) environment (such as a house in a gated community or Israel's Iron Dome) (Shaw, 2016, p. 4). Full-spectral dominance is not antithetical to full-spectrum dominance. However, like the difference between prevention and pre-emption (see chapter 6), each strategy begins with a different ontological starting point relating to space, time, and the nature of the threat. Whereas full-spectrum dominance suggests that space can be controlled in an absolute sense through segregation and buffering (thus minimizing the relevance of time), full-spectral dominance responds to the loss of control over space writ large (the inability to buffer or to create 'green zones' in a global and indeterminate 'red zone'). The Arctic is under threat precisely because this global red zone may rapidly expand into Canada's territory without an adequate defensive posture to control it, collapsing any meaningful distinction between 'here' and 'over there.'

Rather than absolute control over the Arctic, the state's desire or 'will-to- power' is understood to be enhanced through the illumination of the Arctic using the visible and non-visible spectrum and its production as a sovereign space. Under historical and present conditions, the Arctic is exposed as vulnerable, just as the state's capacity to enforce sovereignty is understood to be weakened through the structural effects of globalization. In principle, technological development is considered the appropriate response to these effects as increasing modernization acts as the instrumental response to the needs of sovereign enforcement where its unchallenged status *as given* is threatened.

In particular, the enhancement of surveillance capacity represents a reformulation of sovereignty through security as a dual process of consolidation and dilation. Sensing technologies are envisioned as a means by which the state may consolidate its northern territory through a persistent sovereign gaze that enables the flexible application of state authority in its defence within and outside formal territorial borders. The Arctic is a paradoxical space in the same way that globalization is, where these sovereign practices produce "a universalizing space of disconnection" (Shaw, 2016, p. 18). Sensing technologies are developing through a specific logic, enabling practices that project sovereignty outward, encountering threats from territorial borders both spatially and temporally. Rather than pursuing and defending sovereignty explicitly through the material consolidation of territorial boundaries (such as through fencing, checkpoints, and border crossings), Canada is developing its sensing capacities as a means by which territories can be buffered away from threats before those threats materialize or even necessarily exist at the threshold of Canada's Arctic territory. The pushing out of sovereignty through the spatial expansion of security is an idealized set of practices underpinned by a logic of risk and pre-emption while interlaced through the constraints of neoliberal fiscalism. Overall, this framework involves applying and intensifying techno-mediated forms of sovereign authority in response to the risk of territorial perforation by reterritorializing its power in a more ad-hoc and networked application across the globe.

5.3. Quantum as the pathway to omnivoyance

> With these approaches, developed with our theory collaborators, we hope to develop sensors with quantum advantage, detecting phenomena with a sensitivity far beyond that of classical-physics sensors. *Armed* with these amazing probes, scientists in a range of fields will be able to investigate the world in amazingly fine-grained detail. Exciting new discoveries will surely follow, along with practical applications in the national security arena and far beyond, from more powerful MRIs to submarines and drones (Katarzyna Krzyzanowska, lead researcher for quantum sensing, Quantum Science Centre, Los Alamos National Laboratory, 2021, my emphasis).

The above quote is telling in that it frames quantum physics in terms of its potential to produce quantum sensors as *armaments* and create an advantage for those who possess them. Quantum is often heralded for its potential to revolutionize technology, and interest in it has gained momentum through widespread interest by states and private actors for its theoretical potential to transform everything from computing power to communications. Hence the significant military interest in advancing quantum capabilities.

The volumetric integration of space as a globalized plane of military operations has primarily been a strategic aspiration and metaphorical, at least up to a point. However, quantum signals the potential for a *literal* transformation of the world as a strategic theatre and has been primarily framed in terms of geopolitical and economic competition (the 'race to quantum supremacy') (Roberson, Leach & Raman, 2021). Canada's framework emphasizes the economic dimensions of quantum's potential, whereas the United States is more concerned with overt security-related interests (Roberson, Leach & Raman, 2021). Notably, Canada is the leading G7 nation for per-capita spending on quantum R&D and was ranked fifth among G20 nations for patent filings in quantum computing and telecommunications (Sussman et al., 2019, p. 1). However, the distinction between defence and economic lenses should not be overstated, given that private firms in the defence sector are a significant driver of quantum R&D in Canada and the nature of quantum's dual-use character. Security and economy are increasingly collapsed through their mutually reinforcing competitive pressures and the narrative structure surrounding the need to build capacity in quantum R&D to support economic and defence ambitions, which are not mutually exclusive.

There is a long and varied history of Canada's efforts to understand what is happening in its Arctic territory through technological innovation and research. As this and earlier chapters

demonstrated, historical and contemporary efforts to keep pace with technological innovations by other states, especially in the air and maritime domains, have only resulted in experimental, or, in the case of the North Warning System and NORAD, outdated systems. More recently, the new Arctic imaginary and the globalization of threat within a futurized, unbounded system (the structure that produces 'unknown unknowns') has elicited a strategic response that prioritizes innovation sensing technologies that can map and support knowledge production of the Arctic as a dynamic theatre within an equally dynamic world (and therefore unbounded) system.

However, the level of technology the state needs to rationalize the world as a futurized and unbounded system on a practical scale goes beyond current technological capabilities. The current interest and drive behind quantum science and technology represents a technological and strategic extension of viewing the world as a complex unbounded system because of quantum's potential to expand computational power and, by extension, the capabilities of artificial intelligence-related applications. At a fundamental level, quantum mechanics deals with the behaviour of subatomic particles, such as electrons. The technological application of quantum mechanics is vital for sensing because it allows for much more precise measurements than conventional sensors. Quantum sensors, insofar as they technologically exist and are evolving towards, are magnitudes more sensitive than conventional sensors because quantum units (the smallest amount of a physical entity that can be involved in any material interaction), like a photon of light, are extremely sensitive to any physical interaction they have. This sensitivity is represented by microchanges to that quantum unit, which a quantum sensor can measure. For example, in 2018, NASA developed a prototype quantum sensor that is highly sensitive to changes in gravity and can accurately measure changes in the earth's gravity resulting from melting ice caps (changes in the planet's water mass account for the majority of its gravitational

variation) (Keesey, 2018). Measuring quantum behaviour is highly challenging for several reasons (including their sensitivity to the physical process of measurement itself). However, quantum sensors could detect mineral deposits, water lines, and other material artifacts (natural or artificial) deep underground or underwater without any physical penetration of that ground (the use of conventional radar sensors cannot penetrate very deep without physically being underground or underwater).

Moreover, quantum sensing is particularly well-suited for navigating difficult terrain like that in the Arctic, given quantum sensing's potential for more accurate geo-location, autonomous navigation in areas with dynamic obstacles (e.g., the Arctic's moving ice masses), and complex or 'noisy' environments more broadly. Theoretically, the potential for quantum sensing is seemingly limitless in terms of its applications. Consequently, quantum sensing's potential for military application is readily apparent.

Likewise, the potential of quantum to expand computing power beyond classical computers is driving significant interest and investment. Classical computers have evolved significantly from the giant room-filling towers, but their operation remains the same in principle. Advancing classical computing has relied on increasing the number of transistors to achieve a linear growth in computing power, which has roughly doubled every two years ("Moore's law"). In contrast, quantum computing uses quantum bits (qubits) and represents the possibility of *exponential* (rather than linear) leaps in computing power. The critical point about quantum computing is that it is theoretically well-suited for data analysis and creating simulations, including simulations that create predictions, due to the inherent complexity of those processes.

Quantum sensors (which increase the precision and therefore the volume of data) and quantum computing (the ability to analyze and process that data into simulations, i.e., intelligence) represent the potential for transforming full-spectrum/spectral warfare in a global theatre from a metaphorical and strategic ambition of the state into a literal capability of sovereign power. Quantum technology offers the prospect of rationalizing the world as an interoperable and homogenized system (flattening data into comparable units) and the power to make predictions about that system. Quantum sensing, therefore, offers a creative and imaginative solution to alleviating the issue of *unknown unknowns* through the ability to produce targeted pre-emptive action as a security strategy. As demonstrated below (see section 5.4), this level of sensing awareness and predictive capability is understood to be critical to defending against current and future threats, including, but not limited to, advanced weapons systems.

Quantum physics implies a radically different understanding of the universe than classical Newtonian systems, particularly the traditional subject-object distinction characteristic of rationalist knowledge. The actual ontological implications of quantum physics are widely debated, and there are multiple interpretations of what a quantum theory of the universe implies.[41] The current interest in quantum refers to the potential for technology stemming from the second quantum revolution. As Krelina (2021, p. 1) explains:

> Earlier, the first quantum revolution brought technologies that are familiar to us today, such as nuclear power, semiconductors, lasers, magnetic resonance imaging, modern communication technologies or digital cameras and other imaging devices […] The second quantum revolution is characterised by manipulating and controlling individual quantum systems (such as atoms, ions, electrons, photons, molecules or various quasiparticles), allowing to reach the standard quantum limit; that is, the limit to

[41] In his proposition that consciousness is literally quantum mechanical in nature (and hence, social reality is explainable by a form of scientific realism), Alexander Wendt offers a detailed overview of quantum physics for the discerning social scientist and the major schools of thought among quantum physicists concerning what *is* reality? I sidestep these discussions as the natural language of quantum physics required advanced university mathematics and is beyond the scope required here. See Wendt, 2015.

> measurement accuracy at quantum scales […] Quantum technology does not bring fundamentally new weapons or standalone military systems, but rather significantly enhances measurement capability, sensing, precision and computation power and efficiency of the current and future military technology.

Quantum mechanics has enormous potential for actualizing a defence posture in the de-territorialized world of threat and reenabling states that possess quantum technology with their monopoly on warfare. Quantum also has significant potential for addressing the classical challenges to Arctic situational awareness for Canada, particularly the environmental challenges that have made the surveillance of threatening actors difficult since the Cold War. Quantum is theoretically well-suited for navigating the Arctic's complex marine terrain and may produce technological solutions for sensing that terrain, which has generally fallen short of expectations by state-led R&D efforts. For example, Lanzagorta, Uhlmann and Venegas-Andraca note that

> an underwater vehicle does not have access to radio-navigation aids, GPS and astronomical observations […] To overcome these strict limitations, most underwater Arctic vehicles rely on active sonar arrays that determine the position of the ice, terrain, and other obstacles present at the front, top, and below the vehicle. However, this strategy is not stealthy and can compromise the position of the submarine in a combat scenario. We believe quantum sensors are the best solution to the problem of underwater Arctic navigation in combat and stealthy reconnaissance operations (2015, p. 4).

The potential of quantum technology also stems from its ability to transform the Arctic's environmental 'noise' from a problem for traditional sensors and imaging systems into a strategic advantage for those who possess a quantum system. For example, in one model, "the stealth strategy of the proposed quantum imaging system is to 'hide' the signal photons in the environmental noise" (Lanzagorta, Uhlmann and Venegas-Andraca, 2015, p. 4-5).

Among the more experimental or 'revolutionary' technologies being examined for their potential contribution to Arctic security, the practice of quantum illumination is being studied for its potential application with radar systems. Canada's quantum strategy is to make Canada's military prepared for "technological disruptions in the future operating environment" (National

Defence, 2021). Under the ADSA program, the University of Waterloo's Institute for Quantum Computing (IQC) was issued a contract worth CAD 2.7 million. Under this research contract, technology and techniques enabling quantum illumination are being studied for their potential contribution toward remote sensing methods that overcome the natural environmental challenges to conventional radar presented in the Arctic. These challenges include "geomagnetic storms, solar radiation storms and solar flares [which] interfere with radar operation and prevent the effective identification of objects" (Institute for Quantum Computing, 2018). Traditional radar systems use the emission of radio waves or microwaves, which are projected against an object and then reflected, enabling a receiver to measure the distance, speed, and relative size depending on the system in use.

However, conventional radar is limited in conditions where there is a significant amount of 'noise' in which the natural radiation emissions of other objects (such as the Arctic's numerous and constantly moving ice sheets along with other environmental conditions mentioned above) can cloud the detection of an object of interest. Another limitation concerning conventional radar is that radar generally requires a powerful emission source to be detected, making covertness a difficult achievement. Lastly, quantum technology is being examined for its potential application in countering the evolution of hypersonic weapons systems and stealth aircraft (National Defence, 2018b). Because modern hypersonic missiles and stealth aircraft can fly low and fast enough to evade existing radar systems, these technologies essentially nullify the use of existing Arctic military sensors (including the North Warning System). In contrast, quantum may support the detection of hypersonic weapons systems.

Theoretically, quantum illumination was introduced by scientists at MIT in 2008 and (as a vast oversimplification) is a process by which two 'entangled' light particles are used to

illuminate an object (Lloyd, 2008). Quantum entanglement is when two sub-atomic particles (such as electrons or photons) share a quantum trait (their charge and spin) regardless of proximity, meaning that actions performed on one particle affect the other despite that separation. Einstein, taken aback by this phenomenon, reportedly called it "spooky action at a distance" (Tate, 2013).[42] More recently, and of significant importance concerning its potential use for state security initiatives, a theoretical proposition was made in 2015 to combine quantum illumination with radar (Barzanjeh et al., 2015), which is "the most natural frequency range for signal detection" (Barzanjeh et al., 2020, p. 5). Four years later, quantum illumination has been successfully moved into the "microwave regime" (Ball, 2015) to enable the world's first quantum radar, reportedly (Barzanjeh et al., 2020; see Emerging Technology from the arXiv, 2019). This proof-of-principle demonstration indicates, according to the scientists responsible, "the potential of [Quantum Illumination] as a noninvasive scanning method, e.g., for biomedical applications, imaging of human tissues, or nondestructive rotational spectroscopy of proteins, besides its potential use as short-range low-power radar, e.g., for *security applications*" (Barzanjeh et al., 2020, p. 5, my emphasis). Quantum's potential application to biomedical, security and presumably other applications speaks to how a technology's development is not limited to a discrete field of application but is continuously shaped through those fields, especially as the economized security logic of 'dual-use' increasingly shape its development. The potential for multiple applications of technology also speaks to how social fields continuously shape and

[42] Einstein's key challenge to Neil Bohr's 'Copenhagen' interpretation of quantum theory rested on his revelation that matter, and energy were interchangeable ($E=mc^2$). However, later research that theorized the idea of quantum entanglement violated Einstein's formula because the basic conclusion following $E=mc^2$ is that nothing can travel faster than the speed of light (*c* for *celeritas,* Latin for speed). Theoretically, if two entangled particles like electrons exist at opposite sides of the galaxy, information gleamed from the spin of one electron immediately transmits information about the spin of the other electron, thereby violating the speed of light principle (hence, according to Einstein, "spooky") (see Arianrhod, 2017 for a more detailed explanation and a brief history of the debates involved during quantum mechanic's early years beginning in the early 20th century).

reshape technological development in their functional properties and their functional capacities (DeLanda, 2016, p. 73-74). A technology's functional capacity involves the application of its material properties and projects it through a specific social field, thereby translating those properties into specific, socially determined and securitized practices, including sensing.

5.4. Continental Defence

Canada's focus on enhancing its Arctic situational awareness in a threatening world is important beyond domestic considerations and is critical toward North American defence. Additionally, the logic underpinning full-spectral dominance and its emphasis on sensing technology are emphatically embraced by joint North American defence forces. Specifically, Canada's research and development (R&D) efforts for enhanced surveillance and intelligence capabilities within the ADSA and other related programs are also expected to contribute to NORAD's modernization and renewal of the North Warning System (NWS) (Fergusson, 2020, p. 3).

The potential for quantum to evolve and even revolutionize sensing capabilities is especially relevant to North American defence. NORAD's modernization requirements have generated significant discussion in recent years, given the need to keep pace with advancing capabilities by competing states, including those related to cruise missiles and hypersonic weapons. NORAD is a binational organization between Canada and the United States, and its mission is focused on aerospace warning and control for North America, with the maritime approach added to its mission suite in 2006. Historically, NORAD emerged from an instrumental need for the United States to create a spatial buffer against Soviet bombers during the Cold War, which required joint efforts with Canada to build a credible defensive posture given the

indivisibility of airspace.[43] The early detection of Soviet bombers was enabled through radar surveillance, including the DEW line. NORAD persisted as an institution following the end of the Cold War and shifted its attention after the September 11, 2001, terrorist attacks to focus on defending North America from airborne threats that emerged within and outside of national airspace. Current warning capabilities are provided through the "detection and validation" of threats using "a central collection and coordination facility for a worldwide system of sensors" collated at NORAD and USNORTHCOM's central facility at Peterson Air Force Base, Colorado.[44] NORAD's sensor suite includes the current NWS, which evolved out of the earlier DEW line in the late 1980s and consists of 54 long and short-range radars in the Arctic (47 of which are located in Canada) that form a 'tripwire' stretching from Labrador to Alaska. Critically, the NWS is reaching the end of its lifespan and requires upgrading to serve as an effective deterrent to near-peer competitor states (namely Russia and China), who are developing advanced weapons and delivery technologies.

Discussions centred on NORAD's modernization indicate the potential for the organization's next evolutionary step, where surveillance continues to factor heavily into its overarching mission goals. Advances in weapons delivery technologies rendering current surveillance capabilities obsolete, combined with the greater interest in the Arctic for economic exploitation, require improved early warning capabilities in the region to protect North America's security and strategic advantage shaped by distance. While the Arctic has remained a focus within Canadian policy since the end of the Cold War to greater and lesser degrees, the United States has only recently pivoted towards a renewed interest in the region for supporting national

[43] For a more detailed history, see NORAD, 2016.
[44] NORAD and USNORTHCOM are separate commands but share complementary defensive missions (see NORAD and USNORTHCOM, 2017).

security (Department of Defense, 2019). Thus, given this current binational focus, technological research and development for enhanced surveillance capabilities is a significant policy area directed at meeting Arctic security requirements. Research and development efforts potentially represent a crucial avenue of contribution by Canada towards Arctic surveillance in service of national and binational security. Besides quantum-based R&D, other ADSA projects may aid the modernization of NORAD and facilitate greater sensor and intelligence integration with the United States while contributing toward the minimum 20 percent R&D spending requirement within NATO.

A significant degree of integration will be necessary to achieve the level of technological readiness required for dynamic situational awareness in the Arctic for continental defence. These needs are conceptually embodied by the *Strategic Homeland Integrated Ecosystem for Layered Defense* (SHIELD) framework advanced by former NORAD Commander General O'Shaughnessy and the current NORAD and USNORTHCOM strategy led by Commander General Glen VanHerck (O'Shaughnessy and Peter M. Fesler, 2020; see also NORAD and USNORTHCOM, 2021; Dean and Teeple, 2021). SHIELD and NORAD/USNORTHCOM strategies emphasize enhancing surveillance and intelligence capabilities and point to how sensing is critical for providing complete situational awareness in the Arctic. While distance was technologically reduced as a strategic buffer long ago, there has been a radical transformation in the logic of distance by advances in conventional weapons systems. Specifically, developments in offensive capabilities by peer competitors have focused on closing the spatial gap afforded to North America through conventional means by developing weapons that remain within the threshold of use (below nuclear) as new technology reduces the problems of time, space, and detection. Consequently, these technological advances represent a major problem for current

NORAD surveillance and warning capabilities, creating a significant security gap in the Arctic and North America.

The current National Defense Strategy (NDS) of the United States signals a clear thematic departure from its previous focus on countering extremism to re-engaging with its near-peer states within a framework of strategic competition (see Department of Defense, 2018). However, there is a great deal of consistency between the post-9/11 era and the current US focus on inter-state strategic competition concerning the role of sensing technology in security practices. Notably, both counterterrorism efforts and the current international security environment are understood to be rooted in complexity and relationality on a global scale. Put otherwise, the rapid evolution of technology, its proliferation among state and non-state actors, combined with other trends at the international scale (including climate change, competitive behaviour by Russia and China, and societal instability in multiple contexts, among others) is creating a strategic environment that is increasingly difficult to assess and navigate. This difficulty is borne out because none of these issues exist or operate discretely, creating a complex web of constantly shifting threats. Hence, this complexity creates operational challenges for analysis, resource allocation, and decision-making for security practitioners, particularly when considering future requirements.

Conceptually, SHIELD and the current NORAD/USNORTHCOM strategic vision follow US doctrine and respond to this increasingly complex environment. The focus on advanced sensing requirements represents a strategic evolution of the United States to focus on the exploiting the complete range of visible/ non-visible wavelengths, auditory frequencies, and all other data streams to enable real-time all-domain situational awareness. Teeple and Dean capture this evolution in their characterization of SHIELD as involving the fusion of sensors and data

from multiple sources "into a comprehensive picture that *identifies threats at the extreme edge of awareness*" (2021, xii, my emphasis).[45] This 'edge of awareness' involves the spatial and temporal dimension underpinning sensing practices, where sensing conceptually links to the expansion of state power into the ether of threat activity, beyond a 'system of systems' approach and into a complete 'ecosystem' of sensor architectures within a "global sensing grid" (O'Shaughnessy and Fesler, 2021, p. 10). Massumi captures the strategic logic of encountering threats in the 'extreme edge of awareness' when he states that "[t]he mission of the full-spectrum war machine is to compress its own operation into that interval to the greatest adversarial interval of perception. *Hit them where they potentiate*" (2015, p. 148, my emphasis, see pp. 148-149).

Likewise, the current NORAD/USNORTHCOM strategic doctrine prioritizes all domain awareness within a global framework to support information dominance that can be mobilized towards rapid and flexible action (NORAD and USNORTHCOM, 2018, p. 6). In terms of sensing, the 'edge of awareness' points toward the blurring of space and time as the threat environment is increasingly complex and populated by actors that can, or will be able to, circumvent the geostrategic benefits once enamoured to North America.

For efforts directed at modernizing NORAD to detect and counter these weapons, in addition to the proliferation of other security concerns, this complex threat environment indicates the need for advanced surveillance capabilities to build effective deterrence by denial (Huebert, 2018, p. 176; see NORAD and USNORTHCOM, 2018, p. 3). More fundamentally, any modernization of NORAD requires policymakers to rethink its defensive posturing and the defence/offence strategic framework as a whole because defeating an attack from an advanced weapons system necessarily involves detecting and potentially defeating that attack 'from birth.'

[45] Formally, this is termed as 'Joint All Domain Command and Control' (JADC2) (see Congressional Research Service, N.D.).

Traditionally, NORAD's mission emphasized a defensive posture through its warning and response capabilities against airborne threats to North America. However, current strategic thinking points to the need to develop a *pre-emptive* offensive capacity to create a credible deterrence against current and future capabilities and reconstruct North America's spatial buffer.

Indeed, pre-emption represents the starkest theoretical diversion from earlier surveillance efforts because pre-emption (as General O'Shaughnessy calls it, 'predictive analysis') involves thinking relationally rather than linearly within a global space as a futurized construct. In O'Shaughnessy's words, we need to be able to make decisions that "are thinking about two or three moves downstream" (Hitchens, 2020). The breadth of technologies related to artificial intelligence (AI) (machine vision, deep learning, and other applications) are expected to play a significant role in NORAD's future imaging and intelligence regime.[46] This strategic outlook indicates that AI will be required to automatically examine multiple surveillance nodes across the globe and translate them using predictive analysis into an intelligence picture suitable for decision-making needed to pre-emptively shape the battle environment (O'Shaughnessy and Fesler, 2021, p. 9; NORAD and USNORTHCOM, 2021, p. 7). The growth of AI-based sensor platforms across the Arctic represents a key area of potential contribution for Canada within NORAD modernization efforts.

To summarize, the integration of speed through the dispersion of agency across several discrete but networked actors is designed to mirror other 'system of systems' approaches (at least in principle), such as within decentralized economic production networks that enables redundancy and adaptability. Developments in Arctic security technologies demonstrate a

[46] Another major application for AI in surveillance technology is through automation in navigation and detection systems in vehicle platforms, such as aerial and underwater unmanned vehicles (UUV) for Arctic ISR. For example, see the Canadian Pathfinder project with Transport Canada (Reichmann, 2021).

particular resonance with these broader trends, especially in state-led efforts toward integrating surveillance data with other data sources. Moreover, temporally compressing analysis cycles produces a 'just in time' model for intelligence dissemination and decision making.[47] In principle, the use of AI for these purposes resembles other autonomous behaviour developments inspired by biological neural networks that perform complex cognitive tasks, including those that overwhelm human ability.

5.5. Conclusion

The current emphasis on quantum R&D for Arctic and national defence must be situated within the logic underpinning strategic thinking regarding the world's networked and decentralized character (often termed '4th generation warfare' among defence practitioners). To summarize, the international sphere within the current era is defined by the intersection of several trends, including the advancement and vertical and horizontal spread of technology, the return of geostrategic competition, the proliferation of non-state actors such as terrorists and criminals, all of which are accentuated by climate change as a 'threat multiplier.' The Arctic is a critical theatre within this complex environment for two core reasons. First, climate change enables or will enable greater access to the Arctic, so there is, or there is predicted to be, a surge in interest by state and non-state actors to access the Arctic for their own strategic and economic benefits. Second, like the Cold War environment, the Arctic is a strategic buffer zone for North American defence as an attack on southern targets in Canada, and the United States is likely to

[47] E.g., the *Fusion of open data sources with automated identification system (AIS) and Earth observation data for enhanced marine domain awareness (MDA)* project and the *Compression of the Tasking, Collection, Processing, Exploitation and Dissemination (TCPED) Cycle* project being pursued under the ADSA program. These projects are concerned with using satellites like RCM to create accurate and uninterrupted pictures of Canada's Arctic territory. See Government of Canada, “All Domain Situational Awareness Program,” Projects.

travel through the Arctic. As the Arctic opens due to warming global temperatures and extended ice-free periods, this will increase North America's vulnerability to the proliferation of threats resulting from these broader international trends. This vulnerability is particularly important for Canada given the Arctic's size, extensive coastline, and a relative lack of northern development in terms of infrastructure. Thus, enhancing sensing capabilities through technological superiority in the region has become a central strategic goal for Canada, which shares this logic with NORAD's current strategic outlook and US defence policy more broadly.

Quantum technology is a core focus for state-led R&D efforts in at least two key respects. First, a system-of-systems view of the world implies the potential for an endless network of vertically and horizontally connected nodes of information. Capturing these systems through the omnivoyant gaze and processing that information into 'actionable intelligence' through reassembling its bits into coherent views of the world ('worlding') requires significant computational power on a practical scale. Thus, the magnitude increases in measurement precision and computer processing power that quantum technology may allow in the future is potentially revolutionary. Second, quantum sensors offer the possibility of finally overcoming the environmental and technological challenges limiting Canada's efforts to develop effective all-domain awareness capabilities in the Arctic. Indeed, earlier chapters demonstrate a consistent preoccupation with building Arctic awareness capabilities by Canada, but this goal has largely failed to materialize into a complete working sensing system, particularly in the maritime domain, where 'noisy' environmental conditions thwart detection capabilities. With the current need to modernize NORAD, quantum sensing and computing may actualize SHIELD's vision of building a layered sensing architecture expanding across the globe that can produce the complex analysis underpinning forms of pre-emptive security.

The strategic prioritization of all domain awareness and information superiority is equally a political orientation to the world as it is a technological goal to achieve sensing dominance. Therefore, achieving a globally integrated all-domain awareness involves many questions and issues, including but not limited to actual technical capacity. Andrea Charron points toward these issues by noting that shifting NORAD into an offensive command posture may not be acceptable to the Canadian public, especially within the fiscal and political environment created by the COVID-19 pandemic (Charron, 2021, p. 85). There are several additional considerations for Canada to make advanced sensing capabilities within NORAD a reality. Beyond the technical concerns, there are multiple issues related to intelligence dissemination and ownership and questions concerning Canada's role in shaping an updated NORAD to define the institution's offensive capabilities (Dean and Teeple, 2021, p. 1-3). Most importantly, Charron is wary of prioritizing automation over keeping humans 'in the loop.' Specifically, Charron argues, "On many occasions, however, disaster has been averted because a soldier or analyst doubted what a computer screen was telling him/her or questioned the data blinking on their screen" (Charron, 2021, p. 88). Charron's critique indicates that we must be conscious not to overtly fetishize technology (both existing and experimental) by reducing our understanding of them to their instrumental function. This awareness is essential as the discrepancy between strategy and reality is often not revealed until using technology in theatre conditions. Rhetorically, technology is often treated as deterministic of outcomes in a linear pathway (if we possess *x* technology, outcome *y* will result). However, the outcomes functionally derived from notions of technological dominance are often divorced from how a technology ends up working (or not working). This fetishism is especially troublesome in experimental technologies like quantum

because they are far from proven despite their potential for significant returns as a factor of investment. As Smith III argues on the security hype of quantum:

> It is uncertain whether quantum technologies will live up to these high expectations. If they fall short, they will not be alone. We interpret new and emerging technologies on the basis of collective expectations about imagined futures, including our dreams and nightmares. These expectations are often unmet following hyperbole or hype" (Smith, 2020, p. 500).

Thus, we must be wary of any deterministic accounts of how technology will save us from an increasingly threatening world. In particular, any role that sensor technology will play in the modernization of continental defence systems through NORAD must consider the broader political context outside of narrow instrumentalist reasoning derived from a technological focus. Remaining cognizant of technology's political and social context is especially important concerning the strategic emphasis on all domain awareness, which prioritizes the development of a technological ecosystem with the potential for global reach by integrating numerous sensor networks and data sets. The operational logic of SHIELD and the current NORAD/ USNORTHCOM strategy enjoys a broader symmetry with US strategic thinking. The strategic approach of these cases stresses the role of technology, especially artificial intelligence, in producing the material capabilities for dominating future conflicts through surveillance, information superiority, and decision cycle dominance within an all-domain battlefield. Undoubtedly, current trends within the international sphere are worrisome and invite serious attention to the defence needs in the Arctic and North America. Whatever solutions are delivered in the coming years, an enhanced surveillance capacity supported by technological development will undoubtedly factor heavily into those measures. However, we should not be so bold as to assume that technology will automatically deliver the promised salvation that geostrategic thinking might suggest when divorced from the messy reality that any Arctic future may entail.

The next chapter offers a concluding analysis of this dissertation followed by a brief afterword. The afterword specifically addresses the implications of Russia's invasion of Ukraine for Arctic geopolitics and Canada's Arctic defence strategy and outlines areas for future research.

CONCLUSION

> In a changing world the shores of Hudson Bay have not been overlooked. Churchill, for example. In 1782 the solitude of the North was invaded by a French fleet, which quietly captured Fort Prince of Wales, a massive fortress erected by the Hudson's Bay Company, and a stronghold of British authority on the Bay […] In 1782 the French fleet entered a desolate region, where fur trading was the only activity. The British sloop steamed into a modern harbor, in which, during the season of navigation, vessels from many countries cast anchor. And the Canadian Government ship *Nascopie* was reprovisioning for a journey still further north.[48]
>
> This is an amazing change also from the earlier period when Sir John Franklin and his crew of 129 disappeared while searching in Arctic waters for the northwest passage.
>
> Radio keeps navigators informed of conditions on Hudson Bay; airships hover above, and the peril of its icy waters is greatly minimized. The Arctic is opening up. Northward also the course of Empire takes its way.
>
> The Globe and Mail, "In Churchill's Gay Harbor," August 12, 1937, my emphasis.

> People will come in greater numbers. The frontier will retreat farther and farther north.
>
> The New World for Canada will open.
>
> Raymond Arthur Davies, "Arctic Eldorado," p. 97, 1944.

INTRODUCTION

Mastering the Arctic through technological innovation and control has been a core feature of Canada's nation-building efforts in its northern territory. Indeed, from the post-war idea of building a global aviation route connecting the world's industrial centers to Diefenbaker's

[48] The *R.M.S. Nascopie* was actually an icebreaker owned by the Hudson's Bay Company (HBC) that launched in 1912 as a supply ship for northern outposts and "would be called upon for other duties as well" (HBC Heritage, n.d.). Among those duties was assisting the Canadian government with the High Arctic relocation of Inuit communities. The 1994 report on the relocation by the Royal Commission on Aboriginal Peoples cites a 1940 Eastern Arctic Patrol report, which states "The migration northwards of Eskimo families inaugurated in 1934 has been a success and continues to be popular. Twenty-nine men, women and children migrated from Frobisher Bay to River Clyde, fifteen from Cape Dorset to Arctic Bay, while thirty-eight were transported on the "Nascopie" to hospitals or to join relatives in more favourable hunting areas" (see images below).

northern vision and the Cold War's turn towards greater strategic considerations, the Arctic continues to be emphasized as a place to tame, control, and fill through 'the course of empire.'

R.M.S. Nascopie: “Hudson’s Bay Company’s Nascopie is a symbol both of Canada’s sovereignty in the Arctic and HBC’s formative role there. It remains one of the most historic and celebrated ships of Hudson’s Bay Company” (HBC Heritage, n.d.).

Inuit on the foredeck of R.M.S. Nascopie (September 9, 1936). Retrieved from Library and Archives Canada. Item ID number:5276219

This project has endeavoured to demonstrate how Canada has approached this course through the lens of security and defence considerations emphasizing surveillance and related

practices to rationalize the Arctic as a sovereign space under state control, particularly technologically mediated forms of control. Rather than understanding technology and Arctic sovereignty in taken-for-granted ways, I argue that technology and technological development are constituted through the relational forces of material and social production underpinned by a particular but evolving logic of security. This logic is not neutral or pre-given but socially, culturally, economically, and politically determined by historical and current forces.

This chapter revisits the dissertation's guiding research questions and makes several analytical observations concerning its contributions. The chapter begins with an overview of the theoretical framework outlined in Chapter 2 and analyzes the research findings within that framework. The following section then answers the central research questions and points towards this dissertation's research contribution to the topic of Arctic politics, explicitly addressing how these findings build on the literature and subvert conventional geostrategic viewpoints of the region.

A Melting World

Few people have travelled to the circumpolar Arctic, yet images of bitter cold and desolate isolation often reign supreme across our cultural imagination. In contrast to the 'frozen wasteland' imagery, rising global temperatures linked to anthropogenic climate change are accentuated in the Arctic and thus threaten the region's organic equilibrium, contributing to the planet's climatic shift as a whole through the release of greenhouse gases. This environmental threat appears all the more dramatic given the area's frozen composition, which hosts many species that have evolved to live within that tundra.

It is essential to consider how our dominant cultural and social elucidations of the Arctic affect and are interlaced with official representations because the sum combination of these

representations produces material (and therefore political) consequences. Within the political zeitgeist, the Arctic is routinely framed within this lens as a space ripe for capitalist exploitation and interstate conflict over resources and transport routes in the near to distant future. Such discourses have likened recent geopolitical interest in the Arctic to the late 19th century's surge of colonial expansion in Africa as European imperialism reached a crescendo. While such comparisons have been challenged as analytically ill-conceived, there are certain regional similarities in that both Africa and the Arctic are represented through sets of overlapping and often competing imaginaries that are historically contoured as othered spaces.

Imagining the 'New Arctic'

Culturally, how the Arctic is represented is highly gendered through their reliance on masculinist adventure and rescue narratives that exaggerate the role of the loner/saviour archetype within the Arctic's elemental milieu. Within these situations, conflict is the key thematic driver; man against nature, against himself. Likewise, climate change represents a critical thematic driver of conflict in a different capacity; man *against* nature. The Arctic and its natural inhabitants are suffering as the result of progress made in the industrial age, and rather than mastery over nature, we have lost control as that progress bleeds into the infinite regress of a progressively and irreducibly complex world.

The struggle of scientific modernism to control nature, and the persistence of nature to defy and escape control, is perhaps best thematically illustrated by the Arctic's metaphorical role as a backdrop for conflict between mankind and the desire to achieve godlike powers through science. The Arctic's thematic projection is represented acutely in the emotional and physical conflict of Mary Shelly's *Frankenstein* between the Doctor and his Monster, who are engaged in

a chase across the Arctic's tundra, which represents the Monster's hatred for and violence towards his creator.

There has also been a surge of Arctic representations in more recent films. For example, there is a scene in the 2019 science-fiction drama *Ad Astra* wherein the not-too-distant future, the character of Major Roy McBride (played by Brad Pitt) has just arrived at a base on the moon, which is a place without borders marked by geostrategic conflict over resources. McBride is asked by a military commander from US Space Division, "This your first time in a war zone?" McBride replies, "Three years over the Arctic circle." Similarly, Pitt's fellow Ocean's 11, 12, and 13 alumni, George Clooney's recent film (as both star and director) *The Midnight Sky* finds Clooney's character, Augustine, the sole remaining scientist at an Arctic research station amidst a global, presumably nuclear, catastrophe. In it, he braves the Arctic's dangers (wolves, snowstorms, fragile ice sheets, and frigid waters) to reach a stronger communications array to contact the planet's last spaceship vessel as it returns home from a habitable moon orbiting Jupiter. Unknown to the ship's crew (spoiler alert), there will be no world left to return to in a short time. Thus, the Arctic represents a literal end of the earth. Add to this list Gerard Butler's recent 2018 outing as Captain Joe Glass in *Hunter Killer*, the plot of which involves a US submarine travelling the Arctic Ocean trying to stop a secret Russian coup and avoid World War III (playing off the 'new' Cold War fears) as well as the 2019 survival film *Arctic* about one survivor of a plane crash that must risk his life against the harsh environment of the North in order to make it out alive.

Thus, the multiple and overlapping imaginaries underpinning our current understanding of the Arctic all embody a specific constellation of cultural representations and epistemic interventions premised on what has been termed the emergence of the 'new Arctic.' The 'new

Arctic' is contoured by rising global temperatures, which are rising more acutely in the Arctic, and in turn creating a host of cascading effects for the environment and its flora, thereby altering the Arctic's entire organic composition and, by extension, the region's social and political make-up. The permutation of cultural and epistemic representations of the Arctic also contours debates within the field of international relations (IR), percolating into a set of discourses centred on the Arctic's potential for resource development, year-round shipping, exploitation by non-state actors such as criminals and terrorists, and the prospective for interstate conflict over these economic interests. Put succinctly, the Arctic is changing due to climate change, which in turn may open the region to greater economic exploitation by Canada and other actors in the international realm (though this is not guaranteed and depends on many factors). Conversely, the Arctic is threatened by these changes from the state's perspective because they undermine the taken-for-granted status of sovereignty for Arctic states by challenging their de facto authority and ability to project force (classically understood as the monopolization of legitimate violence). Within the Canadian context, Arctic sovereignty and security have thus returned to the political scene as an issue of focus for policymakers and defence practitioners. The issue of Canada's sovereignty and defence in the Arctic is not new, and there have been several periods of intense interest in the issue by the Canadian state since the turn of the 20th century, but especially during the Cold War. Canada's defence policy in the Cold War Arctic centred on developing surveillance technologies with the United States to warn of Soviet incursion and attack, culminating in the Distant Early Warning (DEW) line and prototype technologies designed for underwater surveillance.

With the growth of interest in the Arctic by Canada and other states, Canada continues to pursue a defence strategy focused on technological innovation following years of disinterest and

disinvestment. Notably, while this strategy echoes earlier developments and strategies by the state, current technological developments are premised on a specific concern for the future of the Arctic. The future acts as a critical structural parameter mediating both the development and function of these technologies, which as a whole, are designed to enhance state power and authority through acts of sensing. Sensing is, in general terms, the combination of surveillance and intelligence practices. Within the Arctic context, the state aims to illuminate the Arctic as a spatial and temporal frontier by predicting its shape and form as a space requiring intervention. The forms of intervention are premised explicitly on an understanding of the Arctic as a space of vulnerability in the future, which is necessarily an increasingly imaginative proposition given that policy is being shaped by concerns that may not reveal themselves until the 22nd century. Such technologies are not apolitical or neutral choices, even if they appear benign. Within Canada's current defence strategy, futurity is a crucial vector of articulation, indicating that it is also a critical political vector of epistemic intervention. Therefore, the future's imaginative quality is an important parameter shaping the Arctic as a defence theatre, which may come at the expense of other imaginaries that shape forms of intervention that promote a more equitable and resilient Arctic in the face of its unprecedented transformation.

Methodological Summary and Analysis

This section summarizes the material-semiotic framework used as a theoretical approach to studying the Canadian state's development and use of sensing technologies in the Arctic and my core analytical findings. The relationship between semiotics and materials offers an account of how materials are made politically meaningful or how certain technologies are partially accorded specific capacities. Within the Arctic, specific environmental conditions and material

components (such as moving ice sheets, melting permafrost, electromagnetic disturbances in the ionosphere, rising temperatures, and considerable physical distances) are studied and produced as scientific phenomena (in environmental science, climatology, and other natural fields). However, they are also translated via discursive and symbolic processes into security concerns. Data and material technologies produced outside the bureaucratic security apparatus (such as through DND, CAF, or other government departments) are integrated into the security repertoire and translated into new data, discourses, and tools compatible with the broader security field. Within securitization processes, materials are made *threatening* to the integrity of the territorial nation-state; non-broadcasting fishing boats, certain human bodies, climate events, and other objects from across the globe that may intersect in unforeseen ways provide a seemingly endless supply of threats. Likewise, technologies are drawn from other fields to counter these threats (their 'dual-use' properties) and securitized. For example, technologies used for mineral and resource exploration and identification (spectral imaging) are being incorporated into threat detection and identification platforms, including sensors designed to illuminate and identify 'dark targets' that exist and operate outside the state's techno-biopolitical regimes. These state-procured and state-developed ('in-house') technologies are also symbolic of the nation, as Canada is actively positioning surveillance technologies and scientific expertise as 'homegrown' initiatives for the international market.

Materials and practices are also relational, where technologically mediated surveillance practices represent a clear intertextual connection between certain practices (e.g., coding and algorithmic processing) that are integrated into specific sensor technologies and simplify surveillance and intelligence practices for human consumption and contribute toward decision-making and resource allocation. Globalized and networked technologies are specifically

employed and developed in order to allow a creative assemblage of sensors and data nodes without the limitations of territorial boundaries and which enable the application of sovereignty outward (pre-emptively encountering threats outside and away from borders and before they emerge as threat effects), allowing for the rationalization of territorial space inward. Scientific and bureaucratic practices, including procurement, research, and technological development, are integrated into material applications organized within a securitized logic.

Lastly, the relationship between practices and semiotics points to how several non-security discourses and symbols are interrelated with state practices and contribute to the securitization of the Arctic. For example, the twin themes of building 'resilience' within communities and sustainable development for those communities in the Arctic under the 'challenges' (rather than 'threats') posed by climate change can neutralize aspects and transmit specific responsibilities commonly held in state-security discourse (for example, the responsibility to protect) by reframing human security through economic languages that legitimate certain state practices in line with neoliberal management. The obligation to defend and protect populations then becomes embedded within specific hegemonic understandings of threats that structure state practices of investment and development towards encountering and *countering* those threats. Bureaucratic-scientific practices and discourses centred on procurement, contracting, research, and development are all enabled through the security imaginary, which exists as a textual and symbolic assemblage of meaning that produces the Arctic as a vulnerable space where sovereignty is threatened. Consequently, that vulnerability is remedied through state-led defence initiatives, and the security of communities is understood to implicitly trickle down through a similar logic that frames economic growth as the harbinger of individual opportunity and wellbeing.

This dissertation demonstrates how a material-semiotic approach to studying security and securitization is fruitful. The security field is bounded by materials, semiotics, and practices but overlaps and is continuously reshaped by other fields over time, making the field both contextually and historically specific. The Arctic is securitized through the assemblage of heterogeneous components and underpinned by a sociotechnical logic that understands state modernization as an instrumental response to globalization. Disparate materials, practices, and discourses are translated through and into the security field, which is borne out of Canada's history as a nascent settler-colonial power in the late 19th century and its international role during the 20th century's great power confrontations. This role includes Canada's relationship and proximity to the United States and other western allies, its particular geography and a political economy heavily linked to resource extraction.

Lastly, while novel technologies are an essential feature of state practices, they should not be overstated as being deterministic of those practices and the state's evolution more broadly. Security and sovereignty are the 'twin watchwords' of Canada's Arctic defence strategy and governance. However, sovereignty is equally part of the sociotechnical imaginary, as it is often portrayed as the referent object of security. The relationship between security and automated technologies often suggests that human agency is likely to be gradually replaced in security practices and an endearing feature for the foreseeable future. While surveillance practices and the development of technologies positioned towards enhancing state presence and capacity in the Arctic may indicate novel technical abilities and the broader application of those abilities through surveillance and intelligence practices (temporally and spatially), these remain mediated by human agency, especially concerning their underlying developmental logic and use. Automation and algorithmic processes that contribute toward all domain situational awareness

will undoubtedly increase the Canadian state's control over its Arctic territory, but these technologies in themselves cannot satisfy the imaginative requirements of sovereignty, which remain thoroughly human.

The Research Questions

The central question of inquiry guiding this dissertation is whether the development of new technologies for sensing purposes in the Arctic represents a new approach to Arctic security by the Canadian state or whether it serves as a continuation of historical pathways.

Recent efforts towards technological development and enhancing the state's sensing capacity in the Arctic clearly link with efforts and are socially and materially drawn out of earlier Cold War defence programs. In particular, the *Distant Early Warning* Line, the *North Warning System*, and underwater sensor technologies demonstrate an obvious resonance and connection to current research and development efforts. However, while 'defending sovereignty' may show a historical continuity with earlier state-led attempts to control the Arctic, the social logic on which these technologies are premised is increasingly novel, as are the technologies and the forms of sensing they enable. Materially, the blend of the old with the new is particularly evident in the use of procurement practices in developing technology out of commercial and civilian applications (their 'dual-use' capacity), along with the assemblage of sensor architectures and data streams through ‘layering.’ Canada's interest in becoming a leader in quantum research and developing quantum sensing and computing technologies for defence in the Arctic and elsewhere is an outgrowth of this logic, given the practical requirements required to rationalize the Arctic and world as a system.

Therefore, this dissertation argues that the *All Domain Situational Program* and related research and technological development efforts are historically contingent while increasingly novel. Technologically mediated sensing systems, assembled from multiple and often discrete sensors removed from spatial and temporal limitations, are grounded in and borne out of recent socioeconomic logics motivated by a desire to illuminate the world and grasp the patterns of life of that which inhabit it.

The sheer number of sensors and data produced in the physical and electronic domains indicates that the state possesses a heightened sensing capacity and will continue to increase that capacity in the Arctic. The state's ultimate ambition is to produce a dynamic image of the Arctic that captures its movements and flows while mapping that dynamism against the state's own goals of sovereignty and security. Against this dynamism, sovereignty is spatially and temporally transformed in its *de facto* application. The sovereign state (as a political entity) and its outer perimeter were historically produced through empire as a set of expansionary processes, including warfare. However, the state was produced and continues to be reproduced through regularized bureaucratic practices. Foucault's exploration of biopower and the introduction of national statistics are prominent forms of state development and the evolution of sovereign power. However, these practices are diverse and include scientific practices like cartographic mapping that enable navigation and the production of spatial images and territories, supporting the never-ending "epistemic project of the nation" (Powell, 2017, p. 28). Current and future sensing technologies will continue to transform state capacity and realize the outer perimeters of sovereign power in ways that are increasingly unbound from state territories (which have never been symmetrical with sovereignty). Arctic sensing technologies and technological development are predicated on a layered and assembled approach designed to illuminate space and rationalize

territory through state-led practices and processes - the full-spectral dominance of its domains. Surveillance and intelligence practices are spatially and temporally extended outward by dilating sovereignty to capture threats everywhere and nowhere because they are pre-emptively encountered vertically and horizontally without limit. In a complex world requiring pre-emptive action, threat takes on an ambient quality (Massumi, 2015, p. 200). These developments emulate other system of systems approaches (specifically in economic production) to consolidate state practices and power around manipulating surveillance architecture and data to produce intelligence products that support flexible and targeted state action against *potential* threats. The flexibilization and totalization of security practices is a form of state power that resembles Massumi's concept of ontopower, which is "a power to incite and orient emergence that insinuates itself into the pores of the world where life is just stirring, on the verge of being what it will become, as yet barely there" (2015, p. viii). Ontopower is productive because it shapes the actual conditions of emergence (hence, 'onto'-power), including for life.

No state has ever enjoyed complete sovereignty as an ontological status through absolute control over a territory and population. Instead, through differentiated social and material practices over time, the state was made sovereign in uneven and variated ways. If the state is unevenly sovereign, it is also unevenly vulnerable. The Canadian Arctic is shaped as vulnerable through the security imaginary, which then legitimates the use and development of surveillance technologies as a strategy to fill the 'gaps and seams' of state authority. The development and use of surveillance technologies are premised on the logic that state authority can be expressed through the techno-sovereign gaze and the machine-human agents that produce it. This dissertation demonstrates how modern sensing practices and technological developments are the culmination of a long series of developments in the field of Arctic security. Canada has been, to

greater and lesser degrees over its recent history, preoccupied with developing surveillance and intelligence capabilities and the ability to visualize the Arctic. This preoccupation is evident in current policy and development efforts directed at technological innovation for Arctic security, but the technologies envisioned to accomplish these tasks (particularly in the quantum realm) are grounded in contemporary logic.

Thus, Canada's Arctic security and defence strategy is a continuation of historical state practices and a new strategy premised on a contemporary world-as-system model. This novelty is contoured through changes in the ontology of threat, even where the language of sovereignty and the need to understand and control Arctic territory through technologically mediated practices remain consistent with historical discourses. On the one hand, the security environment has shifted away from the threat environment that populated the post-9/11 world and from a reigning concern for terrorism. However, in the intervening years since September 11, 2001, the failure of imagination that dominated that era has spilled over. That failure haunts our current epoch as a dominant (if not central) structural condition mediating our understanding of the world, which is increasingly populated by spectral actors and ephemeral encounters. In this world, the future is collapsed with the present. The ontology of threat has evolved such that instability and vulnerability are inherent within an unknowable future that escapes easy compartmentalization or rationalization, which consequently requires increasingly sophisticated methods of predictive empiricism. The affirmation of this ontology of threat is shaping new epistemic practices of security and war. Arctic sovereignty is brought into being through security discourses, practices, and materials and the un-bounding of those practices, which are realigned with the decentralized forces of globalization. Sovereignty is *digitally* materialized over the new Arctic.

Contributions

This dissertation's key contributions can be summarized as follows. Theoretically, this dissertation draws from securitization theory and recent interventions on materialism in International Relations, specifically from assemblage and actor-network orientations, but goes beyond those individual frameworks through a novel material-semiotic framework. This framework applies a much-needed systemization to other material-semiotic approaches in International Relations theory that have been limited in offering a practical and systematic way to analyze data sources through a relational triangulation of discourse, materials, and practices. Each component has generated a great deal of theorization within security studies. However, combining them through material-semiotic approaches in International Relations theory has appeared ad hoc rather than in a systematic way that allows other researchers to employ a similar or augmented framework in their empirical cases. Importantly, this approach incorporates a traditional focus on discourse and speech acts that enable security problems to 'emerge' but deviates from the critical security field's emphasis on meta-theoretical debates to broaden my analysis and the data sources available. Methodologically, this framework is mobilized through a critical content analysis, which creates a robust 'thick' descriptive analysis of the empirical site to tease out relational qualities between sites, thereby incorporating aspects of assemblage and actor-network approaches.

This dissertation also offers the first systematic investigation of current technological developments made by Canada for Arctic security. It situates those developments within the state's historical trajectory, national priorities, and international role as a middle liberal power. This investigation draws from many unclassified sources to demonstrate Canada's overarching strategy to enhance its surveillance and intelligence capacities in the Arctic, which have thus far

escaped any comprehensive examination. Notably, this investigation directly links to an additional contribution of this dissertation, namely its conceptual innovation. Specifically, using the material-semiotic framework leads this analysis towards two interrelated concepts that characterize Canada's Arctic security strategy: the security imaginary and full-spectral dominance of its northern territory.

The security imaginary primarily focuses on the discursive and symbolic artifacts that contour our perception of the Arctic in particular ways, namely through a hegemonic understanding of the region as vulnerable to a myriad of extra-territorial forces and actors that may intersect in unforeseen ways over time. The Arctic is rendered, borrowing from Frowd and Sandor, as an '(in)security assemblage' which "are composed of a host of different types and sets of actors (police, military, developmental, diplomatic, informal, illicit, among others), representing diverse scales of political action, cooperating and competing over their diverse threat framings and appropriate security responses" (Frowd & Sandor, 2018, p. 73). As an (in)security assemblage, various discourses and representations are mobilized to indicate how the Arctic is changing under climate change and globalization. These changes intersect with a lack of *de facto* state authority (including the environmental challenges presented to existing technologies), thereby producing a security challenge for Canada in the future, where vulnerability is explicitly premised on rationalized notions of risk and probability.

Imaginaries require political work to come into being and stabilize, including but not limited to the work traditionally employed by defence actors and state elites that mobilize explicitly securitized understandings of a problem. Full-spectral dominance represents Canada's strategy of demonstrating and applying the state's sovereign power as a symbolic and material expression through technologically mediated practices of surveillance and intelligence, which are

entwined and inseparable through *sensing* practices. Combined, the security imaginary and the sovereign practices of full-spectral dominance advance our understanding outside of narrow policy rhetoric and geostrategic analysis, which implies that security is a by-product of the defence *of* sovereignty. Rather, these concepts demonstrate how the Canadian state is advancing what it understands as its national interest in the Arctic and how sovereignty (following Agamben's insight) is being *produced* through defence practices in the name of security.

In sum, this dissertation offers an original reconceptualization of how we think about the relationship between sovereignty and security and the mediating role of technology outside of an instrumentalized understanding. In turn, this reconceptualization allows for a broader consideration of state security practices, including, but not limited to, narrow military and policy concerns that, as this conclusion will demonstrate, presents several related issues which have yet to be adequately considered.

A view of the future?

There is no shortage of references to the Arctic as a space of conflict and elemental life within the cultural zeitgeist. The degree to which these representations are continuously circulated and reproduced indicates how salient the discourses and images underpinning the security imaginary are. Canada has enjoyed relative isolation from global conflict theatres primarily due to its geographic isolation. However, trends identified under globalization, including the ongoing threats of terrorism, criminal enterprise, and climate change, are argued to intersect and threaten this delicate isolation, particularly in the Arctic. The introduction of nuclear weapons and intercontinental ballistic missiles undermined the importance of space to geographies of security some time ago. However, the opening of the Arctic through

anthropogenic climate change indicates that Canada is and will increasingly become vulnerable to more threats from state and non-state actors. Canada's security is more routinely analyzed through the lens of risk and uncertainty, which is somewhat paradoxical to how the Arctic is treated as an imaginary. The Arctic appears predestined to become a global site of political, economic, and cultural interest. Consequently, the Arctic's future is in some ways preordained through its securitization and the policy choices that are preparing for a warmer, conflict-ridden region. We may not know the specific contours of these conflicts, only that in a world of states, security and sovereignty are of paramount concern, given that they are directly undermined by the forces of climate change, technological diffusion, and the persistence of an anarchic international system.

The degree to which private firms appear to be banking on the imagery of an uncertain and vulnerable future should not be understated, particularly related to the surveillance-industrial complex. Peter Singer has argued that the world is approaching a point where upwards of a trillion sensors span the planet ('On the Radar,' 18 min. mark). The growing volume of sensors indicates Amoore's notion of 'resonance on the horizon,' in which "sovereignty and economy become newly and intimately correlated on the horizon of possible futures" (Amoore, 2013, p. 6) is an accurate reflection of our present condition. Indeed, recent investments and development efforts by states towards surveillance and intelligence technologies indicate the degree to which private corporations and (particularly scientific) expertise "are key element[s] in the contemporary mode of sovereign power" (Amoore, 2013, p. 7). As previous chapters demonstrate, the legitimation and expression of sovereign power is an increasingly creative exercise where security and its attendant practices of algorithmic surveillance and intelligence are imaginative in as much as they are scientific. Risk calculations are also inherently creative,

especially as the future (the condition of what is possible) is extended outward. As Amoore states, “the absence of long-term historical ‘threat’ data on events such as terrorism has encouraged more speculative and imaginative forms of calculation. Where data on past events are incomplete or absent, probabilistic knowledge is loosened to incorporate assumptions about that which is merely possible” (2013, p. 31). In this sense, the growth of marine navigation at the end of the 19th century, the experiences of the World Wars, the Cold War, climate change, the internationalization of criminal and terrorist networks, the Wars on Crime and Terror, academic discourse on governance and geostrategic security, along with evolving international legal regimes, are assembled into an understanding of possible futures for the Arctic well into the 22nd century. This imaginary is enrolled into the complex of sovereignty, discursively and materially, as technological developments and their underlying logic are enveloped and become part of that complex.

The present condition of resonance on the horizon may be even more relevant to regional spaces such as the Arctic, as the effects of institutionalization by the state over territories and populations are always uneven and differentiated across space. Canada understands the Arctic as a critical region for the state's economic wellbeing in the future, making the fields of economy and security inseparable, and where technocratic management and expertise increasingly define the parameters of those fields. State-led technological investment and development strategies toward enhancing Canada's surveillance capacity in the Arctic are about managing the future in the present and building the state into a particular form that can organically adapt to a future populated by numerous intersecting threats. As with all processes of securitization, this strategy (along with the intersection of materials, practices, and discourses that underline and evolve out of that strategy) is essential insofar as a great deal of these discourses, materials, and practices

are depoliticized and normalized in the same way that the state's existence is often taken-for-granted. Imagining the future in one way over others is the sum of multiple intersecting political choices and actions. This dissertation argues that the Canadian state's approach to the management of the Arctic has been one overwhelmingly contoured by traditional security concerns predicated on a hegemonic view of the future, even if the state frames its interests in terms of social and economic development as well as the peaceful governance of the Arctic with other states. Canada has overwhelmingly favoured a course premised on developing new technologies and repurposing existing systems and data to enhance the state's surveillance and intelligence capacity. Undoubtedly, this is primarily a practical consideration as the development of sensor technologies is a much more cost-effective strategy when compared to resource-intensive developments such as stealth technologies (Bousquet, 2018, p. 175), a significant consideration for small and middle powers such as Canada.

Like other institutions in the post-9/11 environment, the Canadian federal government has made efforts to integrate otherwise discrete departments and agencies under broader directives, mainly as they concern intelligence analysis and sharing. Assemblages of various actors and practices into networks are increasingly the organizational logic exhibited by states and sub-state institutions through relations of institutional governance, given that risk management frameworks necessitate very fluid and uneven methods of encounter. This fluid and networked organizational logic are especially prominent in security practices due to the perceived need for targeted and rapid responses by security actors and creativity in data sourcing and intelligence production. The need to creatively develop and employ specific technologies, practices and data sets into a comprehensive and dynamic image of the state's territory in a creative fashion speaks to DeLanda's (2016) understanding that technologies can embody

different capacities (their insertion into and use through different political fields) while possessing specific properties (such as the use of spectral imaging technologies in biomedical and resource extraction practices). DeLanda (2016) argues for thinking of technologies in terms of ‘assemblages of assemblages’ where, for example, the military assemblage gives technology its capacity as a weapon through its relationality. In particular, DeLanda (2016) identifies speed as an integral part of all military systems and is becoming more critical to those systems. Under the amplification of speed, intensive and extensive functions between material and cognitive elements (such as physical movements and decisions) are assembled through networks and into other assemblages using the dispersed agency of technologies, data, and decisions. In principle, the integration of speed through the dispersion of agency across several discrete but networked actors is designed to mirror other 'system of systems' approaches (including economic production) which have repurposed conventional technologies and their properties for militarized use (such as the 'franchising' of criminal and terror networks) and which creates greater redundancy and adaptability. Developments in Arctic security technologies demonstrate a particular resonance with these broader trends, especially in state-led efforts toward integrating surveillance data and temporally compressing analysis cycles using algorithmic programming to produce a just-in-time model for intelligence dissemination and decision-making for security practitioners. In particular, using artificial intelligence for these purposes and the state's border management goals resemble other technological developments inspired by biological neural networks and are functionally premised on the automation of complex cognitive tasks that overwhelm human ability.

Historically, the Arctic has made a grand laboratory for developing and testing technologies due to its frontier quality and resistance to technological rationalization. Efforts

under the ADSA program and related technological developments geared towards surveillance are continuing this historical trend where the state uses the Arctic to test increasingly novel technologies that increase the sensing capacity of the state. This dissertation has endeavoured to begin accounting for how scientific practices and technological developments are shaped by the logic of security in the present moment and how they may contribute to security practices in the future within the Canadian Arctic. While the future imaginary underpinning Arctic security developments is speculative, recent state efforts demonstrate that the political effects of that imaginary in the co-constitution of the security field are concrete insofar as the security field is understood to be the result of a complex assemblage of practices, materials, and discourses that condition policy and shape the actual complex of state sovereignty. Like other social fields that bound and overlap, the security field is part of a wider field of social power. In contrast to other scientific projects in the Arctic involving data, intelligence, and technological development, the ADSA program and the Canadian state's broader Arctic surveillance initiatives may represent a more totalizing project, echoing Latham and William's argument that there is an "ambition to integrate and draw into its network *all* information and knowledge about the Arctic region in order to generate a totalized field of social power, or totalistic information and knowledge matrix over this space" (Latham & Williams, 2013, p. 13). The totalizing field of social power (according to Tester and Irniq, following Sartre [1991]) is "in reference to a process whereby attempts are made to bring all aspects of life (spatial, temporal, social, and economic) into line with a dominant or overarching logic: in the case of Canada, that of a modern capitalist state committed to the idea of progress" (as cited in Latham & Williams, 2013, p 27).

Understanding the production of the social field as a totalizing state project towards progress via capitalist accumulation is only one aspect of the picture. The modern capitalist state

is intimately bound with the modern security state. The Canadian Arctic, as a space of modernization, is being shaped through a totalizing logic where knowledge and knowledge production are conditioned to serve the requisite security needs of the state as a function of sovereignty. Sovereignty is at once made vulnerable and created through the risks and opportunities presented in the Arctic's future and its integration into the global space of flows. In this respect, all domain situational awareness, realized through the unending processes of scientific modernization, is a crucial aspect of state capacity and serves toward a totalizing project of sovereign power and control over the 'new Arctic.' Establishing control over the 'new Arctic' is not a totalizing project where there is a final endpoint that culminates in a hyper-aware surveillance state with absolute control over a territory and population. Rather, surveillance modernization in the Canadian Arctic is a project in which technological developments and the practices they enable are grounded in the state's particular social and political relationships to a population and territory within a historical field. In the final analysis, the Arctic is a laboratory for developing and experimentation with technologies designed to advance the evolution of state-building. State-building is a process contoured by Canada's political economy of resource extraction, its historical relationship with Indigenous communities, its relationship to global governance regimes (such as through the United Nations) and Canada's relationship proximity to the United States and other western allies.

Strategically, there appears to be an effort by the DND and CAF, along with other government departments, to avoid the hawkish language which has previously contoured a great deal of media, academic, and earlier government rhetoric on the Arctic's security future. For example, the 2013 DND/CAF *Northern Approaches* document outlining the Army's *Arctic Integrating Concept* states that "[while] commentators are very effective at employing emotional

appeals and inflammatory language, the Ilulissat Declaration of 2008 sent a clear and sensible signal. At that conference, ministers from the five coastal states bordering on the Arctic Ocean re-emphasized their commitment to the orderly settlement of any possible overlapping claims in the Arctic" (National Defence, 2013, p. 10). This statement represents efforts to appeal to the strength of the Arctic's governance regime and Canada's role in and support for that regime while proactively signalling to other powers Canada's position of sovereignty over its Arctic territory. By enveloping sovereignty as the primary rhetorical device by which security claims are made, strategic considerations are rendered neutral and intelligible in taken-for-granted ways as they are based on the nation-state regime's ontological status, which makes defence an unquestioned part of that regime. Scientific practices (including those related to technological developments) represent a fundamental component of the modern state's legal, normative, and functional claims to its Arctic territory and serve as a binding site for the interaction between military, security, and civilian fields of political and social activity. Hence the Canadian state's broader focus on supporting Arctic research and integrating scientific research from ecology, cartography, and climatology (among many others) into the security field. These scientific areas of research, their practices, and the multiple technologies and sites they are built out of are also framed as an expression of the state's sovereign control and the nation. For example, consider the language behind Canada's announcement of the *Canadian High Arctic Research Station* (CHARS) in 2015: "Our government will build a world-class Arctic research station that will be on the cutting edge of Arctic issues, including environmental science and resource development. This station will be built by Canadians, in Canada's Arctic, and it will be there to serve the world" (Speech from the Throne, October 2007, in Scott, 2015, p. 4).

The assemblage of multiple and heterogeneous narratives into a complementary schematic of the future directly leads to a particular construction of the security field. Rather than explicit rhetorical processes of securitization, the security field is constructed and projected through neutral, scientific and technical language often abstracted from the broader range of discourses found within classic geostrategic concerns. The security field is bounded by technical language designed by and for scientists and engineers within a bureaucratic-technical field that overlaps security with the economic and other fields. Indeed, those concerns form a core aspect of the dominant narrative framework that drives research and development efforts predicated on remote, automated, and cost-effective technologies. That framework is technical and imaginative and relies on historical understandings of the Arctic and abstractions of the technical conditions that underlay our potential future in the forms of climate change, economic development, geostrategic interest and the advancement of weapons systems by a range of nefarious actors.

The development and use of technology for surveillance and intelligence within the Canadian Arctic and other sites point towards the diffuse nature of state practices understood to express sovereignty. The diffuse nature of these practices is particularly apparent as a set of practices that project sovereign power outward while rationalizing the state's territory through consolidating sovereign power over these surveillance practices and technologies. Dilation and contraction capture the simultaneous forms of hardening the state's material control over space and territory while also buffering that space by dilating sovereign power outward in networked and interlaced applications. For example, the dilation and contraction of sovereignty occur by integrating disparate data sets covering spatially distant areas from a single surveillance platform (like Canada's RCM satellite), which is then shared with other allied states, regional security actors, and private corporations. The development and incorporation of 'dual-use' technologies as

part of the broader political economy governing security developments must be understood explicitly as political endeavours because why particular technologies are developed and how they are used does not strictly depend on their need in a functional and instrumental capacity. The development and use of any technology are the results of ethical, social and political choices, indicating that calling a technology 'dual-use' is not neutral or apolitical, even if these technologies are mundane, unseen or every day in their application compared to materials possessing a more singular capacity towards the instrumentalization of state power and violence.

Afterword

> This war front, where the Russians' most serious effort to dismember Finland resulted in a disastrous Red defeat, is not really a front.
>
> There are no well-established battle lines, and the fighting is of the guerilla type.
>
> It is a war of hand-to-hand fighting between men on skis, who ambush, attack by surprise and vanish. It is a war amid snow, silent forecasts and deathly cold. *It is a war of contrasts.*
>
> "Hand-to-Hand Fighting on Skis In Cold and Silent Forests Chief Feature of Arctic War," The Globe and Mail, January 5, 1940, my emphasis.
>
> I personally felt that our best defence in the Arctic was the Arctic itself. We had better be careful about constructing bases, which as the G.G. says may become from which the enemy himself may operate, but would not operate were they not there. It is a difficult problem.
>
> From the diaries of William Lyon Mackenzie King, November 22, 1946 (Library and Archives Canada, item 31105).

A War of Contrasts

In the early hours of February 24, 2022, Russia launched what Vladimir Putin termed a "special military operation" against Ukraine, which included airstrikes against targets across the country and a ground invasion force from multiple points. This action follows the 2014 annexation of Crimea, effectively serving as a declaration of war by Russia against Ukraine and, by some accounts, a de-facto proxy war against NATO. At the time of writing, the war has continued for six months and produced the single largest refugee crisis in Europe since World War II, in addition to significantly affecting global energy and food supply chains. Atrocities in the battle zones and occupied areas are rampant, and the conflict shows no signs of being resolved or slowing down in the short term. The war in Ukraine, along with sabre-rattling

between China and the United States over Taiwan, the COVID-19 pandemic, climate change, and many other issues that continue to threaten human beings and their environments, are producing or amplifying a series of cascading tensions across the world.

Very quickly, the war in Ukraine began to affect regional dynamics and international relations outside of narrow concerns around European security, including the Arctic. Indeed, the war and its political fallout have made Canada reconsider its Arctic strategy and undermined the Arctic as a 'space of exceptionalism' regarding peaceful governance and cooperation. In this spirit, Rob Huebert (2022) argues that "[t]he existing Arctic multilateral, cooperative institutions, along with many of the norms and values that emerged in the period of Arctic exceptionalism, have all been significantly damaged." As a result of this damage, Huebert (2022) argues that we are confronted with what he terms the *new Arctic security threat environment* (NASTE), creating a renewed urgency to existing military alliances and defensive measures.

The new security environment has also reignited discussions on Canada's commitments to NATO, and national and continental defence, including in the Arctic. For example, NATO Secretary General Jens Stoltenberg toured the Canadian Arctic in August of 2022 and used that trip to emphasize to the media that Russia and China constitute significant threats to the region and Canada's security. As General Stoltenberg warned, "Beijing and Moscow have also pledged to intensify practical operation in the Arctic. This forms part of the deepening strategic partnership that challenges our values and our interests" (Brewster, 2022a). Stoltenberg cites Russia's militarization efforts in its own Arctic territory, China's self-declared "near-Arctic" status, and their political economy strategy focused on critical infrastructure investment (such as energy) and research in the Arctic as examples of the threat environment. Secretary General Stoltenberg's tour included visiting the North Warning System radar station in Cambridge Bay,

Nunavut. Notably, this visit followed Canadian Defense Minister Nita Anand's announcement in June of 2022 that Canada would be committing C$4.9 billion to upgrade NORAD to counter "growing threats from Russia and new technologies" (Brewster, 2022b). As General Stoltenberg (2022) wrote for an opinion article in the Globe and Mail,

> This week I am visiting the Canadian Arctic with Prime Minister Justin Trudeau to underline the region's strategic importance for Euro-Atlantic security. The shortest path to North America for Russian missiles or bombers would be over the North Pole [making] NORAD's role vital for North America and NATO.

Specifically, this money is expected to be spent on over-the-horizon radar technologies to respond to modern missiles and networked sensors capable of monitoring continental approaches in the air and sea (Brewster, 2022b).

Like current efforts to develop advanced sensing technologies, the recent surge in opinion pieces and discussions on the Arctic's importance to Canada and the world demonstrate significant linkages to earlier frameworks. The specialized skills of Cold Warriors training and operating in the Arctic's unique environment; the Arctic's strategic importance as a potential cross-through zone for any attack on North America; the geopolitical ambitions of rival states and the potential for resource wars; the rapid advancement and deployment of novel weapons systems and delivery vehicles; increased activity and the remilitarization of critical strategic sites; and the Arctic's importance as a gateway to the North Atlantic; among others. These familiar imaginaries have been rejuvenated by the war in Ukraine and amplified as the dominant framework guiding the discussion on what Canada should be doing to secure its Arctic territory.

The current geostrategic environment begs several questions related to Canada's Arctic policies and the region's governance more broadly. On March 3, 2022, shortly after Russia invaded Ukraine, the Arctic Council's founding partners - Canada, Finland, Iceland, the Kingdom of Denmark, Norway, Sweden, and the United States - announced "a pause in their

participation in the [Council]" (Global Affairs, 2022). Despite a soft commitment to consider "the necessary modalities that can allow us to continue the Council's important work in view of the current circumstances," it is questionable whether the Arctic Council will ever resume normal operations (Huebert, 2022). As a symbol of the rules-based international order and the Arctic as a zone of peace, the Arctic Council's suspension speaks to the larger debate about liberal institutionalism's ability to overcome the immutable structural reality of *realpolitik.*

Russia's actions amplify several policy-oriented questions related to Canada's commitments to North American Defence and NATO. It remains debatable whether Canadians would ever tolerate NATO operations and exercises on Canadian soil, and Ottawa continues to be pressured to increase its spending commitment to the alliance. Canada's commitment to enhancing its defensive posture towards North American defence remains consistent on a rhetorical level, particularly concerning modernizing NORAD and other surveillance and intelligence platforms. However, the strategic shift towards a pre-emptive posture to defend against modern missile systems 'at birth' (see chapter 6) remains highly politicized as that would potentially require offensive capabilities on Canadian soil. Moreover, Canada's sovereignty over the North West Passage remains a matter of official dispute, so any NATO or other allied operations in Canada's Arctic territory may complicate Canada's sovereignty claims in the Arctic, although this is unlikely to be a serious line of conflict given the importance of other security issues.

Human, After All

While there is a certain historical consistency with the current emphasis on geostrategic discussions on Canada's Arctic security, the human dimension of security remains an essential

consideration in complementary and diverging ways from the dominant geostrategic narrative. Indeed, chapter 3 exemplified that Inuit communities are linked to Canada's Arctic security and sovereignty through their historical title. Prime Minister Trudeau recently stated, "We can never forget that sovereignty doesn't come through soldiers or scientists. Sovereignty comes through the people who've lived here for millennia" (Brewster, 2022a). In contrast to a geostrategic lens, other more pressing matters undermine the security of many Inuit communities in the Arctic. These matters include a lack of affordable housing, food and water insecurity, healthcare, and climate change, among many other systemic issues linked to settler colonialism. Canada's three territorial premiers argued inasmuch during an Arctic Circle forum panel on sovereignty and security in Canada's North at the end of August 2022 in Nuuk, Greenland (Blake, 2022). Interestingly, while comments like that of Prime Minister Trudeau continue to invoke a conception of sovereignty as inherited by the state through the Inuit's historical title, the territorial premiers signalled that the material gaps experienced by Arctic communities relative to the rest of Canada undermine state and human security. As Nunavut Premier P.J. Akeeagok states, "The attention of Arctic security has really brought attention to the issues that we've long lived with" and that "In order for Canada to have a strong stake around the world, investments have to be made in our communities so that they become as vibrant as they can be" (Blake, 2022).

In response to recurrent water crises in Iqaluit and Nunavut, Nunavut's member of Parliament, Lori Idlout, has also recently made an explicit link between a lack of investment in Northern communities and Arctic security (The Canadian Press, 2022). As Idlout states, "They always seem to forget how important Arctic sovereignty is when it comes to investing in the North […] They need to do better for Arctic sovereignty, not just by providing military

resources, but actually investing in the people and the resources that are needed to keep the community going" (The Canadian Press, 2022). Given the ongoing issues threatening the Arctic's largely Indigenous communities, the human security element remains an essential lens of analysis for researchers to deploy. More generally, several lines of critical analysis also require consideration for future research, especially as conventional geostrategic analysis will undoubtedly capture the bulk of attention in the near to mid-term horizons.

The Canadian Arctic's largely Indigenous communities are a significant discursive and symbolic component of the state's defence strategy. For example, current efforts to implement the priorities that underlie the Canadian government's defence strategy presented in *Strong, Secure, Engaged* position the Canadian Rangers in a prominent role within strategic efforts to monitor and defend the Arctic.[49] The Rangers are expected to "[a]ugment regional maritime domain awareness" by relaying "what is and what is not normal in their local areas, fostering a 'see something, say something culture' (Lackenbauer & Kikkert, 2018, p. 8) and embodying their motto of *Vigilans* ('The Watchers') (Government of Canada, 2020). The inclusion of the Rangers is also indicative of the state's broader strategy of Indigenous relations in Arctic governance, where concerns for state security in the region are framed as a matter of building community resiliency in which social cohesion and economic development are invoked as the benefactors of security for the state. Indeed, building resiliency is a prominent theme concerning development, peacebuilding, and state security priorities, as elements of the human security paradigm have increasingly meshed with defensive concerns.

[49] The Canadian Rangers number approximately 5000 members divided into five patrol groups across Canada. I am aware of no publicly available count of those Rangers who identify as belonging to Indigenous communities. The Government of Canada simply notes that the Rangers "speak 26 languages and dialects" and that "many [are] Indigenous" (Government of Canada, 2020).

The state's security is essential insofar as it is understood to be necessary for the wellbeing of northern Indigenous communities, and the defence of sovereignty against exogenous threats is prioritized under the umbrella of security. Interestingly, Lackenbauer and Kikkert note that under the state's *Arctic Policy Framework,* security is "something that Northerners, not Cabinet insisted must be included as a key aspect of Canadian Arctic policy given that, without security, it is impossible to make headway on development and social cohesion issues" (Lackenbauer & Kikkert, 2018, p. 5). The prioritization of state security is important because 'social cohesion issues' (however defined) are not understood as the result of ongoing historical processes internal to the Canadian state (understood here as a settler-colonial enterprise) but the result of a lack of proper sovereign control in the state's Arctic territory.

Likewise, state-led developments towards surveillance technologies in the Arctic are often positioned as promoting Indigenous goals. For example, satellite imagery from RADSARSAT has often been cited as supporting Indigenous community safety through its ability to allow safer travel on roads and sea ice. As a whole, Canada's Arctic policy framework is notable for its inclusion of northern Indigenous issues within the auspices of state security and governance initiatives. The incorporation of Indigenous concerns under social cohesion, sustainable development, and resilience is emblematic of the prioritization of state-based discourses and governance frameworks, including those of state security. The deployment of Indigeneity as a securitizing device and the submission of Indigenous wellbeing under the rubric of self-help schematics echoes Greaves' (2012) critique that concerns for human security have largely been stripped of their radical character and appropriated by the government to accommodate traditional institutional frameworks prioritizing the state rather than humans and communities in their own right.

There remains a great deal of research investigating the actual effects of securitization at the community level to be done. For example, while the relationship between the extractive sector and northern communities has become a prominent area of research as civil society organizations and international legal frameworks increasingly challenge state and corporate extraction practices in Indigenous lands (Johnstone & Hansen, 2020), there is no comparative examination of the security sector that I am aware of. Instead, security research concerning northern Indigenous communities has primarily focused on the tensions between Indigenous and state security paradigms more broadly (Gjørv, 2017). This limitation is not incidental, as some have pointed out that security-related developments by the state have been undertaken without any consultation with northern communities (Loukacheva, 2009), suggesting the continuation of paternalistic, colonial relationships in the name of security that require further empirical examination.

The ongoing need for human and community-based understandings of security is linked to the issue of climate change. The relationship between security and climate change in the Arctic represents a fundamental intersection of the Canadian state's complementary and contradictory discourses and practices. In particular, the focus on mitigating the effects of climate change through technological innovation for state security rather than halting climate change itself is indicative of that paradox, as climate change is simultaneously threatening and opportunistic for the state in terms of its effects on the extractive potential of the Arctic. The success of modernization have contributed toward its potential undoing (including the demise of the territorial state) because climate change may very well be the end of humanity for great swaths of people, and our current strategy is an adaptation to those conditions through the protection of the status quo. The transition to sensing as a mode of governance is the preferred

method of adaptation and, according to Chandler, represents a transition from strategies of Mapping because the ontology of sensing is flatter, meaning that it is not concerned with causation so much as it is concerned with correlation. By extension, the current security environment is intimately linked to the Anthropocene. Sensing as a practice is related to the rise of the 'resilience' discourses in that "Sensing accepts that little can be done to prevent problems" (Chandler, 2018, p. 88), so states and communities must learn to deal with those problems. For problems that seem increasingly complex and unavoidable, "Sensing seeks to work on how relational understandings can help in the present" as a form of governance or management (Chandler, 2018, p.89). Sensing is thus a conservative mode of governance in that it seeks to preserve the status quo and reaffirms particular ontologies as given through its flatness, including the existence and priority of the state.

Within the framework of industry partnerships, Canada has focused mainly on technological procurement towards managing climate change's differentiated effects on state power. Notably, Canada and other Arctic states continue to pursue economic development strategies predicated on the potential for resource extraction in the Arctic. Within Canada, defence concerns in the Arctic have become intimately bound with the potential for development and indicate the working relationship between the state's security institutions and extractive firms. Consider these questions posed to Canadian Brig. Gen. Alexander Meinzinger:

> How else are the commands hoping to work with industry [...]? [...] Are there any gaps that you're looking to be filled, or, indeed, are you able to sufficiently gather industry feedback or understand what potential technologies are emerging? And how well does that all feedback into your overall strategic outlook (Silva, 2013, p. 4)?

The response by Brig. Gen. Meinzinger is:

> I believe industry is one of our absolute key partners. I talked previously about working very closely with Shell Oil [...] and I think that's a great example of two groups understanding that there's a common interest in coming together, sharing information and

> working through contingencies. As we look to invest in the Arctic in a prudent way, unquestionably we'll be relying on private industry in some measure to provide capabilities or, in fact, given the shortage of resources, if we can find ways to leverage private industry capability in a dual-use way, that would be wonderful […] (Silva, 2013, p. 4).

As this project has shown, the dual-use character of sensing technologies embodies a social and material dimension in as much as it embodies an economic relationship between private and public actors insofar as they align with state interests.

The relationship between the political economy of the state and its defence interests requires further study and elaboration, especially as critical accounts of extractive resource projects elsewhere have demonstrated how the Canadian state has mobilized its security forces and other resources against civil society actors and Indigenous communities in support of those projects (Monaghan & Walby, 2017). In the Arctic, this endeavour may be especially relevant given that the Department of National Defence has identified environmental activists as potential threats to state security where "environmental activism" is combined with "illicit trafficking, illegal narcotics [...] and illegal immigration/entry" (Lackenbauer & Kikkert, 2018, p. 21).

Lastly, while the induction of public research institutions into the development of environmental surveillance technologies may not indicate any apparent tensions or issues for academic freedom and critical discussion of Canada's defence and security institutions, important considerations must be made. For example, the University of Victoria's geography department entered early negotiations with DND for a potential contribution by the department towards a mapping project under the ADSA project in exchange for a $3 million grant. The University of Victoria's independent newspaper *The Martlet* reported that under the contract, University of Victoria geographers "would participate in a community-based observation network which would monitor climate change and the increases in shipping traffic. This information would then

be given to the DND for the ADSA program, though how exactly the military would use the data is not explicitly known at this stage. Because of this, the ethical implications of the research could outweigh the substantial funding." As the article points out, there are "many issues with geographers working with military bodies," including "the possibility of 'shifting the centre of gravity in the discipline away from forms of critical scholarship towards those with potential military applications" and warns that "the involvement of the military and intelligence agents in academic life has a chilling effect upon independent thinking (particularly of the policies of the state and military)" (Kokoska, 2017).

Concerns centred on the appropriation of research by military institutions in ways that were not envisioned initially are echoed elsewhere, for example, by employees of Google who voiced concerns concerning their research on artificial intelligence being used in unforeseen ways by the Pentagon towards the development of autonomous weapons (Shane & Wakabayashi, 2018). This point should not be read to argue that Canadian researchers necessarily risk compromising their academic integrity if they engage with state-led projects, even defence-oriented ones.[50] However, there are fundamental considerations to be made by researchers when undergoing projects in response to state-led calls, primarily when these initiatives are being pursued outside of explicitly militarized discourses, and strategies as states shift their attention northward and solidify their control over the top of the world.

In conclusion, my point is not to diminish the geostrategic analysis (or any other type of analysis) of the Arctic and the questions that emanate from those frameworks. The subjects and questions that broadly characterize the literature on Arctic security are essential and deserve

[50] As a reminder, this doctoral project is funded by the Department of National Defence through their joint initiative with the Social Science and Humanities Research Council of Canada (SSHRC), Mobilizing Insights in National Defence (MINDS).

ongoing attention. Indeed, thoughtful geostrategic analysis appears to be even more critical given that conventionally understood threats to Arctic security are tangible and material, even if those materials and the international system within which they originate are (at least partially) socially determined constructs. Geopolitical relations, national security, and strategic defence will remain, if not become more important, trends affecting the Arctic.

Even securitization as a process should not be automatically understood as something 'bad' that closes political space and limits countermovement or critical resistance. While the language of security may involve its own gravitational force that legitimates wide-ranging and potentially undemocratic actions by the state, other actors, including Indigenous communities in the Arctic, may be able to use that gravity to carve political space for their voices. As Sejersen argues,

> "security thinking" and "security talk" produce a transformative space in which it is possible for communities and individuals to translate themselves and their identities. The concept of cultural translations also directs our analytical attention toward processes, politics, and meetings driven by this fundamental question: "Whom are we to become when dealing with "future bads?" In this way, translations of risk and security are deeply entangled in negotiations of future identities. If security talk is an act of cultural translation, newness is analytically infused. Security studies can then also focus on the highly difficult but productive tasks of negotiating the "future self" to come (2021, p. 246).

However, this difficulty should not be understated, especially as security and securitization can also close off discussion and undermine accountability for historical and current actions by the state pursued in the name of *sovereignty* and *security*. The ontological power of security reflects my central normative and theoretical claim: namely that we must be attentive to how security is deployed but depoliticized outside of the explicit language of security (in the language of sovereignty, techno-materials, behaviours and practices, and other elements) given that security typically relies on a limited ontology of the world to legitimate actions and claims taken by states

and other powerful actors in its name, which in turn shapes the *life* worlds of human (and other) beings. Thus, we must also be aware of how the dominant lenses used to understand Arctic security are political forces that actively shape our material and social interventions underpinning the future Arctic. How the future of the Arctic relates to sovereignty, security, and human wellbeing remains an open question, one that will undoubtedly shape Arctic scholarship for some time to come.

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