Situational Awareness and the Spatialization of Arctic Security

Benjamin T. Johnson and Trym Eiterjord

'Domain awareness' and 'situational awareness' have become ubiquitous terms within contemporary policy and military discourses on Arctic sovereignty and (military) security. However, their effects and origins as fundamentally spatial concepts remain under-interrogated by geographers and critical security scholars working on the region. This article begins to address this gap and examines how these concepts are deployed in contemporary discussions of territorial sovereignty and national security in the Arctic. The paper argues that these concepts constitute a distinct territorializing logic, wherein the pursuit of 'awareness'—supported, in these cases, by the collection and processing of geospatial intelligence—becomes the central mode by which states seek to exercise sovereignty and security over a given geographical area, thereby enabling military operations across multiple geophysical domains.

Introduction

The Arctic occupies a seemingly paradoxical relationship to the modern world. On the one hand, it is routinely invoked as one of—if not the—last remaining (earthly) frontiers humans have yet to properly know and control. On the other hand, the Arctic is changing at an accelerating rate, politically and environmentally; it is no longer a distant frontier, even if it remains an unruly and widely inaccessible space. This paradoxical relationship is acutely represented by its importance to the defence and security interests of Arctic and non-Arctic states. In particular, militaries are increasingly turning their sights towards the Arctic, including NATO. Indeed, by 'turning their sights', we mean quite literally that Arctic states and their militaries have become acutely concerned with being aware of what is happening, or what will happen, in the Arctic broadly and their Arctic territories specifically.

'Domain awareness' and 'situational awareness' have become ubiquitous terms within contemporary policy and military discourses on Arctic sovereignty and security. Interestingly, while situational awareness has gained attention within scholarly debates in International Relations (IR)

Benjamin T. Johnson, Assistant Professor (UD2), International Relations and International Organization (IRIO), University of Groningen, Netherlands.

Trym Eiterjord, PhD Candidate, Department of Geography, University of British Columbia, Canada.

and related fields such as security studies (Aanonsen, 2026; Borowitz, 2019; Hentschel et al., 2025; Munir et al., 2022; Samimian-Darash, 2025), what it means to be 'aware' in the Arctic has not attracted much attention. This article begins to address this gap and examines how awareness and its related concepts—specifically, domains and situations—are deployed in contemporary discussions of territorial sovereignty and national security in the Arctic.

The main questions guiding our inquiry are: What is Arctic 'domain' and/or 'situational awareness' and how does 'awareness' intersect with contemporary narratives surrounding the Arctic and its (re)emergence as a military theatre? Relatedly, how does articulating, practicing, and demonstrating 'domain' and/or 'situational awareness' spatialize the Arctic? More succinctly, how is the Arctic produced, made legible, and ultimately governable through 'awareness'?

The paper argues that these concepts constitute a distinct spatializing logic, wherein the epistemic pursuit of 'awareness'—in other words, the collection and processing of geospatial data— becomes the central mode through which states seek to enact security over a certain geographical area by enabling military operations across multiple geophysical domains. 'Domains' and 'situational awareness' are more than just strategic or military terms of art. Rather, these concepts are made politically meaningful and powerful through their circulation and repetition, as well as the practices and technologies associated with their fulfillment in the production of 'intelligence' versus other forms of knowledge. As forms of intelligence, these concepts are often linked to military and security actors and become important by invoking the spectre of territorial vulnerability and threats to state security. Consequently, they potentially provide military organizations an outsized ability to articulate (and assuage) security concerns in the Arctic. If militaries are taking an outsized interest in building domain and situational awareness, then this suggests that they are spatializing the Arctic in ways that increasingly subsume—or "singularize," to borrow from Väätänen (2026)—the Arctic's multiple spatializations into a dominant militarized form.

The contribution of this article is two-fold. The article conceptually unpacks the notion of all-domain awareness through an investigation of its spatial and temporal characteristics using literatures across critical geography and critical security and teases out the theoretical implications related to how the Arctic is made legible and governed. Here, our argument is not that the Arctic is being militarized, which is an empirical claim that cannot be substantiated in the literature or empirical material surveyed here. Rather, the theoretical insights generated by this investigation demonstrate that domain and situational awareness are politically meaningful in how they circumscribe space and make the Arctic legible and governable, through a distinctly military 'way of seeing,' to borrow James C. Scott's (1998) term. A particular view of space that turns primarily on notions of uncertainty, risk, and potential threats, and which privileges institutions such as the armed forces and other security actors. The second contribution of this article is analytical, where we draw from the paper's theoretical insights into the onto-epistemic nature of domains and situations to extend Lambach's (2022) framework for studying the Arctic to include *volume* as an additional ontological category and *legibility* as an additional epistemic practice, and apply it to the Arctic, where the United States, Canada, NATO, and other actors are increasingly concerned with domain awareness. The findings of this analysis are neither extensive nor robust due to space constraints. Instead, the intent is to demonstrate the merit and value of such an analytical approach to understanding how domain and situational awareness contribute to the Arctic and its spatialization while deconstructing and distancing essentialized notions of what the Arctic is as a

space, thereby revealing the wider politics of how the Arctic is presented and made legible as a space of governance intervention.

The article proceeds as follows. We begin with a brief overview of domain and situational awareness in terms of their conceptual genealogy and how they are defined in military-strategic thinking. We then turn towards a discussion of how critical geographers and security studies scholars have reenvisioned Arctic spaces to better situate how awareness is discursively and materially implicated in the Arctic's spatialization. Together, these two bodies of work point us towards the onto-epistemic nature of domains and situations. The paper then provides a brief overview of contemporary discourses and policies on domain and situational awareness from Canada, the United States, and NATO. It discusses the Arctic's unique spatialization in these contexts, along with drawing general insights on domains and situations as politically inflected concepts that circumscribe space through the production of intelligence, which is closely linked to military and security institutions. We conclude with a brief reflection on the preceding discussion and suggestions for further research.

Being Aware

'Awareness' has become ubiquitous in modern military parlance, though what it means to be aware is context dependent and often left up to interpretation. Here, we focus on 'domain' and 'situational' awareness because they are arguably the two dominant terms populating military strategic thinking and policy discourses. Military strategy documents today are replete with calls for heightening 'awareness' across traditional and emerging warfighting domains, usually through the incorporation of new and more advanced environmental sensors, communication architecture, and data-processing capabilities. The twenty-first-century saw the proliferation of several more qualified concepts, such as 'space', 'cyber', and 'maritime domain awareness,' signaling a trend among the various (especially American) service branches (Lindsay and Gartzke, 2019, p. 5-6). However, despite this popularity, Ryder notes that domain awareness is "surprisingly […] not formally known in Department of Defense organizations, doctrine, or lexicon" (Ryder, 2021, p. 68). The interpretation of these terms becomes all the more complicated when they are associated with related concepts, such as "joint-all-domain command and control" (JADC2) (Ryder, 2021, p. 68), Canada's "pan-domain command & control" (PDC2) (National Defence, 2024b), and NATO's concerns on providing a "common operational picture" (Aragonés et al., 2024; NATO, 2005). In an effort to align domain and situational awareness into a clearer understanding, Ryder (2021, p. 70) proposes the following definition for domain awareness:

> Domain awareness is having operational knowledge of a particular sphere of concern, and understanding its interactions with other domains in a given environment. By extending Domain Awareness across all domains, the Intelligence Community Enterprise and organic, joint [intelligence, surveillance, and reconnaissance (ISR)] and operational sensors enables superior Domain Awareness through the timely creation and sharing of multidisciplined intelligence data at all classification levels through directed or automated dissemination mechanisms in near real time.

Ryder also argues that situational awareness is dependent on domain awareness, stating that "[d]omain awareness is key to [joint all-domain operations], whereas situational awareness is a lesser concept that more accurately refers to the interplay of battlespace effects on the joint force's

effects in near real time. Domain awareness creates situational awareness, while the converse may not necessarily be true" (2021, p. 70). Thus, in Ryder's formulation, domain awareness is the broader enabling concept that makes situational awareness possible. Similar to Ryder, Munir, Aved, and Blasch define situational awareness as "the cognizance of entities in the environment, understanding of their meaning, and the projection of their status in [the] near future" (2022, p. 55). Pedersen cites Mica Endsley's definition of situational awareness, which is "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future" (2019, p. 104). Thus, while definitions vary and multiply in relation to adjacent concepts, domain and situational awareness entail distinct spatial and temporal dimensions, where environmental data (including geography and actors within it) are collected through multiple channels, collated to form a coherent body of knowledge, and projected into the future to better prepare for and shape our experience with that environment according to the user's desires.

Domain awareness was articulated and institutionalized in the United States within a post-Cold War 'security milieu' and later expanded as a doctrinal concept following the 9/11 terrorist attacks where it became largely preoccupied with non-state actors, counterterrorism, surveillance, and border control. Soon after the 9/11 attacks, the Bush administration issued an "action plan for creating a secure and smart border" (The White House, 2001, 2002). The plan announced a "maritime domain awareness program." At the core of this program, the document explained, was "accurate information, intelligence, surveillance, and reconnaissance of all vessels, cargo, and people extending well beyond our traditional maritime boundaries" (Department of Homeland Security, 2005, p. ii). Elsewhere, situational awareness has been connected to the idea of producing 'transparent battlefields' through increasingly intensive and technologically mediated forms of surveillance (Cavallaro, 2024). Overall, the patchwork legacy of 'domain' or 'situational awareness' is evident in its conceptual transposition onto contemporary military defence and security concerns.

Regionally too, in places such as the Arctic, 'domain' and 'situational awareness' have become conceptual touchstones due to the region's environmental and political transformation. This transformation creates an important and somewhat unique connection between the Arctic and its temporality, as when we speak about the Arctic we are often speaking about it in its future tense—what the Arctic will *become*. This temporality is similar to how threats are always future-bound. The heightened interest in Arctic awareness requires deeper interrogation because 'awareness' is inextricably bound to different and potentially competing political imperatives, especially military imperatives, indicating that domain and situational awareness have a political valence that is underexplored. We begin this task by interrogating the 'domain' and the 'situation' as distinct but interrelated ideas embedded as onto-epistemic concepts. To do this we draw on two separate bodies of literature. The first body of literature is grounded in critical geography, which has made important contributions to how we understand and study the Arctic as a region. The second body of literature draws on recent efforts in critical security and focuses on the spatiotemporal dimension of 'awareness' and the underlying governance strategies that enable it. Together, these literatures provide inroads to theorizing Arctic all-domain awareness as onto-epistemic constructs.

Domains and Situations

There has been a distinct geographic shift toward examining the Arctic in recent years, particularly

among critical geographers following the so-called 'spatial turn' (Arias, 2010). As other scholars have pointed out, seemingly neutral representations of space, such as maps, embody constellations of power and politics, including security and military power (Philo, 2012; Rech et al., 2015). In this spirit, several scholars have gone great lengths to unpack the taken-for-granted notions of how we present and understand 'the Arctic' (e.g. Bruun & Medby, 2014; Keil & Knecht, 2017; Medby, 2019; Strandsbjerg, 2012). Broadly, this geographic turn approaches the Arctic in two distinct but related ways—those that follow a constructivist orientation and those that embrace greater sensitivity to materialism and practices.

Earlier works draw on the many ways the Arctic is imagined as a geographic space and seek to challenge these imaginaries by denaturalizing the assumptions that shape its perception. Importantly, the Arctic is underpinned by the notion of *multiplicity* because it is spatialized according to several different but overlapping geographical imaginaries (Bruun & Medby, 2014, p. 915). Broadly, these physical geographic representations of the Arctic conform to Cartesian abstractions of space in geopolitical terms, though what *geopolitical* means is often left assumed and undertheorized (Knecht & Keil, 2013). Keil and Knecht (2017) argue for the need to escape the Arctic's narrow regionalism, and to replace it with a "global Arctic paradigm" that complicates how we understand the Arctic as a space, recognizing the heterogeneity of Arctic governance actors, particularly those who have a pronounced "ability to frame Arctic imaginaries" (Keil & Knecht, 2017, p. 11). Ergo, states embrace, shape, and reproduce spatial imaginaries that simultaneously justify and inform their policy behaviour. These constructivist accounts have begun to accommodate 'more than imaginative' understandings of what space is, often theoretically reflecting recent materialist orientations that are sensitive to space's relationality, thus challenging purely representational understandings of space (Moore, 2026; Strandsbjerg, 2012; Väätänen, 2022, 2026). Spatial imaginaries do not appear out of thin air; they require epistemic and technical labour to exist, circulate, and reproduce.

In this vein, Elaine Campbell (2019) invites us to think about the space in terms of, but also beyond, *volume* and *verticality* (see also Dodds, 2021; Eiterjord, 2024; Wood-Donnelly, 2025). Campbell draws from Foucault's notion of the *milieu* and advocates its potential to destabilize essentialized views of (securitized) spaces. The milieu understands space as something inherently relational and considers the co-constitutive nature of spatial ideas, materialities, and technologies, along with its intersection with security. A security milieu "signals a mode of spatial thinking which not only eschews the notion of securitized space as a fixed and stable entity" (Campbell, 2019, p. 16). The milieu is a "mode and a medium for grasping the spatial co-ordinates and normalised distributions of circulatory flows such that an optimal circulation of people and things can be managed and maintained" (Campbell, 2019, p. 16). It therefore resists reproducing the same spatial enclosures critical scholars seek to unpack. Moreover, the milieu connects directly to an onto-epistemology of 'awareness,' which can be understood as an expanding practice that treats space as never fully realized, especially as it is premised on uncertainty given its preoccupation with the future. This is what it means to understand space as relational and eventful; it is always in the process of becoming and never fully sedimented (Moore, 2026).

The onto-epistemic shift embraces the sensitivity to practices, including, but going beyond, scientific practices. Väätänen (2026), for instance, approaches the Arctic as a case study, where the region exists as an "Arctic multiple." In this example, "the Arctic as a region of multilateral

cooperation does not exist beyond the practices that enact it as such" (Väätänen, 2026, p. 4). However, in contrast to these multiple Arctics, a process that Väätänen (2026, p. 7) terms "singularization" is occurring. Singularization is where "the multiplicity of a region gradually diminishes as different actors align themselves around one proposition for regionalization" (Väätänen 2026, p. 7). According to Väätänen (2026, p. 7), "[i]n the Arctic context, the ontological politics of singularization is best illustrated by the recent developments connected to the militarization of the Arctic." Thus, an onto-epistemic view of Arctic spatialization invites us to consider whether, and how, the "Arctic multiple" is increasingly circumscribed by a singular view of space. In our case, domain and situational awareness represent the potential tendency toward military singularization, as in 'seeing like a military.'

This is a theoretical claim rather than an empirical one. We are not arguing the Arctic *is* being militarized in a totalizing form (though there are clear signals that militarization is occurring). Rather, theorizing domains as onto-epistemic constructs that are uniquely linked to military-strategic discourse and operations suggests that spatializing the Arctic in terms of domains implies a certain trajectory for how the Arctic is made governable by and for certain actors within and outside of militaries. How domains are constructed epistemically and materially implicates how situations are conceived and circumscribed for governance intervention as continuities and ruptures of space-time. It is these values and logics, specifically those which actively shape how we understand the 'situation' in 'situational awareness.', which require further elaboration and which are taken up next.

Given the ubiquity of 'awareness' in contemporary security and military discourses, critical security scholars have begun to turn their attention towards what it means to be 'situationally aware' (Hentschel et al., 2025). As part of this shift, scholars have made important interventions unpacking situations as the focus of security practitioners and governance broadly (O'Grady, 2025) and have contributed to debates on its onto-epistemic features (Stanton et al., 2010). Indeed, these efforts go to great lengths to demonstrate security's shifting structure, which is increasingly premised on the growth of risk and uncertainty as governance logics (Ericson, 2005; Kavalski, 2008; Kessler & Daase, 2008). These resulting security practices are increasingly underwritten by new technologies linked with surveillance and intelligence-gathering, aligning with techno-fetishistic dreams of providing omniscient or 'god-like' vision (Suchman, 2023). Within this vision, we view the 'situation' as a spatiotemporal fixation upon which the present must always yield to a dangerous and threatening future on the horizon, where insecurity is an enduring condition necessitating endless vision and knowledge in an effort to attain the closest approximation of Truth epistemologically possible.

Situational awareness is invoked as a distinctive security imperative that assures us we can arrest and temper uncertainty (Hentschel et al., 2025, p. 2). Situational awareness is about engaging with liminality in that it is always practiced and enacted against the backdrop of growing danger, but the 'situation' is only experienced after the fact. The promise of 'total security' through situational awareness is thus rendered illusory because total security is premised on a contradictory logic underpinning situational awareness. Situational awareness is about enabling action *ex post facto* rather than anticipatory or preventative action because the situation is never resolved in a concrete or meaningful way; the situation itself is an enduring feature of how we understand the connection of space-time in a given environment—"as a logic or objective always beyond reach" (Lewis and

Coaffee, 2025, p. 40). As Samimian-Darash (2025, p. 7) explains, situational awareness supports a response after an event begins, though that response is grounded in techniques developed prior through anticipatory exercises linked to a rationale of preparedness. This spatiotemporal quality lends itself to the idea that situational awareness is made explicitly possible through technology and an "omniscience" of "total security" (Aanonsen, 2026; see also Suchman, 2023). To be aware is an epistemic practice that requires a reflexive account of one's environment and their relationship to it (Aanonsen, 2026, p. 10).

Crucially, domain and situational awareness practices blur the distinction between civil-military relations, underscoring the important (and sensitive) role of science in Arctic spatialization (Bruun & Medby, 2014; Eiterjord, 2024; Pedersen, 2019; Väätänen, 2022). The Arctic has long been a site of scientific interest, but there has been an explosion of Arctic science focused on environmental and climate awareness, and these scientific endeavours often serve military interests. However, there is a distinct difference between collecting and disseminating environmental knowledge and using that knowledge as military intelligence, where the latter shapes and is shaped by the Arctic according to its specific needs, values, and logics. To explore and exemplify the onto-epistemic nature of domains and situations as crucial to shaping how knowledge regimes are enacted and (re)configured to produce intelligence, and with it, domain situational awareness, we consider the recent preoccupation with Arctic awareness by reviewing recent policy documents and statements across three related sites, namely Canada, the United States, and NATO. We chose these cases because the Arctic has regained a significant focus for them and each involves several unique considerations related to domain and situational awareness. This analysis is not extensive and does not in itself empirically demonstrate militarization, but is only suggestive of the ways in which domain and situational awareness construct, and are constructed by, the Arctic as a space of military and wider governance intervention.

Arctic Domain and Situational Awareness

As we demonstrate, critical geographers and security scholars have both contributed to theorizing how we think about Arctic spaces and situational awareness, with only minimal overlap between geography and security considerations (Philo, 2012). Given our focus on domain and situational awareness, how can we bridge these insights to produce a broader analysis on domain and situational awareness in the Arctic? What is needed is a general approach to acknowledging the co-constitutive nature of discourses, practices, and materialities of space. We propose a three-step process to do this. First, as discussed, we begin with the premise that domain and situational awareness are onto-epistemic in nature, but the specific qualities of that nature are always in flux and debated, echoing Väätänen's (2026) 'Arctic multiple' thesis and Campbell's (2019) use of the milieu. Second, these onto-epistemic natures are overlapping and subject to political contestation. Therefore, we can tease out the specific contours of these natures through systematic analysis accounting for the different ontologies and epistemologies underpinning discourse, practices, and materialities. To do this, we draw on Lambach's analytical framework for studying space (2022, p. 296, see Appendix 1). Following the critical geography literature on the importance of practices that make space knowable, and the volumetric turn in and outside the Arctic, we propose adding *legibility* as an epistemic practice and *volume* as an ontology within Lambach's analytical framework as a third move, because both are implicitly invoked in policy and strategic discussions on military awareness. With this move, we shift the focus to the construction of domains and situations as

inherently spatial concepts that are enacted through the convergence of practices, discourses, and materialities. In the remainder of this section, we apply this framework in analyzing how Canada, the United States, and NATO deploy concepts of domain and situational awareness in public-facing policy documents about the Arctic.

Canada has long been preoccupied with awareness in its Arctic territory. Recent years have witnessed a pronounced growth in developing new technologies for enhancing its 'all-domain situational awareness', including a dedicated research and development program (Defence Research and Development Canada, 2019). For instance, the title of Canada's recent defence policy (National Defence, 2024a), "Our North Strong and Free", demonstrates the importance of the North and the Arctic in Canada's national identity. The defence policy emphasizes a commitment to improving operational capabilities in the Arctic, including for awareness. It states that "we commit to improving the Canadian Armed Forces' mobility and presence on land in the Arctic and North. We will explore options to acquire new vehicles adapted to ice, snow and tundra […which will] allow the military to maintain awareness in remote regions […]" (National Defence, 2024a, p. 25). Moreover, the defence strategy commits "to extending the Canadian Armed Forces' reach in Arctic waters […to] increase the Canadian Armed Forces' ability to assert Canada's sovereignty in the Arctic and North, conduct surveillance, reconnaissance, and search and rescue…" (National Defence, 2024a, p. 25). In the 2024 Canadian Coast Guard Strategy (2024), Area of Focus 4 is on Arctic Sovereignty and Maritime Domain Awareness and emphasizes partnerships with domestic and international groups, including Indigenous communities. Goal 7 item 3 of Canada's Arctic and Northern Policy Framework (ANPF) is to "strengthen Canada's domain awareness, surveillance, and control capabilities" (Crown-Indigenous Relations and Northern Affairs Canada, 2019, p. 81). By contrast, Canada's 2026 Defence Industrial Strategy (National Defence, 2026, p. 36) only mentions "awareness" once, but the Arctic represents Pillar V of the strategy. The strategy emphasizes Canada's expertise and capabilities in space-based surveillance, including in the Arctic, while stating that "[s]uccess will require close collaboration with domestic partners beyond industry, including the provinces and territories, Indigenous rights-holders, and communities across Canada. This will be especially true in Canada's North". The PDC2 Concept Paper stresses the Arctic and its importance for Canada's military defence capabilities, emphasizing challenges associated with the complexity of the threat environment, the weakness of traditional "domain-centric approaches to command and control (C2)," and the risks of further militarizing the Arctic (National Defence, 2024b, p. 3).

Domestically, Canada's interest in domain and situational awareness is rhetorically linked to sovereignty concerns (though there are few disagreements as to where Canada's Arctic sovereignty lies). The 'domain' in this context is quite general but focused on Canada's sovereign territory, often with an explicit concern for its maritime approaches and airspace. Understanding the Arctic in terms of multiple and overlapping ontologies, the Arctic is intimately connected to territory as "Our North" and a "special place" due to the emerging landscape characterized by a changing environment and new actors populating the region. Recent documents emphasize the politics of scale in the Arctic, with local places and actors serving national interests, connecting to the relationality of space envisioned and practiced between different bodies as actors, including Indigenous actors. Here, the Canadian Rangers, the "eyes and ears" of the Arctic (Government of Canada, 2026), provide an explicit scalar relationality between the local and national, as they are the experts on the Arctic's changing landscape, reducing Canada's "awareness gap" (Crown-

Indigenous Relations and Northern Affairs Canada, 2019, p. 41).

Focusing on practices of legibility and volume, we see that the Arctic 'domain' is operationalized in terms of Canada's ability to consistently monitor national as well as extra-national spaces in the Arctic. Here, environmental awareness is particularly relevant, demonstrating the 'domain' as an onto-epistemic construction of civilian and military practices that serve national defence priorities. This construction is particularly apparent in the PDC2 operating concept, where the domain is a volumetrically constructed space made knowable for defence and security purposes via technologically mediated practices and infrastructures. Situations in the Arctic are framed by their indefinite future potential form, and by gaps in military presence, sensing capabilities, and physical and digital infrastructures, reflecting limitations in the networks supporting military domain and situational awareness across Canada's Arctic territory. PDC2, similar to the more widely used JADC2 concept, reflects the desire for 'total security' by providing intimate and endless knowledge of the Arctic and constructing it in such a way as to circumscribe activity in it; in other words, to control the eventfulness of the Arctic as a relational space built through practice and representation between actors. The 'pan-domain' itself represents a networked ontology, crossing multiple scales and actors to account for a geographically and temporally dynamic landscape and producing a volumetric rendition of space.

The United States has likewise (re)turned its sights to the Arctic. While a leader in environmental sensing and surveillance capabilities, the US noticed Arctic awareness gaps at least as early as the 2010s, including in environmental awareness. For instance, a 2012 presentation by Dr. Jon E. Zufelt (2012) of the US Army Corps of Engineers stated that inadequate meteorological, hydrological, and navigation information represented an important shortfall in US capabilities in the Arctic. The presentation recommended that the US leverage environmental data collection, analysis, prediction, and exploitation with non-Department of Defense partners, in addition to promoting international information sharing agreements, supporting the Navy assessment of Arctic observing, mapping and environmental prediction capabilities, and fielding new environmental technologies (Zufelt, 2012).

The US Arctic Domain Awareness Center (ADAC) was established in 2014 and sponsored by the Department of Homeland Security (DHS). In 2024, DHS established ADAC-ARCTIC, a new Center of Excellence led by the University of Alaska Anchorage. The centre leverages academic partnerships and expertise, with educational initiatives including a master's degree in Arctic security and an Indigenous Elder, Knowledge Keeper, and Leader-in-Residence Program (ADAC, 2019; ADAC, 2026; Arctic Domain Awareness Center, 2026). The ADAC's mission "is to develop and transition technology solutions, innovative products, and educational programs to improve situational awareness and crisis response capabilities related to emerging maritime challenges in the dynamic Arctic environment," with the institution's primary "customer" being the US Coast Guard (Department of Homeland Security, 2022).

More recently, the 2022 National Strategy for the Arctic Region emphasizes the need for modernizing awareness, environmental sensing, and threat detection (The White House, 2022, p. 9). This emphasis is thematically echoed in a joint statement issued the year prior by the American and Canadian chief defense officials on modernizing the binational North American Aerospace Defense Command (NORAD), which singled out "situational awareness" of the two countries' "northern approaches" as a priority area, including the ability to maintain "persistent awareness

and understanding of potential threats […] in the aerospace and maritime domains," leveraging "a network of […] sensors from the sea floor to outer space," and "fuse and integrate data from all domain sensors" (National Defence, 2021; see also Charron and Fergusson, 2023). The most recent 2024 U.S. Department of Defense's Arctic Strategy likewise announced that it will be "enhancing [its] domain awareness" in the Arctic in order "to better monitor and respond to threats from and through" the region, and in turn, to "better deter aggression and defend the U.S. homeland" (U.S. Department of Defense, 2024). The strategy sets out a programme for "all domain awareness" in the region, including strengthening partnerships with civilian agencies for the collection and dissemination of "critical environmental information," and deepening relations with transatlantic allies in order to "strengthe[n] domain awareness" (U.S. Department of Defense, 2024, pp. 13–14).

The US emphasis on maritime awareness is also represented in the 2024 Operation POLAR VORTEX (Hudson, 2024). Like NATO's Task Force X-Arctic (see below), POLAR VORTEX focused on awareness through novel technologies. POLAR VORTEX involved a Naval and Amphibious Liaison Element (NALE) led by US 3rd Fleet, supported by US Fleet Forces, and embedded in the Alaskan NORAD Region. POLAR VORTEX brought together NALE operators with US Air Force and Royal Canadian Air Force (RCAF) members

> to increase domain awareness in the Arctic region […] by instantly linking maritime and air domain awareness […]. By co-locating, the NALE and 611 AOC were able to coordinate information instantly to the Joint Force Air Component Commander (JFACC) and provide a detailed real-time operating picture from the surface to air across some of the most remote operating areas in Alaska. [...] (Hudson, 2024).

The operations also supported USNORTHCOM and NORAD's mission of homeland defense, aerospace warning and control, and preserving a stable Arctic region in cooperation with U.S. Allies and partners (Hudson, 2024).

The Arctic has emerged as an important area of focus for NATO, too, particularly after Sweden and Finland's recent accession. As NATO states:

> [t]he Arctic and the High North are increasingly important for NATO's collective security. Seven of the eight Arctic states are NATO Allies, so the Alliance has a clear interest in preserving security, stability and cooperation in the region. NATO Allies regularly conduct exercises in the High North, ensuring that they are ready to defend and operate in all conditions (NATO, 2026b).

Arctic domain and situational awareness are core trajectories for NATO in this regard. NATO's efforts in the Arctic include Arctic Sentry, "a multi-domain activity that is strengthening NATO's posture in the Arctic and High North" (NATO, 2026b). Arctic Sentry is led by Joint Force Command Norfolk (JFC Norfolk), which "will also collaborate with Allied Command Transformation and coordinate activities with the joint US-Canada NORAD, as well as the US Northern Command and US European Command" (NATO, 2026b). In addition, NATO's Supreme Allied Commander Europe (SACEUR) updated its geographic boundaries outlining the coordination of NATO military activities in December 2025 to add Denmark, Finland, and Sweden to JFC Norfolk's area of responsibility.

As part of Arctic Sentry, NATO has also launched Task Force X-Arctic (TFX-Arctic), an initiative designed "to strengthen the Alliance's awareness and presence in the region" (NATO, 2026a). According to NATO, TFX-Arctic "is designed to demonstrate, for the first time, how networked uncrewed systems, under ultimate human control, can deliver persistent multi-domain situational awareness across the North Atlantic, the Arctic, and the High North" (NATO, 2026a). TFX-Arctic is envisioned as an exercise for testing new and innovative technologies from companies selected through NATO's Defence Innovation Accelerator for the North Atlantic (DIANA) and technically led by the NATO Science & Technology Organization's Centre for Maritime Research & Experimentation (CMRE) (NATO, 2026a).

Discussion

Returning to our original premise, namely that domains and situations are onto-epistemic in nature reveals several characteristics related to their spatiotemporal qualities. The language of 'domains' is rooted in military discourse and strategic planning, which carve space according to 'exclusive operating areas' or 'areas of responsibility' and assign them to unique institutional actors, such as JFC Norfolk or NORAD. These institutional actors are sovereign-bound in that they reflect and actively construct Arctic places in relation to mythmaking and symbolism connected to the nation ('Our North', 'the homeland'), its inscription on the landscape (sovereignty, territory), and their security ('homeland security'). This sovereign form is epistemologically networked in that 'awareness' of space requires the assemblage of multiple actors and systems. Indeed, domains are reified by military actors, especially in layered and volumetric terms, where geography is topographically oriented 'from sea to space'. The language and practices of 'domains' shape how we think about and understand space in sovereign terms.

Domain and situational awareness reify the Arctic as legible in particular ways and put the Arctic's 'secrets' into service of a higher-order political ambition. We see these efforts as environmental awareness in the Arctic has long been put in service of military needs, especially space weather awareness given its effects on joint military operations (Perron, 2014, p. 18). In this spirit, situational awareness reveals the military desire to mitigate against future threats while projecting power in the present, especially in spaces that are highly dependent on imaginative constructions for our own understanding such as the Arctic. Threats are always future-oriented, but the Arctic in particular is increasingly future-bound as a space always under transformation within an emerging condition, namely climate change and geopolitical reorientation.

This transformation is partly why Arctic military exercises and awareness plans appear more pronounced in recent years. NATO's TFX-Arctic, US-Canada activities linked with POLAR VORTEX through NORAD, and other military scenario exercises are critical tools of situational awareness in the Arctic because they enable militaries to display 'awareness' as a form of sovereign power and to demonstrate their resolve in the absence of, but anticipation in, a future event or condition. The use of military exercises in the Arctic reflects Samimian-Darash's (2025, p. 8) observation that scenarios allow us to make sense across temporalities, where "[situational awareness] is part of a range of governing techniques that are activated after an event takes place – that is, within the context of governing after the fact [….]. However, these techniques are learned and practiced before the event takes place as part of preparation efforts."

What do these insights suggest in terms of how we think about the relationality of the 'domain', the 'situation', and the Arctic? Domains and situations, and the practices of awareness associated

with them, are predominantly military in nature, and thus shape space in particular ways according to their needs. The Arctic is spatialized as a military space that is eventful in the sense that situational awareness is premised on rendering space through its relationality in the form of intelligence, which is itself often linked to military and security actors. The consequence for the Arctic is that, while domain and situational awareness appear as neutral state practices inherent to and demanded by the sovereign form, viewing and understanding the Arctic in terms of awareness constructs and amplifies a specific spatial orientation of it, privileging a governance structure that may displace other (perhaps more equitable or even more cooperative and peaceful) forms of space making while incentivising to think about Arctic space and governance in security and military-specific terms and ways. In Canada, the United States, and NATO, domain and situational awareness are invoked as central to the emerging demands of sovereign power, especially along defence and military considerations. We argue that 'domain' and 'situational' awareness in this respect constitute the Arctic according to a distinct spatializing logic. Here, the epistemic pursuit of 'awareness', including the collection and processing of geospatial data to support intelligence, becomes the central mode through which states and military organizations seek to enact security over a certain geographical area while enabling military operations across multiple geophysical domains

Conclusion

This article examined the concepts of domain and situational awareness, along with sibling concepts, in a spatial register. This examination is more than a semantic exercise as we contend that these terms—now ubiquitous in strategic and operational level doctrines and increasingly adopted by civilian decision-makers to frame regional security issues—represent a distinct way of apprehending and, in effect, 'territorializing,' physical space. As we attempted to show in this excursion, these concepts, and the doctrines and technological systems that underpin them, constitute a military 'way of seeing,' a set of spatial techniques that produces a form of 'strategic' second nature. Intelligence is fundamental to their onto-epistemic regimes, but it also aids in the 'singularization' of the Arctic; 'intelligence' is premised on the 'domain' and the 'situation' as militarized onto-epistemologies while shaping how we know and understand the Arctic. It circumscribes power because intelligence is often a privileged field of military and security activity and it is necessarily extractive in that militaries take knowledge and make it 'intelligible' for their own needs. As we discussed above, this represents a theoretical rather than a strictly empirical set of claims. Our examples including Canada, the United States, and NATO serve as brief, if rudimentary, illustrations of how an onto-empiric investigation of the Arctic and domain situational awareness may be conducted. To the extent that the Arctic is being (re)militarized, it is uneven, variated, and heterogeneous across different Arctic spaces, with the Russian Arctic perhaps standing out as a site where more intensive militarization is taking place given its centrality to Russia's economic and state power (Limon and Gürdal Limon 2024; Miller 2023; Staun 2023). Future work could emphasize case studies in and across national boundaries, for instance examining how the political and economic logic underpinning Arctic domain and situational awareness hosts an array of military and non-military actors while incentivizing or disincentivizing certain practices and discourses as they relate to governance and intervention, including infrastructure development and environmental monitoring.

References

Aanonsen, C.E. (2026). Operationalising uncertainty. The automation of threat knowledge and situational awareness. *Security Dialogue*, xhag010. https://doi.org/10.1093/secdia/xhag010 ADAC. (2019).

ADAC Center Overview [Video recording]. https://arcticdomainawarenesscenter.org/ADAC_Media.php

ADAC. (2026). *About ADAC-ARCTIC*. https://www.adacarctic.com/about.php

Aragonés, M., Climente, A., Pérez, I., & Esteve, M. (2024). *Framework for Cognitive Warfare Situational Awareness Visualization*. https://www.sto.nato.int/document/framework-for-cognitive-warfare-situational awareness-visualization/

Arctic Domain Awareness Center. (2026). *Homepage*. https://arcticdomainawarenesscenter.org/
Arias, S. (2010). Rethinking space: An outsider's view of the spatial turn. *GeoJournal*, *75*(1), 29–41. https://doi.org/10.1007/s10708-010-9339-9

Borowitz, M. (2019). Strategic Implications of the Proliferation of Space Situational Awareness Technology and Information: Lessons Learned from the Remote Sensing Sector. *Space Policy*, 47, 18-27. https://doi.org/10.1016/j.spacepol.2018.05.002

Bruun, J. M., & Medby, I. A. (2014). Theorising the Thaw: Geopolitics in a Changing Arctic. *Geography Compass*, *8*(12), 915–929. https://doi.org/10.1111/gec3.12189

Campbell, E. (2019). Three-dimensional security: Layers, spheres, volumes, milieus. *Political Geography*, *69*, 10– 21. https://doi.org/10.1016/j.polgeo.2018.11.010

Canadian Coast Guard. (2024). *Canadian Coast Guard Arctic Strategy* [Policy]. Government of Canada. https://www.canada.ca/en/canadian-coast-guard/corporate/publications/arctic-strategy.html

Cavallaro, G. (2024, June 25). *The Transparent Battlefield: Combat Training Centers Sharpen Unit Tactics for High-Tech Fight*. Association of the United States Army. https://www.ausa.org/articles/transparent-battlefield combat-training-centers-sharpen-unit-tactics-high-tech-fight

Charron, A., & Fergusson, J. (2023). NORAD Modernization: Past, Present and Future. In T. Juneau & P. Lagassé (Eds.), *Canadian Defence Policy in Theory and Practice, Volume 2* (pp. 75–95). Springer International Publishing. https://doi.org/10.1007/978-3-031-37542-2_5

Crown-Indigenous Relations and Northern Affairs Canada. (2019). *Arctic and Northern Policy Framework* [Policy]. Government of Canada. https://www.rcaanccirnac.gc.ca/eng/1560523306861/1560523330587

Defence Research and Development Canada. (2019). *All Domain Situational Awareness Science and Technology Program*. Government of Canada. https://www.canada.ca/en/defence-research development/programs/all-domain-situational-awareness-program.html

Department of Homeland Security. (2005). National Plan to Achieve Maritime Domain Awareness for The National Strategy for Maritime Security. https://www.dhs.gov/sites/default/files/publications/HSPD_MDAPlan_0.pdf

Department of Homeland Security. (2022). *Arctic Domain Awareness Center (ADAC) Fact Sheet*. https://www.dhs.gov/science-and-technology/publication/arctic-domain-awareness-center-factsheet.

Dodds, K. (2021). Geopolitics and Ice Humanities: Elemental, Metaphorical and Volumetric Reverberations. Geopolitics, 26(4), 1121–1149. https://doi.org/10.1080/14650045.2019.1697240

Eiterjord, T. (2024). Securitise the volume: Epistemic territorialisation and the geopolitics of China's Arctic research. *Territory, Politics, Governance*, *12*(1), 93–111. https://doi.org/10.1080/21622671.2023.2179535

Ericson, R. (2005). Governing through risk and uncertainty. *Economy and Society*, *34*(4), 659–672. https://doi.org/10.1080/03085140500277310

Gartzke, E., & Lindsay, J. R. (2019). *Cross-Domain Deterrence*. Oxford University Press.

Government of Canada. (2026). *Operation NANOOK*. https://www.canada.ca/en/department-national defence/services/operations/military-operations/current-operations/operation-nanook.html

Hentschel, C., Krasmann, S., & Zebrowski, C. (2025). Situational awareness: Sensing insecurity and coming catastrophes. *Critical Studies on Security*, *13*(1), 1–5. https://doi.org/10.1080/21624887.2025.2466893

Hudson, D. Tech. Sgt. (2024, October 28). Enhancing Domain Awareness in the Arctic [Government]. United States Government. U.S. Fleet Forces Command. https://www.usff.navy.mil/Press-Room/News Stories/Article/3948702/enhancing-domain-awareness-in-the-arctic/

Kavalski, E. (2008). The Complexity of Global Security Governance: An Analytical Overview. *Global Society*, *22*(4), 423–443. https://doi.org/10.1080/13600820802366391

Keil, K., & Knecht, S. (2017). Introduction: The Arctic as a Globally Embedded Space. In K. Keil & S. Knecht (Eds.), *Governing Arctic Change: Global Perspectives* (pp. 1–18). Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-50884-3_1

Kessler, O., & Daase, C. (2008). From Insecurity to Uncertainty: Risk and the Paradox of Security Politics. *Alternatives*, *33*(2), 211–232. https://doi.org/10.1177/030437540803300206

Knecht, S., & Keil, K. (2013). Arctic geopolitics revisited: Spatialising governance in the circumpolar North. *The Polar Journal*, *3*(1), 178–203. https://doi.org/10.1080/2154896X.2013.783276

Lambach, D. (2022). Space, scale, and global politics: Towards a critical approach to space in international relations. *Review of International Studies*, *48*(2), 282–300. Cambridge Core. https://doi.org/10.1017/S026021052100036X

Leslie, S. W. (2021). Under the Radome: The Architecture of American Cold War Surveillance. *Fabrications*, *31*(2), 153–179. https://doi.org/10.1080/10331867.2021.1945732

Lewis, T., & Coaffee, J. (2025). Atmosphere, imminence and the Manchester Arena Inquiry: On

the affective modalities of becoming situationally aware to urban terrorism. *Critical Studies on Security*, *13*(1), 38–57. https://doi.org/10.1080/21624887.2024.2385185

Limon, Onur, and Elif Gürdal Limon. 2024. "The Impact of the Ukraine War on Russian Military Capabilities in the Arctic." *Polar Geography* 47(3):157–78. doi:10.1080/1088937X.2024.2399003.

Medby, I. A. (2019). Language-games, geography, and making sense of the Arctic. *Geoforum*, *107*, 124–133. https://doi.org/10.1016/j.geoforum.2019.10.003

Miller, Steven E. 2023. "The Return of the Strategic Arctic." *Arctic Yearbook 2022*. https://arcticyearbook.com/arctic-yearbook/2022/2022-commentaries/452-the-return-of-the-strategic-arctic.

Moore, A. (2026). The Eventfulness of Place. *Geographical Review*, *116*(3), 329–344. https://doi.org/10.1080/00167428.2025.2467747

Munir, A., Aved, A., & Blasch, E. (2022). Situational Awareness: Techniques, Challenges, and Prospects. *AI*, *3*(1), 55–77. https://doi.org/10.3390/ai3010005

National Defence. (2021, August 14). *Joint Statement on Norad Modernization*. https://www.canada.ca/en/department-national-defence/news/2021/08/joint-statement-on-norad modernization.html

National Defence. (2024a). *Our North, Strong and Free: A Renewed Vision for Canada's Defence* [Policy]. Government of Canada. https://www.canada.ca/en/department-nationaldefence/corporate/reports-publications/north-strong-free-2024.html

National Defence. (2024b). *Pan-Domain Command & Control (PDC2) Concept Paper* [Policy]. Government of Canada. https://www.canada.ca/en/department-national-defence/corporate/reports publications/pan-domain-command-control.html

National Defence. (2026). *Canada's Defence Industrial Strategy* [Policy]. Government of Canada. https://www.canada.ca/en/department-national-defence/corporate/reportspublications/industrial strategy/security-sovereignty-prosperity.html

NATO. (2005). *Visualisation and the Common Operational Picture (RTO-MP-IST-043)*. https://www.sto.nato.int/document/visualisation-and-the-common-operational-picture/

NATO. (2026a, June 6). *NATO launches Task Force X-Arctic to strengthen awareness in the Arctic and the High North*. https://www.nato.int/en/news-and-events/articles/news/2026/06/06/nato-launches-task-force-xarctic-to-strengthen-awareness-in-the-arctic-and-the-high-north

NATO. (2026b, July 24). *Arctic security*. https://www.nato.int/en/what-we-do/deterrence-and defence/arctic-security

O'Grady, N. (2025). (Re) framing the politics of climate change: Resilience, reparative critique and affective life in situations of extreme heat. *Critical Studies on Security*, *13*(1), 70–86. https://doi.org/10.1080/21624887.2024.2410521

Pedersen, T. (2019). Polar Research and the Secrets of the Arctic. *Arctic Review on Law and Politics*,

10, 103–129. JSTOR.

Perron, P. (2014). Space Weather Situational Awareness and Its Effects upon a Joint, Interagency, Domestic, and Arctic Environment. *Canadian Military Journal*, *14*.

Philo, C. (2012). Security of geography/geography of security. *Transactions of the Institute of British Geographers*, *37*(1), 1–7. JSTOR.

Rech, M., Bos, D., Jenkings, K. N., Williams, A., & Woodward, R. (2015). Geography, military geography, and critical military studies. *Critical Military Studies*, *1*(1), 47–60. https://doi.org/10.1080/23337486.2014.963416

Ryder, R. M., Chief Warrant Officer. (2021). Domain Awareness Superiority Is the Future of Military Intelligence. *Military Review*, *November-December*. https://www.armyupress.army.mil/Journals/Military

Review/English-Edition-Archives/November-December-2021/Ryder-Domain-Awareness/
Samimian-Darash, L. (2025). Situational awareness across different temporalities: Scenario exercises for health, security and energy futures. *Critical Studies on Security*, *13*(1), 6–20. https://doi.org/10.1080/21624887.2024.2383802

Scott, J. C. (1998). Seeing like a state: How certain schemes to improve the human condition have failed. New Haven, CT: Yale university Press.

Stanton, N. A., Salmon, P. M., Walker, G. H., & Jenkins, D. P. (2010). Is situation awareness all in the mind? *Theoretical Issues in Ergonomics Science*, *11*(1–2), 29–40. https://doi.org/10.1080/14639220903009938

Staun, Jørgen. 2023. "Russia's Arctic Policy: Upcoming Change?" *Polar Record* 59:e31. doi:10.1017/S0032247423000220.

Strandsbjerg, J. (2012). Cartopolitics, Geopolitics and Boundaries in the Arctic. *Geopolitics*, *17*(4), 818–842. https://doi.org/10.1080/14650045.2012.660581

Suchman, L. (2023). Imaginaries of omniscience: Automating intelligence in the US Department of Defense. *Social Studies of Science*, *53*(5), 761–786. https://doi.org/10.1177/03063127221104938

The White House. (2001, December 12). *Action Plan for Creating a Secure and Smart Border*. https://georgewbush-whitehouse.archives.gov/news/releases/2001/12/20011212-6.html

The White House. (2002, January 25). *Securing America's Borders Fact Sheet: Border Security*. https://georgewbush-whitehouse.archives.gov/news/releases/2002/01/20020125.html

The White House. (2022). *National Strategy for the Arctic Region*. https://bidenwhitehouse.archives.gov/wp content/uploads/2022/10/National-Strategy-for-the-Arctic-Region.pdf

U.S. Department of Defense. (2024). *2024 Arctic Strategy*. https://media.defense.gov/2024/Jul/22/2003507411/-1/-1/0/dod-arctic-strategy-2024.pdf

Väätänen, V. (2022). The construction, solidification and political implications of geographical

scientific facts: A perspective on the 'changing' Arctic region. *Geoforum*, *128*, 21–32. https://doi.org/10.1016/j.geoforum.2021.11.019

Väätänen, V. (2026). Doing regions: Multiplicity and singularization in the ontological politics of the Arctic. *Political Geography*, *125*, 103460. https://doi.org/10.1016/j.polgeo.2025.103460

Wood-Donnelly, C. (2025). Sovereignty cubed: The Arctic as a territorial and ontological volume. *European Journal of Social Theory*, *28*(2), 169–184. https://doi.org/10.1177/13684310241270533

Zufelt, J. E. (2012, September 19). *Advancing Arctic Domain Awareness*. https://smap.jpl.nasa.gov/files/smap2/Day2_6_Zufelt2.pdf14

Appendix

Appendix 1. Domain and Situational Awareness - Ontology and Spatial Practices (see Lambach 2022).

SPATIAL PRACTICES	ONTOLOGY						
	Territory	***Place***	***Scale***	***Network***	***Body***	***Landscape***	***Volume***
Reification	Domains as part of exclusive operating areas or "areas of responsibility". Militaries rely on their territories (JF Norfolk, NORAD, USNORTHCOMM)	The 'Arctic' as a fluid place – 'the Arctic', 'the North', 'Our North'. Domains reified through place and situations are knowledge about places (often through sovereignty)	Power is distributed across the national, regional, local scales, but military power is concentrated at the national. Domains are abstracted through scale – everywhere and nowhere at once.	Arctic awareness is practiced and envisioned as a networked activity through distributed capacity. Requires breakdown of institutional and technological silos. Domains and situations as inherently flattened, networked effects that are interconnected.	Bodies are reified as in service of higher-order imperatives, often through scale (e.g., 'local' knowledge holders). Much of domain and situational awareness strips the Arctic of bodies or reifies them as enablers of awareness (e.g., the Rangers as the 'eyes and ears' of the Arctic) or threatening and 'dangerous'.	Environmental governance is core to Arctic military operations and awareness.	The Arctic and domains are rendered in 3-dimensional terms. Physical domains are vertically ordered ('from sea to space').
Inscription of meaning	Inscription is performance-oriented; displays of (military) power. Arctic operations and exercises (e.g., TFX-Arctic, VORTEX). Domain and situational awareness as deterrence and denial-oriented.	The Arctic as that which must be secured and defended in relation to a constructed place defined by sovereign power (e.g. the 'Homeland', 'Our North'). The Arctic increasingly a militarized theatre (singularization).	The Arctic as shifting from a zone of international cooperation to narrower forms of (military-scientific) cooperation underpinned by shared values (e.g., 'liberal' states, allies).	Networks preferred organizational form for security/military response to domain and situational awareness challenges in the Arctic. Networks enable scalar integration (local national, regional partnerships).	Bodies are ascribed status through their connection to place (i.e., 'local'). Place defines what bodies belong or do not belong.	Domains and situations are shaped by place as "operating" or "battlefield" environments; common operating pictures. Overlaps with inscription narratives of the Arctic as 'natural', 'wild', 'untamed', creating an awareness gap.	Domain and situational awareness is amplified as a policy concern through lack of total (volumetric) knowledge. Militaries uniquely primed to respond via the production of intelligence.
Boundedness	Borders are formed in areas of military/security responsibility, national and Indigenous territories: the Canadian Arctic, the US Arctic, the Euro-Arctic; exclusive economic zones; aerospace approaches.	Multiple, overlapping Arctics (the Arctic multiple). Arctic spaces constantly negotiated through boundary making. Domains bounded by physical criteria; situations are temporally fluid, but event-focused (before/after).	Power is hierarchically ordered. Local often absent or subsumed within the national and incorporated into regional/international. Boundaries are difficult to discern as domains/situations cut across.	Nodes of awareness (e.g., sensors, satellited, bodies, undersea cables, other infrastructure) form network structures that constrict and enable inside (e.g., NATO Allies) and outside (Russia).	Bodies are part of sociotechnical assemblages of awareness. Boundaries are impossible to specify outside of the assemblage.	Domain classification and representations based on specific criteria (e.g., operating areas; environmental phenomena; temporality of events and if/when to intervene).	Volumes of space are vertically oriented and part of the landscape. They become bounded by technologies and sensing abilities (e.g., hyperspectral imaging).
Relations	Awareness is necessarily relational between different territories. Practices of representation and exchange define territories (e.g., bi/multi-lateralism; civilian-military)	Awareness implicated in spatial divisions of labour and spatial proximity (e.g., core-periphery). In the US, the Arctic is often peripheral to the US 'homeland'; in comparison, the Arctic is central to Canada but regionally peripheral to its south.	The scalar division of labour in awareness practices (e.g., the local often positioned in relation to national). Power is ordered through scale, including the ability to define and project awareness.	Network infrastructures for awareness promote or constrict relations and spatializations of awareness (e.g., 'common' operating pictures and who can participate, such as NATO Allies). Networked interoperability between commands and military divisions. Networks depend on legibility to be enacted and enable greater legibility in turn (e.g., interoperability and common operating pictures require networked capabilities, which depends on prior consideration of nodal points and network structure).	Awareness enabled through Human-machine teaming. Bodies defined relationally through civilian/ security/military mediation.	Environments are complex ecosystems. Arctic undergoing profound change that reshapes old and forms new relationships through the 'global Arctic' (planetary crisis; geopolitics). Awareness increasingly sought to mitigate these changes.	Volumetric awareness relationally produced. Domains defined through relations between entities and the ability to project behaviour forward in time in 3-dimensional space.
Legibility	Epistemic in nature. Sensing practices (e.g., measurement, imaging) enable territorialization through institutionalization (e.g., seabed mapping and EEZs through UNCLOS). Legibility enables territory but increasingly unbound by it.	The Arctic constructed according to specific practices and institutions of legibility and representation.	Particular sites are made legible through awareness and reflected through scale (e.g., the Kola Peninsula is a multi-scalar site of local, regional, national, and international significance made legible through different practices.		Bodies are made legible via categorization (biopolitics). Awareness depends on legibility to discern normal/abnormal, friend/enemy	Scientific practices core to legibility of environments and ecosystems, supporting environmental governance.	Volumes are connected in how they inscribe legibility (e.g., space observation of terrestrial domains). Space is made legible vertically (e.g., all-domain awareness – 'from sea to space').