



**SPACE-ENABLED PERSISTENCE AND
TRANSPARENCY IN THE ARCTIC TO
SUPPORT INFRASTRUCTURE AND
NATIONAL SECURITY NEEDS**

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The United States has maintained territorial claims and has advanced political, economic, national security, environmental, and cultural interests within the Arctic region since the 1867 acquisition of Alaska. The Arctic Council and the United Nations Convention on the Law of the Sea (UNCLOS) are avenues to engage our partners to promote a stable and secure Arctic. Commercial satellite data, including enhanced communications, navigation and timing, and remote sensing, will play a key role in establishing persistent situational awareness. It is through reliable and ubiquitous commercial satellite capabilities that the United States can meet its economic, national security, and environmental imperatives.

This chapter provides an overview of U.S. Arctic policy and national interests and describes how commercial satellite services can provide domain awareness to observe and adapt to the region's rapidly changing conditions. While geopolitical tension is rising in the Arctic, stakeholders will benefit from sharing satellite data with each other and the public. Sharing can enhance operations, establish greater transparency and accountability, and strengthen a common rule-based order.

Introduction

The area north of the Arctic Circle (66.3° latitude) includes vast expanses of ocean, ice, and land masses. Surface air temperatures in the Arctic are rising at twice the rate of the rest of the planet, resulting in widespread permafrost melting.¹ Melting sea ice has cleared two major sea routes for increased maritime traffic (see Figure 1), and harbors have become available year-round for shipping, resource extraction, and industrial development.

As both allies and potential adversaries have expanded their activity, protecting U.S. interests in the Far North has become increasingly complex. National security, cooperation, and environmental sustainability are enduring objectives from the past five administrations. More recently, a June 2020 Presidential Memorandum requires *persistent* Arctic domain awareness and directs an assessment to ensure a strong presence in the Arctic, including using operational means such as space systems, sensors, command and control, data transfer capabilities, and intelligence assets,² which could be provided by space-based services. This operational persistence underpins the DOD's Arctic Strategy (2019), which aims to provide a secure and stable region and a rule-based order, respecting both national sovereignty and constructive engagement.³

Fortunately, the polar region is developing at a time when the burgeoning commercial space industry can provide persistent space-enabled connectivity, navigation, and increased surveillance. A combination of strategically aligned commercial satellites, in a variety of orbits, can provide the coverage necessary to step up to national security, industry, and environmental challenges.

Arctic Governance

Various conventions and rules of order create the basis for Arctic governance. The most prominent are a binding framework for nations' ocean rights and responsibilities known as the United Nations Convention on the Law of the Sea,⁵ and an intergovernmental forum, the Arctic Council.

United Nations Convention on the Law of the Sea (UNCLOS). In 1994, the United States along with the other seven members of the Arctic Council agreed that UNCLOS provided sufficient governance due to the fact that much of the Arctic is ocean. The United States has not ratified UNCLOS but abides by it.⁹ UNCLOS establishes territorial boundaries, facilitates international coordination, and promotes peaceful, equitable, and efficient utilization and conservation of ocean resources and the marine environment.¹⁰

Arctic Council. The Arctic Council is an intergovernmental forum that encourages cooperation, coordination, and interaction among the Arctic States, indigenous communities, and other Arctic inhabitants on sustainable development and environmental protection.^{11,12} Additionally, the council looks to the United Nations' Sustainable Development Goals as a guiding framework for sustainability.

The United States is one of eight members of the Arctic Council along with Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, and Sweden. These eight "Arctic States,"¹³ all with land inside the Arctic Circle, are permanent members

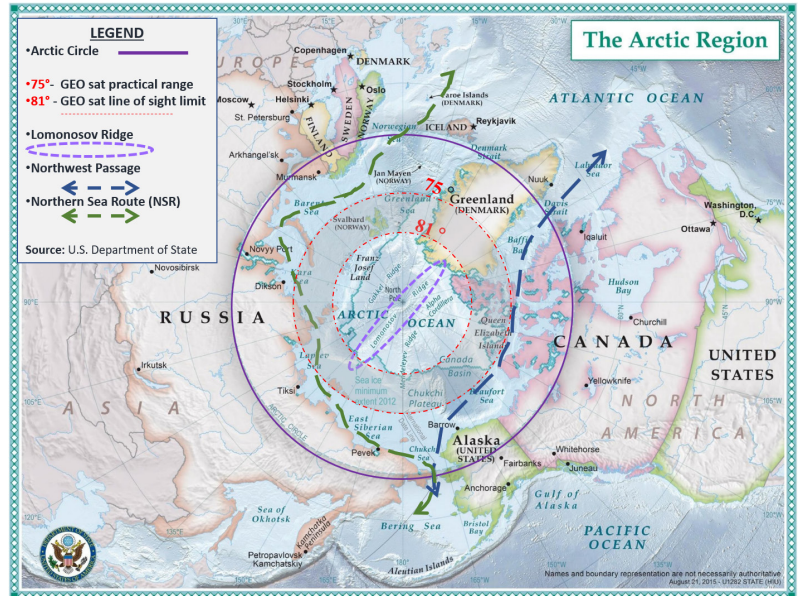


Figure 1: The Arctic Region. The smaller red circle (81°3') is the maximum latitude beyond which a geostationary satellite (GEO) is unable to provide coverage because it is below the local horizon. Operationally, a GEO satellite's limits are several degrees lower due to receiver noise from atmospheric refraction, frequency interference due to Earth's thermal emission, line-of-sight obstructions, and signal reflections with ground structures at approximately 75°.⁴

Organizational Alignment to Optimize Arctic Strategy

The Arctic will require military strategic and operational integration among all U.S. forces operating in the region. Yet the region is currently split between two combatant commands: U.S. Northern Command (USNORTHCOM) and U.S. European Command (USEUCOM). A single authority could facilitate and streamline other countries' engagement with the United States.⁶ The trend appears to be pointing to further consolidation. During 2011, the Unified Command Plan removed a portion of the Arctic region from the U.S. Pacific Command (USPACOM) area of responsibility (now USINDOPACOM).⁷ More recently, in December 2019, Senator Dan Sullivan (R-Alaska) introduced a bill (S. 3080), "Strategic Arctic Naval Focus Act," which addresses the need for strategic placement of military assets in the Arctic. Among other things, the bill calls for "the establishment of the position of Deputy Assistant Secretary of Defense for the Arctic tasked with optimizing the Unified Command Plan for the Arctic and other overarching strategies for the Arctic region."⁸

of the Arctic Council, which was established by the 1996 Ottawa Declaration to promote cooperation, coordination, and interaction. In addition, mid-latitude countries normally not associated with the Arctic such as China, India, and Singapore, are accorded Observer status.¹⁴

The pace of growth of human activity in the Arctic is astounding, and the scramble to gain access to the region’s resources has reached a fevered pitch. Recently, during a May 2019 Arctic Council meeting, U.S. Secretary of State Mike Pompeo noted, “We’re entering a new age of strategic engagement in the Arctic, complete with new threats to the Arctic and its real estate, and to all of our interests in that region.”¹⁵

U.S. Policy Responses

The United States has defined its strategic and commercial interests through a series of policy statements, each building on previous documents to address the changing environment and geopolitics. Despite the steady building of Arctic policies there is “a lack of operational articulation,” according to Troy Bouffard, University of Alaska Fairbanks instructor and Arctic Security expert. Bouffard notes further “let’s get serious – current policies leave room for too much interpretation which could result in pulling resources from other global mission sets. An operational plan (OPLAN) is needed as an actionable catalyst, otherwise DoD could potentially shift funding from current missions when trying to resource unfunded capabilities for the Arctic.”¹⁶

Table 1: National Arctic Policies Across Three U.S. Administrations. Policies build on common themes of national security, cooperation, and environmental sustainability.

Key National Policies	Priorities
National Security Presidential Directive 66/Homeland Security Presidential Directive 25 (Bush 2009)	Addresses national security and homeland security needs and calls for: <ul style="list-style-type: none"> ◆ Environment and natural resource conservation and management ◆ Strengthening institutions and cooperation ◆ Greater involvement of indigenous communities
National Strategy for the Arctic Region (Obama 2013)	Responds to challenges and economic opportunities: <ul style="list-style-type: none"> ◆ Advances security interests and evolves infrastructure and capabilities ◆ Pursues stewardship to protect the Arctic and conserve its resources ◆ Strengthens international cooperation through bilateral relationships and multilateral bodies, including the Arctic Council ◆ Advances collective interests such as shared Arctic state prosperity, environmental protection, and regional security
U.S. Coast Guard Arctic Strategic Outlook (2019)	Establishes three lines of effort crucial to achieving long-term success: <ul style="list-style-type: none"> ◆ Enhance capability to operate effectively in a dynamic Arctic domain ◆ Strengthen the rules-based order ◆ Innovate and adapt to promote resilience and prosperity
DOD Arctic Strategy (2019)	Describes a secure and stable region, where: <ul style="list-style-type: none"> ◆ Interests are safeguarded and homeland is defended ◆ Nations work cooperatively to address shared challenges ◆ Reliance on a rules-based order is emphasized

Key National Policies	Priorities
Memorandum on Safeguarding U.S. National Interests in the Arctic and Antarctic Regions (Trump 2020)	Safeguards national interests and emphasizes a persistent polar presence: <ul style="list-style-type: none"> ◆ Requires a fleet of polar security icebreakers and cutters by 2029 ◆ Establishes fleet acquisition program ◆ Directs basing assessments for two national and two international locations ◆ Supports maximum use of additional capabilities such as “unmanned aviation, surface, and undersea systems; space systems; sensors and other systems to achieve and maintain maritime domain awareness; command and control systems; secure communications and data transfer systems; and intelligence-collection systems”¹⁷
The Department of the Air Force Arctic Strategy (2020)	Articulates the Air Force’s role in the Arctic, including efforts to optimize Air and Space Force capabilities, including: <ul style="list-style-type: none"> ◆ Enhancing missile defense ◆ Exploring new surveillance and communications technologies ◆ Updating regional infrastructure

Moving to a Persistent Arctic Presence. During June 2020, the White House issued a memorandum, “Safeguarding U.S. National Interests in the Arctic and Antarctic Regions,” which is, in part, a response to Russia’s and China’s increasing presence in the Far North. The White House memorandum calls for a review of the United States’ requirements for icebreaking capabilities in the polar regions, with the goal of getting a fleet in place by 2029. The Trump administration emphasized *persistence* to retain a strong security presence with allies and partners.¹⁸ Beyond expanding the nation’s Arctic maritime fleet, space system capabilities are needed to support persistent domain awareness. Joint Publication 3-14, *Space Operations*, notes that “Most space-based intelligence collection capabilities consist of multiple satellites operating in concert, or supplemented by other sensors, when continuous surveillance of an area is desired.”¹⁹ This type of persistence is possible through a combination of commercial low Earth orbit (LEO), highly elliptical orbit (HEO), and geostationary Earth orbit (GEO) satellites.

Commercial Systems for Disparate Stakeholders and Multinational Collaboration. Following the White House memorandum, the Air Force issued its own Arctic Strategy in July 2020, which outlines an approach for collaboration with the Joint Force, international allies, and partners to protect U.S. sovereignty and national security interests. The Air Force Arctic Strategy calls for greater investments in command, control, communications, intelligence, surveillance, and reconnaissance (C3ISR), as well as in space operations and missile defense.

While defense-focused satellite systems are customized and only available to DOD stakeholders, commercial systems provide a more open means to cooperate and collaborate for other critical missions.

Seamless Data and Connectivity. During a rollout of the new Arctic Strategy, Air Force Gen. Dave Goldfein emphasized a strong data strategy and investment in networks that operate “seamlessly.”²⁰ Given Gen. Goldfein’s comment, one must consider the commercial satellite sector’s progress in closing the infrastructure gap to seamless connectivity (see section “Communication and Connectivity,” below). Eventually Far North stakeholders will have access to the same cloud-hosted services on which lower latitude counterparts have relied, including data storage, predictive analytics, and various enterprise solutions for logistics and supply chains. Cloud-based commercial solutions are leading the way for collaboration for emergency and natural disaster operations, which often require a massive amount of data originating from various organizations and devices.

Great Power Competition – China and Russia

China – Polar Silk Road. As part of a larger strategy to increase access to global natural resources, China’s president Xi Jinping stated that China would encourage enterprises to build infrastructure and conduct commercial trial voyages, paving the way for Arctic shipping routes that would form a “Polar Silk Road.”²¹ China is also increasing its operational presence by using and constructing icebreaking vessels and supporting a growing number of research efforts, which could fortify a military presence in the Arctic Ocean.²² China sees potential future economic benefits in the development of the Arctic and has undertaken an aggressive diplomatic and economic effort to establish a foothold in the Arctic region.²³

Many mid-latitude countries²⁴ have gained permanent observer designation at the Arctic Council, whereby they can observe the work of the council and contribute at the of working group level. China goes a step further and has declared itself a “near-Arctic state,” which is an informal self-designation not recognized by Arctic Council members, including the United States.^{25,26}

Russia – Growing Military and Industry Presence. Unlike China, Russia has a long-established stake in the Arctic region and has significantly increased shipping through the Northern Sea Route (NSR), a Europe-to-Asia shipping passage which is 3000 miles shorter than an alternate route through the Suez Canal. Russia has asserted and exceeded its maritime regulatory authority across the entire NSR (approx. 3,500 miles) and views the NSR as an internal waterway (see Figure 2). The rest of the Arctic community, however, views the NSR as an international passage since only portions of the route flow through Russia’s internal waters.²⁷ Similarly, the United States has long disputed Canada’s sovereign claims to the Northwest Passage. Therefore, any Freedom of Navigation Operation (FONOP) with Russia could unintentionally open the door to a similar territorial dispute with our ally, Canada.^{28, 29}

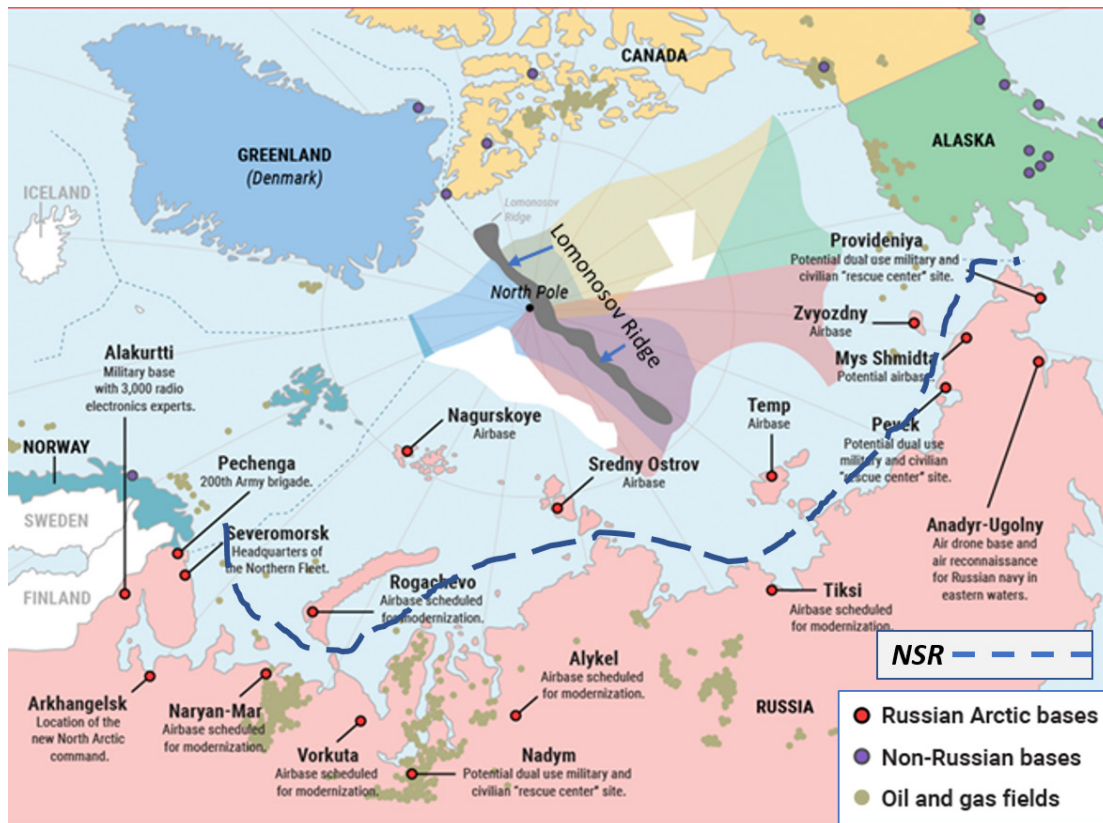


Figure 2: Arctic Countries, Military Installations, and Landmarks.³⁰ Map shows key Russian military and maritime installations, as well as the Lomonosov Ridge trending northwest and southeast across the North Pole. This ridge represents an ongoing scientific dispute regarding continental shelf geography and territorial claims between Russia, Denmark, and Canada.

Regardless of disputed sovereign claims to the NSR, Russia's activities are proportionate to its enormous territory (Figure 2) and economic resources in the Arctic region. Still, concerns remain. In July 2019, Air Force General Terrence O'Shaughnessy, commander of U.S. Northern Command, noted that "if you look at the northern approaches through the Arctic, that's a key avenue of approach that we have to be able to defend." He also identified cruise missiles by way of the Arctic "as one of the biggest threats that we face."³¹

Russia's military defense investments in the Arctic are aimed at protecting its territory and controlling the NSR. Russia has increased its military infrastructure and activity around the Arctic Ocean by refurbishing old airfields and establishing new military bases along its Arctic coastline. Existing and planned networks of air defense and coastal missile systems, early warning radars, rescue centers, and a variety of sensors are pivotal to Russia's military ambitions.³²

In March 2020, Vladimir Putin unveiled "Arctic 2035," a 15-year plan calling for increasing the local population's quality of life and accelerating economic development through improved infrastructure and technology. As the Arctic's most significant stakeholder in terms of land, this plan will advance Russia's "persistence" in the region. Economic measures include boosting private investment in key energy projects on the Arctic shelf and paying Russians who want to relocate to the north.³³

China and Russia Cooperation and Tension. Both Chinese ambitions and Russian territorial claims and strong military presence in the Arctic are even more concerning as these two countries collaborate across diplomatic, economic, and security areas.³⁴ For example, Russia remains a top source for Chinese energy imports and China has demonstrated a financial commitment to Russia's energy economy. This symbiotic relationship between Russia and China is a marriage of convenience, not trust. Recently, for instance, Russia arrested a well-known Russian scientist for allegedly sharing classified information with China.³⁵ Despite lack of full trust, the Arctic Institute notes that "there is a growing interdependence" between Russia, who needs capital investments in infrastructure, and China, who needs commodities.³⁶

Increasing Space Capabilities in the Arctic

As the United States grows more concerned about its strategic rivals, China and Russia, interest is increasing in creating a "force presence," which would include rebuilding the United States' polar security icebreakers and cutters, adding a deep-water arctic port in Alaska, and hosting military exercises. As part of this increasing commitment, the United States has continued to host military exercises. From a civilian perspective, connectivity is critical to the residents of Alaska to engage in commerce, e-medicine, and distance learning. In referencing affordable satellite connectivity for Alaskans, senator Lisa Murkowski noted that "this has a potential for transformational opportunities for us."³⁹

Access to Denied Areas. Satellites are a practical option to consider in the Arctic because they provide global coverage and enable access to otherwise denied areas. Space-based assets provide timely, persistent, and objective coverage, which can support requests for continuous operations, scheduled interactions, and emergency requests.

Typically, Arctic Council discussions focus on cooperation, natural resources, sustainability, and environment. However, in May 2019, Secretary of State Pompeo delivered a blunt message to Arctic Council members during a meeting in Finland, where he countered Beijing's territorial aggression in the Far North, asking, "Do we want the Arctic Ocean to transform into a new South China Sea, fraught with militarization and competing territorial claims?"³⁷

A comparison to the South China Sea is apropos and crucial in understanding Chinese strategy. China has imposed domestic laws to supplant international law to limit the rights of foreign vessels, preferring to base its claim on historical rights rather than distance to its land territory per the UNCLOS.³⁸ China's rejection of UNCLOS in the South China Sea has fueled circumspection and fear that China will wedge itself into the Arctic region and play by its own rules. This suspicion could be extended beyond matters of territorial claims to fishing rights as well.

“Unlike the rules for aircraft overflight, there are no overflight restrictions for spacecraft in outer space. Therefore, space-faring nations benefit from unrestricted space overflight. This characteristic makes space-based ISR, remote sensing, SATCOM, and PNT more responsive than terrestrial alternatives.”⁴⁰

Arctic stakeholders such as ship operators, scientists, Arctic residents, teachers, public safety, medical professionals, and industry will be able to benefit from these new commercial developments, which will allow greater connectivity options with some satellite operators offering broadband speeds.

Communication and Connectivity. Historically, simple store and forward constellations, such as Gonets (Russia) and Argos (France), served the polar regions using narrowband, unidirectional communications for scientific, environmental, and meteorological purposes. By the late 90s Iridium Communications introduced global satellite communications that provided coverage to both poles. Few new satellite services to the region were introduced until recently. Within the past two years, a flurry of new commercial satellite offerings has expanded in the Far North, providing a range of services across LEO, GEO, and HEO.

LEOs. Incumbent operator Iridium replenished its global constellation, Iridium NEXT, to provide voice and data communications, although Iridium does not offer broadband speeds (25 Mbps and higher, as defined by the FCC). In 2018, three new small satellite players entered the market: Kepler, Hiber, and Fleet Space, all targeting the Internet of Things (IOT) or machine-to-machine (M2M) markets.

New proliferated LEO (pLEO) operators, such as OneWeb and SpaceX “Starlink,” are introducing satellites in polar or near-polar orbit. OneWeb has 72 satellites in high inclination orbit, which could provide broadband capabilities for an interested buyer. Although OneWeb filed for Chapter 11 bankruptcy, it now appears that the Indian mobile network operator along with the government of the United Kingdom will take a significant equity share in return for providing \$1 billion in new funding for the global constellation of broadband satellites.⁴¹

Far North GEO Coverage. The current generation of GEO high-throughput satellites (HTS) can also support high latitude regions, including a significant portion of the Arctic, with large amounts of capacity concentrated in small areas, using high power, multiple spot beams, and frequency reuse. Pacific Dataport (Anchorage, Alaska), for instance, is launching two GEO HTS for coverage of Alaska and the surrounding Arctic region, with the first satellite scheduled for launch in July 2021 and a second satellite launch in 2023. These GEOs will provide full coverage of Alaska with a minimum beam pointing elevation angle of 10 degrees* and Arctic coverage well beyond Alaska for land, maritime, and aero services (up to 80 degrees North latitude, depending on the application). The two satellites will provide backup capacity and signal diversity for each other.⁴²

HEO and Hosted Payloads. Space Norway, owned by the Norwegian government, is cooperating with commercial satellite operator Inmarsat and the Norwegian Ministry of Defense to offer mobile broadband coverage to civilian and military users in the Arctic. Two HEO satellites are scheduled to be launched in late 2022. The ground station will be established in Norway, and both satellites will provide full coverage from 65 degrees North. Each of the two satellites will carry multiple payloads and the system is scheduled to be operational for at least 15 years, with users able to switch between current GEO satellites and the HEO satellites.⁴³ Among the various payloads will be the U.S. Space Force’s stopgap Arctic

*The elevation angle refers to the angle between the beam pointing direction of the antenna (e.g., satellite dish) toward the satellite and the local horizontal plane.

communications system known as Enhanced Polar System Recapitalization (EPS-R). This system will fill a vital gap for defense operations in the Arctic region.⁴⁴

Observation. Polar orbiting satellites in LEO circle the planet every 90 minutes and have fields-of-view spanning hundreds of miles. GEO satellites can also view parts of the Arctic region up to a practical limit of 75 degrees. Together, GEO and LEO space capabilities can provide situational awareness for air, land, and maritime domains. The market momentum provided by commercial space providers offers Far North stakeholders a range of technical options as they seek to navigate, communicate, and maintain persistent situational awareness over the region.

Operational and Tactical Response

Space-based capabilities provide the ability to quickly surge and reallocate assets when there is an emergency or crisis. Space operations are especially useful for coordination across multiple stakeholders and nationalities that must work together (see Table 2) across Arctic critical mission areas.

Table 2: Arctic Missions. Persistent commercial satellite imaging, continuous connectivity, and open data sharing will enable cooperation and magnify transparency in the Arctic region.	
Arctic Missions	Benefits to Increased Transparency
National Security	Imaging satellites can share data with both allies and adversaries regarding military exercises and to surveil for trespassing.
Border Patrols and Sovereignty Protection	Sharing images and data along national borders will allow observation and enforcement of border security and access to territories and natural resources.
Passage Assistance and Management	Sharing imagery, data, and communications to ensure safe passage for ships in the Northern Sea Route, Northwest Passage, and other areas.
Fisheries Monitoring	Sharing information on fishing activities to encourage compliance. Imaging satellites can provide cost-effective solutions to support fisheries management bodies, fishing moratoriums, and ensure ocean sustainability.
Environmental and Oil Spill Response	A multilateral treaty ratified by Canada in 2014, <i>Marine Oil Pollution Preparedness and Response in the Arctic</i> , aims to increase cooperation and coordination among Arctic countries. Commitments include mutual assistance and information exchange to improve oil spill response success.
Search and Rescue	<i>The Arctic Search and Rescue Agreement</i> , ratified by all Arctic Council countries and entered into force in 2013, calls for coordination, cooperation, and response between all Arctic nation coast guards.

Open data is structured, machine readable, open licensed, and well maintained.⁴⁵ Open data is a key enabler for data sharing, which allows for increased government transparency and accountability.⁴⁶ Sharing data between governmental agencies and nations will be a game changer as scientists continue to monitor global climate change and as governments focus on increased cooperation across a range of Arctic missions.

Opportunities for Decisionmakers

The fallout from the COVID-19 pandemic will introduce unique fiscal challenges, including a worldwide decline in military spending.⁴⁷ During this period of rapid change, Russia, China, the United States, and NATO allies will assert their territorial, economic, and military interests. It is, therefore, a pivotal time to support affordable and persistent satellite capabilities for communications, connectivity, navigation, and observation. The United States space enterprise can start by considering the following opportunities:

- ◆ **Emphasize open, available, and shared systems for multi-partner cooperation.** Commercial satellite services offer open and readily available systems for responding to missions that require multinational interoperability, and multistakeholder cooperation.
 - ▶ **Open solutions.** The Air Force Arctic Strategy calls for greater investments in areas such as C3ISR, space operations, and missile defense. Beyond secure and protected defense-focused satellite systems, more open and available systems are needed for emergency response. These missions require joint, multi-national capabilities to prepare and respond to large-scale disasters (natural and man-made), coordinate readiness with allies and partners, and plan for rescue and personal recovery.⁴⁸
 - ▶ **Ready access.** Defense systems often require 15- to 20-year acquisition cycles. Decisionmaking and design/production processes alone can take 5 years, on average, to mature a concept, gain stakeholder validated requirements, and establish an acquisition program, and another 7.5 years, on average, to reach first launch.^{49,50} By contrast, contracting with a commercial space provider to develop and operate communications, navigation, and remote sensing services could entail a couple of years instead of close to a decade, which is the amount of time government programs often need.⁵¹
 - ▶ **Optimize networks, data sharing, and cloud connectivity.** Arctic stakeholders can optimize communication paths through network convergence and interoperability standards. Enterprise cloud connectivity for polar region customers (commercial, civil, and military users) will also drive efficiencies and allow remote Arctic business locations and operations to become more integrated and central.
- ◆ **Update the U.S. relationship with our Arctic allies to integrate an evolving Arctic Strategy.** The United States has a unique relationship with Canada for mutual deterrence, defense, and space operations. It is now a propitious time to update our space alliances and partnerships to address the new Air Force Arctic Strategy, including optimizing combined space capabilities, exploring new surveillance and communication capabilities (including commercial solutions), and updating regional infrastructure.

Canada's combined space operations with the United States includes Sapphire orbital space surveillance and RADARSAT Earth observation. As a partner, Canada participates with the United States in the following programs: Space Situational Awareness (SSA); Wideband Global SATCOM; North American Aerospace Defense Command (NORAD) Command, and missile warning, maritime warning, and positioning, navigation and timing capabilities.⁵² To ensure that our longstanding relationship with our northern neighbor remains strong, the United States and Canada should jointly operate all domain Arctic awareness for security and stability applications.⁵³ The United States should continue to promote and expand the enduring defense relationship with Canada via NORAD and bolster strategic messaging to enhance deterrence. On the civil front, the Alaska Domain Awareness Center (ADAC) works as a collaboration hub for safety, security, and crisis response and should be further resourced.

- ◆ **Engage and incentivize the commercial sector.** Expanding commercial space capabilities can provide the rapid access, reach, and domain awareness to advance our political, economic, national security, environmental, and cultural interests as an Arctic nation. Now is the time for policymakers to examine how government can encourage

commercial ventures, perhaps as a committed customer, anchor tenant, or seed investor, to support critical mission areas and to improve the lives of the people in the Far North region.

Looking Forward

The Arctic region will continue to grow in strategic importance for commercial, national security, and environmental interests at a time when space assets are poised to respond to a range of challenges and needs across private sector, civil, and defense interests. This is a unique time in the space sector as commercial space is proving its resilient capacity to provide open and hybrid architectures across a range of orbital regimes. Emerging ubiquitous networking options and open data sharing will usher in a new age of greater persistence, transparency, and cooperation. By strengthening our international Arctic partnerships, particularly with Canada, and fully leveraging our commercial satellite-based assets, the United States can build Arctic awareness, enhance Arctic operations, and strengthen a common rule-based order. Good actors can be recognized, bad actors can be exposed, and rules can be enforced.

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