Statement before the

Canadian House of Commons

Standing Committee on National Defence

"North American Aerospace Defense Command (NORAD) Modernization"

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Chair Sousa, Vice Chairs Bezen and Savard-Tremblay, members of the standing committee:

Thank you for the invitation to join you today to discuss NORAD modernization and the prospect for improved air and missile defense capability to defend our homelands. I am a senior fellow and director of the Missile Defense Project at the Center for Strategic and International Studies (CSIS), the defense think tank in Washington, DC. CSIS does not take policy positions; the views represented in this testimony are my own and not those of my employer.

Our topic today is a critical and timely one. Missile threats are no longer niche or boutique threats. They have become weapons of choice for our adversaries, our friends, and ourselves.[1]

Today's global threat landscape is accompanied by the advent of a new missile age, one defined by a surge in the global supply and demand for a broad and diverse spectrum of strike capabilities as well as the means to counter them. Long-range strike and air and missile defense are the top defense modernization priorities for both Australia and Japan, and are the two capabilities for which Ukraine requests most for its defense.

Non-Ballistic Threats

In past decades, ballistic missile defense understandably received outsized attention, given the threat of rogue state ballistic missiles. Today, however, non-ballistic missile threats are particularly growing in salience and number. Cruise missiles fired in Ukraine far outnumber ballistic missiles. According to the U.S. Defense Intelligence Agency, China maintains around 1,000 land attack cruise missiles (LACMs), and Russia has between 300-600. Both countries are expected to have around 5,000 LACMs, each, by 2035. China currently has around 600 hypersonic weapons, and Russia has 200 and 300 boosted hypersonic weapons. By 2035, China is expected to have 4,000, and Russia around 1,000 hypersonic weapons.[2] China's recent military parade in early September showcased several new missile capabilities, including the CJ-1000 long-range hypersonic cruise missile. Even so-called "ballistic" missiles are becoming less so, inasmuch as more maneuverability is being introduced for the purpose of less predictable trajectories.

Adapting to the Threat

In any future conflict, there could be a significant threat to the North American continent from Chinese or Russian cruise or hypersonic missiles. The particular salience of the cruise missile threat should come as no surprise. We have seen this threat coming for over a decade. In 2015, for instance, Vice Admiral James Winnefeld noted that cruise missile threats to the homeland were becoming a greater problem than regional ballistic missile threats.[3]
It is therefore unfortunate that air and missile defense has long taken a backseat for decades, and that NORAD's legacy capability and focus has been on other threats. The jointly operated North Warning

[1] John Plumb, Statement before the House Armed Services Committee Subcommittee on Strategic Forces, 117th Cong., 2nd sess., May 11, 2022 (statement of Dr. John Plumb, Assistant Secretary of Defense for Space Policy), 1, https://armedservices.house.gov/_cache/files/3/b/3b83d672-da64-4ce7-b1bd-00ed6707e592/28BF09D70A60BA0BAE8E7DC07EE32DC0.2022511-str-witness-statement-plumb.pdf
[2] "Golden Dome for America: Current and Future Missile Threats to the U.S. Homeland," Defense Intelligence Agency, May 2025, https://www.dia.mil/Portals/110/Documents/News/golden_dome.pdf.
[3] James A. Winnefeld, Jr., "Missile Defense and U.S. National Security" (speech, May 19, 2015, CSIS, Washington, DC), https://www.csis.org/events/missile-defense-and-us-national-security.

System (NWS) through NORAD has been the mainstay for providing sensor coverage of incoming threats to North America. While this networked architecture is critical for detecting medium- and high-altitude aerial threats, it is not as suited to detecting those travelling at lower altitudes.

The Canadian Department of National Defence has noted that existing radar capabilities are "becoming increasingly challenged by modern weapons technology, including advanced cruise missiles and hypersonic weapons," using their non-ballistic trajectories to exploit the gaps in radar coverage. Canada will therefore "continue to invest in the operation and maintenance of the current NWS until a suitable replacement is put in place."[4] Concern about the suitability of existing NORAD systems for detection of increasingly advanced threats has been expressed by a number of NORAD commanders, including General Terrence J. O'Shaughnessy, who in 2019 noted that Russian advances in cruise missile technology allows them to "strike North America from well outside NORAD radar coverage."[5]

In July 2022, the CSIS Missile Defense Project team published a report, *North America is a Region Too: Phased, and Affordable Approach to Air and Missile Defense for the Homeland*.[6] The title reflects the argument that air and cruise missile threats are no longer just a regional problem "over there," but rather a problem much closer to home. The lingering homeland-regional dichotomy creates a vulnerability that near-peer adversaries are seeking to exploit.

The past perception that air and cruise missile defense of North America is pointless stems from the outdated assumption that the air and cruise missile threat to the homeland is a lesser included case of strategic nuclear attack, which is primarily deterred by the threat of retaliation. Deterring non-nuclear air and missile attack, however, requires deterrence by denial. As seen in Ukraine and other recent conflicts in the Middle East, precision-guided cruise missiles and advanced aerial systems are capable of inflicting strategic effects. Missile defense has helped keep Ukraine sovereign, and the Ukrainians have even put the Patriot system on their currency.[7]

Recent Developments

In light of the significant threat developments, it is gratifying to read the 2024 Canadian Defense Review's "commitment" to "build on" past investments for NORAD modernization, and to "explore" a "more robust approach" to integrated air and missile defense."[8]

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[4] Canadian Department of National Defence, "Backgrounder – North Warning System In-Service Support," Government of Canada, January 31, 2022, https://www.canada.ca/en/department-national-defence/news/2022/01/backgrounder--north-warning-system-in-service-support.html.

[5] Terrence J. O'Shaughnessy, Statement before the House Armed Services Committee, 116th Cong., 1st sess., February 26, 2019 (statement of General Terrence J. O'Shaughnessy, Commander, United States Northern Command and North American Aerospace Defense Command), 3, https://www.armed-services.senate.gov/imo/media/doc/OShaughnessy_02-26-19.pdf

[6] Tom Karako et al., *North America is a Region, Too,* (Washington, DC: CSIS, July 14, 2022), https://www.csis.org/analysis/north-america-region-too.

[7] National Bank of Ukraine, "NBU Issues Circulation Commemorative Coin to Celebrate Ukrainian Air Defense Troops," August 4, 2023, https://bank.gov.ua/en/news/all/natsionalniy-bank-prisvyativ-obigovu-pamyatnu-monetu-voyinam-protipovitryanoyi-oboroni-ukrayini.

[8] Our North, Strong and Free: A Renewed Vision for Canada's Defense, X. https://www.canada.ca/en/department-national-defence/corporate/reports-publications/north-strong-free-2024.html

Forward-based sensing from the High North is an especially critical asset to the mutual defense of both our nations.[9] It is therefore likewise gratifying to see the announcement by Canadian Minister of National Defense David McGuinty at NORAD headquarters in Colorado in July 2025 that Canada has removed all restrictions on air and missile defense, to enable Canada to take a more active role in the defense of North America.[10]

Numerous other allies and partners are making similar pledges to address the yawning gaps of air and missile defense capability. The United Kingdom's 2025 Strategic Defense Review pledged up to £1bn in new funding for homeland air and missile defense.[11] In June 2025, NATO Secretary General Mark Rutte suggested that the alliance may need "five times as many systems to defend" the alliance, amounting to a 400 percent increase in its air and missile defense.[12]

Golden Dome

The U.S. Golden Dome initiative announced this year is a long overdue effort to counter this spectrum of threats. If it is sustained on a combined and bipartisan basis, it could become the beginning of a generational opportunity to counter these threats.

So far, limited details about the architecture have been publicly released. When more becomes available, however, I expect it will be recognized as a necessary, prudent, and quite tractable approach. It will almost certainly also correct the past imbalance of attention to ballistic rather than non-ballistic threats. One may expect the prioritization of, in the first instance, better tying together existing capabilities and creating an integrated battle management layer to better coordinate and control current and future elements. U.S.-Canadian cooperation will be critical to the success of Golden Dome.

Sensors

As the Canadian government explores the potential for improved and better integrated air and missile defense capabilities, it may be worth paying particular attention to sensors. Both our nations require a significant investment in a robust and layered sensor architecture to support domain awareness, detection, and tracking of potential air and missile threats, with a focus on cruise missiles.

The need for robust sensor architectures has been a key feature of the CSIS Missile Defense Project's research agenda over the years.[13] If one cannot see a threat, one cannot kill it. Conversely, if an

[9] Tom Karako et al., *North America is a Region, Too,* (Washington, DC: CSIS, July 14, 2022), 49, https://www.csis.org/analysis/north-america-region-too.
[10] Canadian Department of National Defence, "Minister McGuinty Visits NORAD," Government of Canada, July 16, 2025, https://www.canada.ca/en/department-national-defence/news/2025/07/minister-mcguinty-visits-norad.html.
[11] United Kingdom Ministry of Defence, *The Strategic Defence Review 2025: Making Britain Safer: Secure at Home, Strong Abroad* (London: UK Government, 2025), 6, https://assets.publishing.service.gov.uk/media/683d89f181deb72cce2680a5/The_Strategic_Defence_Review_2025_-_Making_Britain_Safer_-_secure_at_home__strong_abroad.pdf
[12] Mark Rutte, "Building a better NATO," speech, Chatham House, London, June 9, 2025, https://www.nato.int/cps/en/natohq/opinions_235867.htm.
[13] Masao Dahlgren, Patrycja Bazylczyk, and Tom Karako, *Mesh Sensing for Air and Missile Defense: A Vision for Passive, Proliferated Sensor Networks* (Washington, DC: CSIS, July 21, 2025), https://www.csis.org/analysis/mesh-sensing-air-and-missile-defense; Masao Dahlgren, *Getting on Track: Space and Airborne Sensors for Hypersonic Missile Defense* (Washington, DC: CSIS, December 18, 2023), https://www.csis.org/analysis/getting-track-space-and-

adversary can negate or circumvent the defender's sensor architecture, it can defeat the air defense capability broadly. Our 2022 cruise missile defense report depicted a layered defense design with a layered sensor architecture that included over-the-horizon radars, towered sensors, an aerostat, and a mobile airborne asset, with an eye to future incorporation of space sensors and other passive sensing for wide area surveillance.

The first area of improvement is of course the North Warning System, and investments on that front are underway.[14] Canada's investment and momentum on OTHRs is a critical step forward.[15] While OTHR may not provide fire control quality tracks, it can provide broad domain awareness over a wide area, providing early cues of incoming bombers and missiles. It is unfortunate that U.S. efforts to field OTHRs have been so tardy, and I hope this will soon be corrected.[16]

Another area ripe for exploration is how space sensors will contribute to the non-ballistic threats. In recent years, the United States has, as NORAD/NORTHCOM Commander Gen. Gregory M. Guillot noted, deployed "a number of prototype AMTI [air moving target indicator] systems on orbit now" to track airborne targets.[17] As noted in the CSIS report on cruise missile defense, future architectures should consider incorporating space-based AMTI when mature.[18] Doing so jointly would pay additional dividends in securing North American airspace.[19]

To be sure, space AMTI investments will not and should not undercut investment in terrestrial OTHR. Low and slow-flying targets, with cooler thermal signatures, remain difficult to detect and track. It is important to retain a layered sensor architecture that is difficult to defeat, and putting all of one's eggs in the proliferated Low Earth Orbit basket is not the best approach.[20]

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airborne-sensors-hypersonic-missile-defense; Wes Rumbaugh and Tom Karako, *Extending the Horizon: Elevated Sensors for Targeting and Missile Defense* (Washington, DC: CSIS, September 27, 2021), https://www.csis.org/analysis/extending-horizon-elevated-sensors-targeting-and-missile-defense.

[14] U.S. Department of the Air Force, "Notice of Intent To Prepare an Environmental Impact Statement for Homeland Defense Over-the-Radar at Northwest Region," *Federal Register* 90, no. 74 (April 18, 2025): 16513–16514, https://www.federalregister.gov/documents/2025/04/18/2025-06573/notice-of-intent-to-prepare-an-environmental-impact-statement-for-homeland-defense-over-the-radar-at.

[15] Canadian Department of National Defence. "National Defence Announces Progress on the Arctic Over-the-Horizon Radar Project." Government of Canada, July 17, 2025. https://www.canada.ca/en/department-national-defence/news/2025/07/national-defence-announces-progress-on-the-arctic-over-the-horizon-radar-project.html.

[16] Canadian Department of National Defence. "National Defence Announces Progress on the Arctic Over-the-Horizon Radar Project." *Canada.ca*, July 17, 2025. https://www.canada.ca/en/department-national-defence/news/2025/07/national-defence-announces-progress-on-the-arctic-over-the-horizon-radar-project.html.

[17] *To Receive Testimony on the Department of Defense Missile Defense Activities in Review of the Defense Authorization Request for Fiscal Year 2026 and the Future Years Defense Program,* 119th Cong (2025) (statement of Gregory M. Guillot, Commander, NORAD/NORTHCOM), https://www.armed-services.senate.gov/hearings/to-receive-testimony-on-the-department-of-defense-missile-defense-activities-in-review-of-the-defense-authorization-request-for-fiscal-year-2026-and-the-future-years-defense-program.

[18] Tom Karako et al., *North America is a Region, Too,* (Washington, DC: CSIS, July 14, 2022), https://www.csis.org/analysis/north-america-region-too.

[19] Theresa Hitchens and Michael Marrow, "Space Force testing space-based sensors to track airborne targets," *Breaking Defense,* May 15, 2025, https://breakingdefense.com/2025/05/space-force-testing-space-based-sensors-to-track-airborne-targets/

[20] Masao Dahlgren, *Getting on Track: Space and Airborne Sensors for Hypersonic Missile Defense* (Washington, DC: CSIS, December 18, 2023), https://www.csis.org/analysis/getting-track-space-and-airborne-sensors-hypersonic-missile-defense; Julian Barnes, Karoun Demirjian, Eric Schmitt, and David Sanger, "Russia's Advances on Space-Based Nuclear Weapons Draw U.S. Concerns," *The New York Times,* February 14, 2024, https://www.nytimes.com/2024/02/14/us/politics/intelligence-russia-nuclear.html

Our Canadian allies have already made significant commitments responding to these threats. The 2022 announcement of increased investment in continental defense amounting to $38.6 billion over twenty years, including for the modernization of NORAD, was a critical step in the right direction.[21] These investments are important, especially those for establishing a new Northern Approaches Surveillance system in cooperation with the United States: two over-the-horizon radars, space-based sensors, and a joint US-Canada network of sensors with classified capabilities.[22] Additional investments in modernizing capabilities, including air-to-air missiles, communications infrastructure, fuel depots and runway in the High North, and the NORAD Pathfinder initiative, will allow the U.S. and Canada to more effectively neutralize threats once they are detected.

Defended Areas

Thick and overlapping sensors are necessary to defend anything, but it is not possible to defend everything, especially against missile threats with less predictable trajectories. Our 2022 report advocated the selected defense of a handful of what we called "Prioritized Area Defense" areas, or PADs. In a similar manner, the Golden Dome architecture industry day depicted a handful of Limited Area Defense (LADs) zones.[23] A topic of potential consideration for the exploration of future Canadian capabilities might be the development of limited area defense zones for critical command and control, infrastructure nodes, or perhaps the capital. The current exploration of capabilities might also include early discussion of creating a list of generalized categories of the type of things that should be defended most.

Thank you for the opportunity to join you all today, and I look forward to your questions.

[21] Canadian Department of National Defence, "Minister Anand Announces Continental Defence Modernization to Protect Canadians," Government of Canada, June 20, 2022, https://www.canada.ca/en/department-national-defence/news/2022/06/minister-anand-announces-continental-defence-modernization-to-protect-canadians.html.
[22] "Fact Sheet: Funding for Continental Defence and NORAD Modernization," Government of Canada, July 21, 2022, https://www.canada.ca/en/department-national-defence/services/operations/allies-partners/norad/facesheet-funding-norad-modernization.html.
[23] Stan Stafira, "Architecture" (presentation at Golden Dome for America Industry Summit, Huntsville, Alabama, August 7, 2025), slide 2.