RESEARCH NEEDS FOR A SECURE AND PROSPEROUS ARCTIC

WHY THE ARCTIC MATTERS. The United States is one of only eight Arctic nations. In 1959, Alaska became the 49th State of the Union after being purchased from Russia in 1867. Alaska covers an area that is one-fifth the size of the entire continental United States, and its shoreline is longer than the combined shoreline of all other states. It is home to 733,000 people, 20% of whom are Alaska Native whose ancestors have inhabited the Arctic for thousands of years.

Thanks to its bountiful natural resources, Alaska contributes enormously to the U.S. and global economies. Alaska boasts several of the world's largest and most valuable fisheries (e.g., salmon, pollock, and crab) and has abundant hydrocarbon and mineral resources. The United States recently declared sovereign rights over additional seafloor and subsurface resources in more than a 1.6 million square miles of Alaska's outer continental shelf, which must be assessed for its potential and managed appropriately.

Alaska's strategic geographic location has long been recognized. U.S. Air Force General Billy Mitchell in his 1935 testimony to Congress said, "I believe that in the future, whoever controls Alaska controls the world." For example, Anchorage, Alaska, located fewer than 9.5 hours from 90% of the industrialized world, is currently home to the fourth largest cargo (by volume) airport in the world. Alaska also hosts a significant percentage of our strategic and national air and missile defense capability, including fifth-generation fighter aircraft and a ground-based ballistic missile defense system.

The Arctic is changing in many ways, and quickly. Russia is rapidly expanding its military and economic presence in the Arctic. Non-Arctic nations such as China are showing greater interest in the region, as demonstrated by their icebreaker voyages and joint military operations with Russia in the Arctic Ocean and their continued global quest for resources. Working collaboratively with allies and partners, a deep understanding of the impacts of the rapidly changing Arctic environment globally, as well as at the community level, is required for the United States to maintain an international leadership role in the region.

ABOUT THIS DOCUMENT. Consistent with the President's support of Arctic research, as expressed in the May 2025 *Implementation Plan 2025-2026 for the Arctic Research Plan 2022-2026* published at https://www.whitehouse.gov/wp-content/uploads/2025/03/2025-2026_implementation_plan-artic.pdf, the U.S. Arctic Research Commission provides this document to further advance U.S. Arctic research.

USS Pasadena at ICEX 2022. *Image credit: U.S. Navy's Arctic Submarine Laboratory*

Melting Ryder Ice Shelf in Greenland's Sherard Osborn Fjord. *Image credit: John Farrell*

In support of strengthening national security, the U.S. Arctic Research Commission (USARC) has identified research topics within four key sectors: military, community, energy, and economy. These sectors inform both domestic and foreign policy, ideally, in a mutually reinforcing manner, and are often interlinked.

U.S. Coast Guard Cutter *Healy* and Canadian Coast Guard Ship *Louis S. St-Laurent* surveying the Arctic Ocean. *Image credit: USCG Petty Officer 3rd Class Patrick Kelley*

MILITARY SECURITY. The Arctic region is critical to the defense of our homeland, the protection of U.S. national sovereignty, and the fulfillment of our nation's defense commitments. Research is critical to ensuring that the United States sustains strategic and tactical advantages over our competitors and adversaries as Arctic conditions evolve. To preserve this edge, research should focus on the unique aspects of Arctic terrestrial, air, space, and maritime domain awareness. Research should also address issues of high-latitude communications in, and access to, cold, isolated regions, including research infrastructure (e.g., bases and stations in Alaska and Greenland) and platforms that can operate in, atop, or under the ice (e.g., icebreakers and autonomous vehicles). To better measure and predict the Arctic's atmospheric, oceanographic, and terrestrial environments, essential for tactical and strategic operations, research efforts will need to focus on Arctic sea ice, the seafloor, permafrost, coupled atmosphere-land-ocean modeling, and the ionosphere. Research into emerging applications of quantum sensing and artificial intelligence could significantly advance key Arctic domain awareness and data challenges in the Arctic, including alternative positioning and navigation needed in GPS-degraded environments and the detection of extremely weak electromagnetic fields, allowing for improved intelligence, surveillance, and reconnaissance.

COMMUNITY SECURITY. Arctic research in support of national security can often serve multiple purposes as exemplified by the development of durable dual-use infrastructure that is critical to both military applications and to the security of Arctic communities. Advancements require Arctic-specific, multi-risk assessments that evaluate combined risks from hazards, including permafrost, landslides, subsidence, erosion, flooding, and wildfire, to improve the capacity to respond to the economic, ecologic, and societal impacts. Improvements in engineering design systems, responsive construction practices, and workforce development are necessary to create more resilient infrastructure, including housing and utilities, that support vibrant communities experiencing rapidly changing environmental conditions. Additionally, research is needed to establish a robust broadband network that will support economic development, education, telehealth, and overall community well-being.

Berry picking near Buckland, Alaska. *Image credit: John Farrell*

OVERARCHING THEMES. Rapid advancements in high-resolution remote and in situ sensing, broadband satellite-based networked communication, data fusion, artificial intelligence, quantum sensors and computing, supercomputing, sensor miniaturization and autonomous drones, and small satellites will enable unprecedented capacity to observe and understand the Arctic. These tools will generate the high-resolution baseline and real-time data and data fusion needed for assessing, managing, and operating in all four of the sectors listed in this report.

Additionally, the knowledge of Arctic residents, and opportunities for them to participate in and lead research, are vital for developing effective solutions in each security sector and for enhancing community resilience. Arctic research is an essential component of meeting the trust responsibility the United States has to Alaska Native Peoples, applied across the full spectrum of applications, including Arctic infrastructure, wildlife, and human health. It is also essential for training the next generation workforce to conduct critical research.

Department of Energy and international partners' gas hydrate production test site on the Alaska North Slope. *Image credit: Kris Hall, Little Red Services*

ENERGY SECURITY. Energy that is locally produced, affordable, and from diversified sources is required to greatly enhance energy security for Alaskan communities, commercial development, and military installations. These energy sources must efficiently generate electricity and heat while minimizing adverse environmental impacts. Globally, energy producers and markets are evolving rapidly, with new technology and energy sources providing both opportunities and challenges for Alaska. In addition to research on currently well-understood technologies (oil, gas, and renewables), innovative research is needed on emerging sources and technologies that are well suited for Alaska. Examples of these sources include geologic hydrogen, methane hydrates, enhanced geothermal, and small modular nuclear reactors and microreactors. Alaska is also a good location to explore the geological sequestration of carbon dioxide through both mineralization and in supercritical liquid form in underground reservoirs. Importantly, Alaska is a current and potential future source of strategic and critical minerals that are necessary for advancing U.S. energy security and economy.

ECONOMIC SECURITY. Many components of Arctic economic security (e.g., energy, minerals, and infrastructure) are addressed under Military, Community, and Energy Security; however an, essential element of Arctic Economic Security, the Alaskan fisheries, need special attention. Five of Alaska's fishing ports consistently rank in the top 10 in the country by volume; Alaska is the seventh largest exporter of seafood in the world. The industry generates more than $5 billion in annual revenue and employs about 60,000 people. As importantly, Alaska Native Tribal communities have relied on fishing for centuries to sustain their customary and traditional way of life. Changes that impact these fisheries are occurring both on land and in the ocean, and research and infrastructure that allows continuous environmental monitoring are needed to understand the impact of these changes and ensure viable and prosperous fisheries.

Workers at the Unisea pollock processing facility in Dutch Harbor, Alaska. *Image credit: John Farrell*

USARC will assess developments in these four sectors and identify evolving research needs to inform decision-makers and to help ensure a safe, secure, stable, and prosperous Arctic.

ABOUT THE U.S. ARCTIC RESEARCH COMMISSION. The U.S. Arctic Research Commission (USARC) is an independent federal agency established by the Arctic Research and Policy Act of 1984 and assigned specific duties therein. The Commission develops and recommends Arctic research priority areas and practices, implements an integrated national Arctic research policy, and builds cooperative links in Arctic research within the federal government, with the State of Alaska, with Tribes and Alaska Native Organizations, and with international partners. The law also requires the Commission to review the Arctic research budget "crosscut" in the President's annual budget request and report to Congress on how the crosscut supports the Arctic Research Plan produced by the Interagency Arctic Research Policy Committee (IARPC).

Point Lay, Alaska.
Image credit: John Farrell

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