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New Technologies, Climate Change and War in Ukraine: What Impacts on NORAD Modernization?

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The Russian invasion of Ukraine has brought the important modernization of the North American Aerospace Defense Command (NORAD) back on the agenda of the Canadian government. In response to the war, Defence Minister Anita Anand assured that while she was not able to provide plans to modernize NORAD at this time, National Defence is actively working to develop a set of new technologies in the near term. Canada finally seems inclined to prioritize homeland defence, after leaving that chapter unwritten in its 2017 defence policy.

There are two main drivers that must guide Canada in the NORAD modernization process, which will be a priority over the next decade: the well-defined defence imperatives of the United States and the urgency of climate change, particularly in the Arctic region. Underlying both drivers is the international context of great power competition, in which the Arctic will be a decidedly important theatre, pushing the United States to act and creating new threats as climate change alters the geography of the territory.

On the one hand, the United States must modernize its capabilities to counter new Russian and Chinese technologies, which are difficult to detect and defeat. NORAD's capabilities in this regard are very limited, especially with respect to the North Warning System (NWS), which has already been targeted as a priority in the NORAD modernization process. In turn, the United States has clear priorities for its defence strategy in this regard – which is not the case for Canada.

On the other hand, climate change not only creates opportunities for new external threats through its impact on the geography of the land – such as melting ice in the Arctic – but also through threats intrinsic to climate disruptions, such as potential damage to critical defence infrastructure, or the overtaking of the operational capabilities of the Canadian Armed Forces (CAF). Yet climate change is almost absent from NORAD discussions, despite the major impact it will have on defence activities in the coming years.

The climate emergency and U.S. imperatives must push Canada to define its own priorities and choose its own avenues for concrete action – avenues that will also reflect Canadian values. This policy report provides an overview of NORAD's modernization and an assessment of Washington and NORAD's defence imperatives and priorities. The text presents the progress of Canadian Defence in the area of climate change and the various impacts that these will have on its activities and capabilities. Finally, considerations and recommendations for Canada are formulated, in light of the international context currently disturbed by the war in Ukraine.

An Overview of NORAD's Modernization Progress

In January 2022, General VanHerck, Commander of NORAD and United States Northern Command (USNORTHCOM), suggested that NORAD modernization must be completed within a five-to-six-year window. Technically, much has already been done to determine what needs to be modernized and what the priorities are. For example, the upgrade of the NWS, the importance of integrated deterrence, and the urgent need to enhance domain awareness, surveillance, and monitoring capabilities, particularly in the Arctic, are already established as priorities for the next evolution of NORAD. However, concrete actions are still pending.

The Department of National Defence (DND) announced on January 31, 2022 that it has granted a contract to Nasittuq Corporation, an Inuit company, for in-service support of the NWS. This contract for maintenance and support of the current system does not include a modernization component, which has been expected for several years due to the outdated capabilities of the NWS, a system that was completed between 1986 and 1992 using available technology from the 1970s. It was designed to detect the threat of aerial bombardment from the USSR, a threat that is already 50 years old.

Although listed as a priority in Canada's 2017 Defence Policy *Strong, Secure, Engaged* (SSE), NORAD and NWS modernization still lacks a concrete and specific avenue adopted by the United States and Canada. The last federal budget of 2021 allocated over $100 billion in new spending over the next several years, of which only $163 million will be allocated to NORAD modernization. All indications are that these funds will be used for research and concept development, as no concrete modernization projects have been announced in the past year. Estimates of the cost of modernization range from $10 billion to $15 billion, with Canada potentially paying 40% of the total bill. This means that spending on NORAD modernization will increase over the next decade, beyond what has been anticipated in the Trudeau government's defence policy.

General VanHerck stated that the next step in this modernization is now in the hands of the politicians:

> "The next step in my mind is for the Secretary of Defense and the Minister of National Defense to sit down and come up with a framework that moves both Canada and the United States forward within our departments on how we would talk about fielding of these capabilities, the agreements for who's going to pay for what, what capabilities."

The evolution of NORAD has therefore begun, but it has yet to be completed. Although the United States and Canada have been reaffirming their partnership for the past year, the details of the plan to modernize NORAD have not been revealed. This is especially problematic given that American requests to implement their vision for modernization will stimulate debate in Canada. This is likely to happen soon: Defence Minister Anita Anand recently stated that she intends to complete NORAD modernization in the short term and that "Canada will be at the table with a robust package to enhance NORAD." Regardless of the nature of these measures, the government will be accountable to the Canadian public and must be transparent.

U.S. Imperatives in the Modernization of NORAD and Its Defense Strategy

In a January 2022 interview, General VanHerck clarified three of his priorities for modernizing NORAD. The first is domain awareness, which includes modernizing NWS capabilities to create an effective deterrent that enables informed decision-making. The second priority flows from the first:

decision superiority, or information dominance, to ensure that information gets to the right people faster. The third priority is the implementation of an integrated deterrence of all domains, because according to the general, all the problems and issues today are global and can no longer be solved regionally or by a single domain. General VanHerck's vision extends beyond North America:

> "My defence plan for North America doesn't start in North America. It starts forward with allies and partners. It starts forward with my fellow combat commanders and CJOC [Canadian Joint Operations Command] being able to create day to day deterrence options, and de escalation options, and if required, defeat, but not defeat in North America, defeat forward."

These priorities are clearly consistent with the March 2021 NORAD/USNORTHCOM Strategy, which details four key strategic principles: an integrated defence approach (in terms of regions, domains, and states), domain awareness, information dominance, and decision superiority. To better understand this strategy, it is important to distinguish the roles of NORAD and USNORTHCOM: NORAD conducts aerospace control and aerospace and maritime warning for the defence of North America, while USNORTHCOM defends U.S. territory – deterring, detecting, and defeating threats to the United States, conducts cooperative security activities with allies and partners, and supports civil authorities. NORAD and USNORTHCOM have been cooperating since the latter's inception in 2002. Thus, it is important to keep in mind that new U.S. defensive developments associated with aerospace or the Arctic do not necessarily have to go through NORAD: this is the case with ballistic missile defence (GMD and BMD).

The United States, consistent with its defence strategy, values and prioritizes the creation of a structure for integrated deterrence and a window of opportunity for first strike/response. This deterrence is integrated in that it considers five categories:

1. All domains (conventional, nuclear, cyber, space, information);
2. All theatres of competition and potential conflict;
3. All aspects of the conflict spectrum (from high-intensity warfare to the grey zone);
4. All instruments of national power (economic sanctions, diplomatic tools, etc.);
5. All U.S. allies and partners (Europe, Asia, Americas, etc.).

The United States does not want to be in the vulnerable position like it did during the Cold War era. It fears falling behind the development of new Russian and Chinese technologies. These technologies, such as hypersonic vehicles, which Russia has been testing in the Arctic over the past year, can evade ground-based radar by hiding behind the curvature of the Earth. Because of their speed of travel and manoeuvrability to elude defensive measures, these missiles are extremely difficult to detect and defeat. The United States is pursuing two key technologies to win the race: "boost-glide" systems that place a hypersonic glide vehicle atop a ballistic missile booster, and hypersonic cruise missiles that would use "scramjet" technologies (which enable efficient operation at hypersonic speeds and supersonic combustion). Hypersonic weapons will allow the United States to be a credible deterrent against China and Russia, both of which already have functional hypersonic weapons.

Hypersonic weapons are also part of the U.S. "Conventional Prompt Global Strike Program," through which Washington seeks to acquire the capability to conduct strikes with minimal delay (no more than one hour after giving the order to strike the target) with a high degree of technical security anywhere in the world. This is a way for U.S. power to gain faster response or attack time – meaning decision superiority, one of the strategic priorities of NORAD and USNORTHCOM.

In testimony before the U.S. House Armed Services Committee on March 8, General VanHerck reaffirmed the gravity of the Russian threat. He proposed two solutions to improve detection and domain awareness capabilities: an integrated underwater surveillance system and an over-the-horizon radar system. The General mentioned his intention to work in conjunction with the U.S. Navy and Canada to monitor and provide situational awareness of submarines around the globe. Finally, with regard to over-the-horizon radars, VanHerck said the system would have a range of approximately 4000 miles in the maritime, air and space domains. This new system would provide a much greater early warning capability than existing systems, overcoming the limitations of the NWS.

To achieve information dominance, the NORAD and USNORTHCOM Strategy is based on the Joint All-Domain Command and Control (JADC2) concept to overcome the silos between services, agencies, and countries. Artificial intelligence and machine learning will enable NORAD to rapidly process, display and disseminate data collected by the systems. Resilience of critical systems and infrastructure will also be an important theme for NORAD and USNORTHCOM in the coming years. According to Colin Kahl, the Under Secretary of Defense for Policy, U.S. adversaries do not intend to wage prolonged conflict against itself, but rather to blind and slow it. Yet resilience, defined as the ability of a system to prevent, respond to, and/or adapt to disruptions, has been neglected in recent years by Washington. Needless to say, this attribute is critical to the field of aerospace defence, of which NORAD is a primary custodian.

Thus, in the plight of the United States in maintaining its defence superiority, NORAD can be a vehicle through which it materializes new technologies and necessary upgrades to achieve U.S. objectives. The NORAD and USNORTHCOM Strategy clearly states that:

> "We must defend our nations should deterrence fail and our adversaries attack. Our surest path is through a globally integrated and resilient all-domain awareness infrastructure that is processed, synchronized, and presented to create information dominance, resulting in decision superiority over adversaries. Embracing these strategic principles requires a fundamental change of culture for NORAD and USNORTHCOM and our mission partners."

The full impact for Canada of this announced change of culture within NORAD is difficult to assess at this time. The fact remains that Canadian priorities are not as clearly defined and that the offensive aspect of some of the U.S. imperatives mentioned above does not align with the Canadian values that have traditionally been put forward in recent years. Climate change, on the other hand, is an obvious priority for Canadian defence, although it is not mentioned much when it comes to NORAD modernization.

Climate Change and Canadian National Defence

Climate change is considered, from a defence and security perspective, to be a "threat multiplier," since climate stress increases interrelated security risks. Climate change is therefore a national security issue and should be treated as such when thinking about NORAD modernization.

The DND and the CAF have, in recent years, put in place several instruments and strategies that take into consideration the impact of climate change on Canadian defence. Canada's 2017 Defence Policy identifies climate change as a predominant component of various Arctic, human, and national security issues and humanitarian disasters. This leads to "greater demand for search and rescue [and to] increased international attention and military activity."

The DND also released the *2020-2023 Defence Energy and Environmental Strategy* (DEES) in 2020, which reports on the progress of DND's greening goals. Indeed, DND is recognized as the federal government's "largest user of energy and the single largest emitter of [greenhouse gas (GHG)]." The DEES has three main goals: produce less energy waste and cleaner energy, reduce climate change risks, and reduce DND's environmental footprint. It targets several subgoals, such as a 40% reduction in GHG emissions by 2025 and net zero emissions by 2050, use of cleaner energy sources for buildings and vehicles, and developing frameworks for assessing climate change risks on the CAF.

However, the absolute GHG emission reduction targets (40% by 2025 and 90% by 2050) do not apply to Canada's National Safety and Security fleet – which includes aircraft, ships and tactical land vehicles of DND, the Royal Canadian Mounted Police and the Canadian Coast Guard. It is announced that in order to contribute to the DEES and the Greening Government Strategy's goal of zero net emissions by 2050, fleet upgrades will take into account "availability, affordability and operational feasibility." Indeed, despite the achieved or fixed DEES 2020-2023 targets, Canada's two largest current procurement projects – the 88 fighter jets and 15 Surface Combatant ships – do not appear to be in line with the DEES, as these procurements will still use petroleum-based energy and continue to emit GHGs.

In this sense, there is a contradiction between Canada's obligation to renew its capabilities in order to be a useful partner within its alliances (NATO and NORAD in particular) and to be able to ensure its sovereignty over its territory, *vis-à-vis* Canada's desire to reduce its ecological footprint. Certainly, national security issues cannot be separated from the challenges posed by climate change in such an uncertain international environment. However, finding a way to reconcile these imperatives is necessary, especially when DND is already aware of the impacts of climate change on its activities.

Indeed, climate change has multiple major impacts on DND and CAF activities, particularly in three broad categories: their infrastructure, emerging threats in the Arctic, and military deployments.

CAF and DND Infrastructures

Climate change is having a significant impact on Canada's military facilities, particularly in the Arctic region. This infrastructure is potentially in need of redesign, relocation, or renovation due to climate change impacts, but also to meet DND's GHG reduction goal and its DEES 2020-2023 targets. Melting permafrost and rising water levels, in particular, could have serious consequences for NORAD facilities in the Arctic. The operating environment is particularly challenging in the Arctic, and infrastructure must be adapted to be more resilient to extreme weather conditions. And yet, climate change is barely considered in the debate surrounding NORAD's evolution.

Arctic and Climate Change

Climate change is increasing the geostrategic importance of the Arctic. According to DND, climate change has made " the Arctic more navigable for everyone" and Canada needs to improve its ability to monitor activities in the Arctic. This need is included in the NORAD modernization priorities, but also in the 2019 Canada's Arctic and Northern Policy Framework. The Framework identifies two priorities: to strengthen Canada's domain awareness, surveillance and monitoring capabilities in the Arctic, including "the acquisition of new air, land, sea and space-based capabilities," and to strengthen environmental protection in the region. Yet, aside from modernizing the CP-140 Aurora fleet, there is no investment specifically for underwater surveillance in Canada's defence policy – a critical capability in the Arctic.

Human security is also particularly important, especially for the First Nations who are facing major challenges, including population displacements, floods and forest fires, due to the consequences of climate change. The CAF and the Rangers therefore play a key role in the Arctic region, both to ensure Canadian sovereignty and to ensure the safety of the inhabitants: a role that is expected to grow. Yet, the only permanent base in the Arctic region consists of about 55 people in Alert, on Ellesmere Island, and about 1,400 members of the 1rst Canadian Ranger Patrol Group scattered across the North.

Military Deployments

The CAF are already feeling the impact of climate change on their readiness, operations, training, exercises and facilities. The demand for CAF response to natural disasters in Canada (Operation LENTUS) is increasing, and this trend will continue to worsen due to the instability generated by climate change. This is in addition to the demand caused by domestic issues other than natural disasters, such as Operation LASER - the CAF response to the COVID-19 pandemic. Furthermore, this pressure on CAF demand extends to the international arena as well. As part of the international engagement pillar reiterated in Canada's defence policy, the CAF is called on to assist in humanitarian missions in the wake of disasters – disasters that will become more frequent with climate change.

The issue of increasing demand and deployments for the CAF overlaps with the issue of personnel shortages. The CAF is projected to have about 100,000 full-strength soldiers, but was about 10,000 members short at the end of November 2021. Another 10,000 members were listed as unavailable for duty due to lack of training, illness or injury. Defence Minister Anita Anand said that while the world wants to see Canada more involved around the world, DND is working to assess the CAF's ability to meet the demand simultaneously in multiple locations. The demand for CAF support is high and requires prioritization of requests and training of staff.

Climate change must therefore be a priority in the modernization of NORAD, along with U.S. demands and international geopolitical considerations.

The Consequences of the Russian Invasion of Ukraine: Geopolitical Considerations for Canada

Prevention rather than (offensive) defence of North American territory has been the preferred approach of NORAD since its creation, despite the strategic ambitions of the United States. This prevention goes hand in hand with deterrence. The debate over offensive avenues of aerospace defence – part of NORAD's mandate – resurfaces from time to time, as new threats, the changing international environment and NORAD renegotiations emerge. The current NORAD modernization, now in the hands of politicians, coupled with new Russian and Chinese technologies, are enough to reignite this debate.

Russia's invasion of Ukraine on February 24 could well pave the way for a reversal of Canada's position on missile defence. The war in Ukraine is already affecting Canadian perceptions of Russia, both at the public and political levels. The Conservative Party is also calling for Canada to take the security of its Arctic territory more seriously and stresses the importance of modernizing NORAD. Canada, home to the largest Ukrainian diaspora outside of Ukraine and Russia, has a vested interest in reacting strongly against Russia – and this is advantageous for electoral support from the Ukrainian population in the next election. It is likely that the Russian invasion, seen by some as a moment that "inaugurates a new era in global geopolitics," will provide sufficient impetus for Canada to re-evaluate its involvement in missile

defence. As Andrea Charron notes, "Ukraine has made NORAD even more important, because we are the back door to NATO." Since the end of the Cold War, the fear of a limited Russian attack in the Arctic has never been as real as it is now, especially if Putin feels trapped in Ukraine. In this sense, missile defence would be a way to deter such an attack, but also to effectively defend Canadian territory.

The current geopolitical context leads many experts to recommend an increase in Canada's defence budget in order to improve its defence capabilities. Minister Anand is currently considering several options for the DND budget, including "aggressive" options up to exceeding 2% of GDP. In any case, the priority must be to invest in upgrading NORAD. The Russian invasion of Ukraine is an opportunity for Canada to prove itself worthy of its NATO allies, at a time when the political calculus of defence spending in Europe is changing profoundly, and to invest concretely in the enhancement of its defensive capabilities.

Finally, Canada should not forget the four years of Donald Trump's presidency in the United States, during which it was much more difficult to reach consensus between the two states. The Trudeau government should capitalize on the cooperation and openness of the Biden administration, as the tides may well turn in the next U.S. election. The return to power of an administration led by the Republican Party with a potentially unpredictable president such as Trump could severely limit Canada-U.S. military cooperation and the work of NORAD modernization, as the international environment plunges ever deeper into multipolarity. In this scenario, the U.S. could decide to play the unilateralist card and stop prioritizing partnership with Canada, taking action without consultation. Canada cannot defend its territory alone and depends on cooperation with the United States, whether it likes it or not – including the U.S. nuclear weapon capacity. A Republican administration as known under President Trump would therefore not be a good omen for Canada. Given the current geopolitical environment and the polarization of the U.S. electorate, there is every reason to believe that the best time to be proactive in reaching agreements on NORAD modernization is now.

Recommendations for Canada

The holistic dimension of NORAD modernization (all domain awareness and integrated deterrence) involves many ramifications and grey areas at this point. What role will Canada play and what are the limits of its involvement in the new technologies coveted by the United States? These answers are in the hands of the politicians for now, but they will have to be defined. Canada and the United States agree on several elements of NORAD's modernization. There is consensus on the need for domain awareness, especially in the Arctic, and on the importance of integrated deterrence. However, Canada's participation in each of these domains (conventional, cyber, space, information), theatres and spectrums of intervention remains nebulous, as it is hardly addressed by the Canadian government and little debated in civil society. This, of course, includes the delicate issue of ballistic missile defence.

Canada needs to define the capacities it wishes to prioritize on its territory. Over-the-horizon radar systems for the NWS must be one of the priorities to counter new Russian and Chinese technologies, as General Van Herck has argued. Undersea surveillance will also be a necessity, a capability that is not currently prioritized in DND investments, but which is among the U.S. priorities. The possibility of investing in cyber capabilities is not to be overlooked, and this could be a way for Canada to acquire offensive capabilities without going through missile defence. The use of drones, submarines and satellites for Arctic domain awareness should also be targeted as a priority, both for threat detection and for monitoring the consequences of climate change. Climate change and the current resurgence of the Russian threat in the Arctic also highlight the importance of investing in improved search and rescue

capabilities. Added to this are the challenges associated with the DND procurement process, the lengthy time frames required to complete projects – the majority of current acquisition projects will not be ready until later in the decade – and the limited capabilities of the CAF. Canada simply has no choice but to invest in NORAD now.

The impacts of climate change must also be concretely considered in the modernization of NORAD. This is not only necessary, but urgent. Canada must consider that climate change is increasing the demand on the CAF, both internationally and domestically. The current uncertain global environment will lead to U.S. requests for the protection of North American territory, not to mention the European and Asian theatres. The CAF, understaffed and overstretched, will have to review its priorities and structure in order to meet the new demands.

DND should also prioritize the modernization and greening of CAF and DND infrastructures, especially in the Arctic. While consistent with DEES and SSE, this would allow for the upgrading of installations and facilities in terms of both GHG emissions and the prevention of climate change impacts on them. In addition, it would balance the environmental costs associated with the previously mentioned major Canadian procurement projects. These upgrades also include the modernization of NORAD: a modernization that must take place in order to strengthen Canada's surveillance and domain awareness capabilities.

Finally, Canada must rethink its approach to collaboration with the United States. Ottawa must be proactive about the impact of climate change on its defence operational capacity instead of only reacting to the decisions of its southern neighbour. Partnership and dialogue with the United States are necessary, but that does not mean that Canada should be in a state of waiting. The climate emergency is growing as fast as the geopolitical context is shifting: Canada must assert its choices and demonstrate its leadership in modernizing NORAD.