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"Amplifying the Arctic: Strengthening Science to Respond to a Rapidly Changing Arctic"

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Chairwoman Johnson, Ranking Member Lucas, and distinguished members of the Committee, thank you for holding this important hearing. I am Dr. Larry Hinzman, and I am honored to appear before you today. I serve as Executive Director of the Interagency Arctic Research and Policy Committee (IARPC) and Assistant Director for Polar Sciences at the White House Office of Science and Technology Policy (OSTP).

I will start by commending this Committee for your visionary leadership in shaping Arctic policy, both in current times and in recent decades. Today, I will testify about the necessity of Arctic research and the work of IARPC, and I will also remark upon the importance of research infrastructure required for Arctic research, international collaboration, and respectful engagement with Arctic communities as key facets of Arctic research. The importance of Arctic research at this time cannot be overstated. While the impacts of the changing climate are drastically affecting Arctic people, wildlife, infrastructure, and the environment, the consequences of these changes are reverberating throughout the global climate system, influencing extreme weather, wildfires, sea level, and increases in temperatures of communities throughout our nation.

<u>Arctic Research</u>

The U.S. is an Arctic nation. The ongoing environmental and climate changes in the Arctic have impacts on the American economy and society.

The Arctic territory is remote and data-sparse, thus understanding Arctic change requires significant effort, expertise, and commitment to sustaining and re-capitalizing critical research infrastructure. There are changes underway in the Arctic, from changes in climate and the environment, to changes in demographics, to changes in economies and livelihoods. Research is critically important to understand the drivers, the societal and environmental responses, and possible pathways to adapt to these changes.

The Arctic is undergoing rapid change in ecological, socio-economic, and political responses to climate and other drivers. The impact of climate change in the Arctic is the engine for the evolution of the physical, social, operational, and geopolitical environments. Climate change is impacting our national security across this region, and science is the foundation in understanding the evolution of the Arctic. Now and for decades to come, that scientific understanding will enable the U.S. to be proactive in advancing our national security objectives and those of our like-minded allies and partners. For example, climate effects are causing direct and indirect impacts on the region's physical, chemical, and biological environments. Social, cultural and environmental changes alter the fabric of Indigenous and other communities, and may inhibit the continuation of Native cultural practices and the ability to actively pass on Indigenous Knowledge.

Economic change can bring opportunities but also dislocation as local residents are trained to work in fields that may not exist or persist in their home regions. This region is geographically vast, sparsely populated, and characterized by strong connections among its Indigenous Peoples and the land and sea. Adaptation to climate change intersects with other environmental issues and needed policies confronting Arctic residents, including those concerning food security, human health and welfare, environmental security and quality of life, and resilience of ecosystems.

The complex interplay of physical, chemical, biological, and social processes interacts to such an extent that an understanding of future trajectories requires a holistic perspective of the complete system. To achieve this goal, the U.S. Arctic research community must work collectively and in collaboration with our international colleagues.

Environmental drivers are increasingly impacting the lives of people in riverine and coastal communities and other parts of the Arctic. These impacts are expected to grow in magnitude and effect during the 21st century. Changes that affect Arctic coastlines will continue to direct, for example, the location of human habitations and the staging and feasibility of subsistence activities. The changes in the duration and distribution of sea ice will severely impact the availability of marine and coastal subsistence resources that are critical for survival. The small number of jobs, high cost of living, and rapid social change makes rural (predominantly Indigenous) communities highly vulnerable to climate change, especially through impacts on traditional hunting and fishing activities and cultural connections to the land and sea.

Both mitigation and adaptation responses to climate change are underway in the region in order to reduce and manage current and future risks. Small-scale farming and gardening in Alaska are providing locally-grown food resources and might alleviate some food insecurities that are likely to increase in the coming years. Long-term monitoring and adaptive management approaches can help us understand the effectiveness of human interventions (e.g., management or regulatory policies) and develop an understanding of trajectories of change.

Thawing of permafrost is having serious implications for the integrity of homes, municipal buildings, and essential facilities, including infrastructure of the oil, gas, and mining industries and Department of Defense installations. Innovative scientific and engineering research is needed to resolve ongoing technical challenges to infrastructure while developing novel solutions to enable future growth and development.

The relatively few roads in the Arctic and difficulty of off-road travel has prompted most travel by boats or on frozen rivers or sea ice. However, reduced coverage of sea ice and river ice compounds the difficulty of winter travel. More challenging travel conditions and increasing unpredictability of animal movements and availability of those animals can decrease harvest success and require additional hunting effort associated with additional fuel costs, time away from jobs and families, increased wear and tear on equipment, and increased risk of exposure and injury.

Interagency Arctic Research and Policy Committee (IARPC)

IARPC was established by Congress in the Arctic Research and Policy Act of 1984 (ARPA), legislation that advanced through this very committee. The law called for a comprehensive national policy focused on Arctic research, and IARPC was created to implement the legislation. IARPC was later reorganized as an interagency working group of the National Science and Technology Council (NSTC), which OSTP leads. IARPC comprises 17 Federal agencies, departments, and offices. OSTP is also the home of the Arctic Executive Steering Committee, which has a mandate to help Arctic communities adapt to the rapidly changing environment.

IARPC facilitates partnerships and collaborations that improve our understanding of the rapidly changing Arctic system and its impact on the Earth system through critical advances in cryosphere, atmosphere, ocean, and ecosystem science; advanced modeling and projections of environmental dynamics and future climate conditions; improved understanding of current and future Arctic change; and advanced human-centered research critical to Alaska community health, infrastructure, and environmental safety.

IARPC also supports IARPC Collaborations, a platform that facilitates implementation of the Arctic Research Plans and coordination among 3,500 researchers from the Federal Government, universities, foundations, and international organizations, along with Arctic community members. IARPC Collaborations has been successful by bringing together expertise, data, and resources, to solve complex problems that cannot be addressed in isolation. An example of successful interagency collaborations is the creation of a new position of Indigenous Community Engagement Specialist, which serves to coordinate federal research activities with local Indigenous communities in Alaska. The position is open in Anchorage; it is cooperatively funded by four Federal agencies. This position is stationed with the Smithsonian Arctic Studies Center's Alaskan office at the Anchorage Museum.

IARPC's 2022-2026 Arctic Research Plan

Section 109 of ARPA requires IARPC to create and implement five-year Arctic Research Plans, which show how Federal agencies work together to conduct Arctic research. The plans are developed in consultation with the U.S. Arctic Research Commission, the State of Alaska, Arctic residents, the private sector, and public interest groups. IARPC's role is to facilitate and encourage collaboration in Arctic research.

In December 2021, IARPC introduced the 2022-2026 Arctic Research Plan to address complex research challenges that are of great concern to our nation. This plan builds on focus of the previous plans on processes, such as sea ice dynamics, permafrost changes, and oceanic stratification and circulation. The 2022-2026 Plan moves beyond disciplinary-specific goals to the following four interdisciplinary priorities:

1. **Community Resilience and Health**: Improve community resilience and well-being by strengthening research and developing tools to increase understanding of interdependent social, natural, and built systems in the Arctic.

2. **Arctic Systems Interactions**: Enhance our ability to observe, understand, predict, and project the Arctic's dynamic interconnected systems and their linkages to the Earth system as a whole.

3. **Sustainable Economies and Livelihoods**: Observe and understand the Arctic's natural, social, and built systems to promote sustainable economies and livelihoods.

4. **Risk Management and Hazard Mitigation**: Secure and improve quality of life through an understanding of disaster risk exposure, sensitivity to hazard, and adaptive capacity.

This plan builds on the Administration's priorities for racial equity and Tribal engagement. The plan includes "Participatory Research and Indigenous Leadership in Research" as a foundational activity to support true engagement, community participation, and co-production of knowledge.

The pace of change and achievement has been so rapid that it is important to set long-term goals every five years that define the trajectory of research foci, while also periodically assessing our accomplishments, considering the changing scientific landscape, and resetting our intermediary targets. The IARPC agencies and collaborating researchers will implement the guidance provided in the 2022-2026 Arctic Research Plan through Biennial Implementation Plans (BIPs), detailed plans that identify specific activities and deliverables that can be achieved in the near-term and names the agency that will provide the leadership to complete those deliverables.

IARPC's U.S. Arctic Observing Network (U.S. AON)

Accurate assessment of environmental conditions is essential. The U.S. Arctic Observing Network (U.S. AON), which is a subcommittee of IARPC, is an initiative to promote establishing and maintaining sustained networks of Arctic observations among Federal agencies and other partners. These networks will provide high-quality monitoring, observations, and expertise.

Presently, the monitoring density of meteorological, hydrological, oceanographic, seismic, and other environmental variables in the Arctic is inadequate to enable us to answer the critical questions being posed by society. The land area of U.S. Arctic, as defined by ARPA (1984) is 267,185 square miles. In that area, which is about the size of Texas, there are 6 ASOS meteorological stations operated by the U.S. National Weather Service and 14 river monitoring stations operated by the U.S. Geological Survey (but only 8 are currently active). At this density of observations, most storms or flood events would not be detected, let alone well characterized. Sustained environmental monitoring is necessary for field research studies and for documenting rates of change, but this information is also vital for industry, resource managers, state agencies, and community planners. Due to limited information, infrastructure was not designed and constructed for the environmental conditions likely to be encountered, but rather roads, bridges or culverts were repaired or replaced as needed. Due to the lack of observations and limited understanding of climate change, the Trans-Alaska Pipeline has been repeatedly retrofitted with additional thermosyphons to prevent thawing of underlying permafrost. Federal agencies and non-Federal organizations administer observation stations operating at single points but those stations cannot capture the scale of the problem of characterizing this huge area, almost entirely in remote locations with little to no infrastructure or technical support, and typically in harsh weather, with inquisitive wildlife, and unstable surface conditions.

Sustained marine and terrestrial observations are essential in developing, verifying, and validating the models used to forecast weather, plot aircraft or ship navigation, or predict extreme events, wildfire behavior, or volcanic plume trajectories. These are just a few of the hundreds of civil applications that are products of research born of field observations. Examples of on-going research that will similarly yield societal benefits include projecting species migrations, quantifying sea level rise, characterizing coastal zone stability or vulnerability, or forecasting harmful algal blooms. Our nation will benefit substantially from strategically enhanced, well-coordinated observing capacity in the Arctic. U.S. AON was created to help coordinate and implement a pan-Arctic observing system. Many nations, including non-Arctic countries, are providing substantial support to help achieve the goals laid out by the international Sustaining Arctic Observing Network (SAON) strategy.

Research Infrastructure

High quality Arctic research requires high quality research infrastructure. In addition to U.S. AON that I discussed above, Arctic researchers have many other infrastructure needs, including some that I discuss here.

For the foreseeable future, we will have Arctic sea ice in the winter, with remnants into spring. The U.S. Arctic research community needs icebreakers to access the Arctic Ocean and marginal seas even as ice cover diminishes. The magnitude and consequences of the scientific questions regarding the role of sea ice in global climate dynamics, commercial fisheries, and transpolar shipping are immense with tremendous impacts to the U.S. and global economies. The research community would welcome additional capabilities for increasing sea ice research.

The Summit Station Greenland is the premier and only high-latitude, high-altitude, year-round observing platform in the Arctic. It is a uniquely critical platform for understanding past and current climate and environmental changes, which also permits modelling of future ice sheet, climate, and sea level rise scenarios. Unfortunately, there is a great need to maintain and update the Summit facility. The current infrastructure is near failure, sinking into the snow, creating access and maintenance challenges. The rapid loss of ancient ice from the Greenland Ice Sheet presents a tremendous threat to U.S. coastal infrastructure.

There is a need for greater collection, storage, and accessibility of Arctic data, across scientific fields and nations. Infrastructure that supports data management and curation is costly and relatively invisible compared to more physical infrastructure, but is sorely needed. We must enable optimum utilization of the existing observed and modeled data to maximize the return on our scientific investments, while also promoting synergy across scientific disciplines and new scientific findings.

International Collaboration in the Arctic

The Arctic research community has long been a beacon and a bastion of international collaborations. International partnerships with European and Asian partners greatly advanced our understanding of the role of the Arctic in the global climate system. Such cooperation promotes more rapid learning and more efficient achievements.

Following Russia's further invasion of Ukraine in February, the U.S. ceased government-to-government and multilateral engagement with Russia that was not in the U.S. national security interest. Research that has been disrupted includes field studies of natural carbon emissions, permafrost degradation, large river discharges, and population dynamics of walrus, polar bears, and waterfowl. Since Russia decided to escalate this brutal war, Federal scientists have ceased these partnerships and shelved plans for new joint efforts. We have had no choice but to forgo the regular collegial communications that enriched our understanding of Arctic science since the thawing of the Cold War.

Russia's unlawful invasion of Ukraine has caused tremendous suffering and a cascade of misery throughout Europe; the disruption of Arctic science is but one negative outcome that is far outweighed by the loss of life and threats to democracy. However, we must not ignore the impact to science, and we remain hopeful that Russia will fully withdraw from Ukraine and end this war. It was through scientific partnerships and collaborations that the U.S. and Russia developed a more open working relationship at various points in history. We remain hopeful that the scientific friendships we developed in the past can one day pave the way for mutual respect and cooperation in science and policy. It is for this reason that I worry about proposals to erect barriers to future scientific collaboration, such as a policy contained in Section 535 of H.R. 8256, the *Commerce, Justice, Science, and Related Agencies Appropriations Act, 2023*, which would prohibit OSTP, NASA, and the National Space Council from collaborating with Russia.

The magnitude of the challenges associated with climate change in the Arctic are simply too great for any nation to resolve in isolation. We must continue to collaborate with our international partners, particularly in field studies and observations, but also by sharing results, accomplishments, and understanding.

Indigenous Knowledge

Climate impacts on Arctic Indigenous communities are magnified by additional social and economic stresses. Additionally, many Indigenous communities still suffer from enduring health disparities and socioeconomic conditions.

The insights and knowledge of Indigenous Peoples and other local residents must be part of an approach to relevant adaptation planning. Integrating Indigenous Knowledge with science-based management principles can yield culturally-appropriate solutions that incorporate scientific and technological advances. The inclusion of Indigenous Knowledge, traditional knowledge holders and equitable practices in the co-production of research offers benefits to local communities and Federal agencies. Engaging a whole ecosystem perspective, which includes humans, in understanding the drivers and impacts of change, enables communities and Federal agencies to be better stewards of limited resources and assure sustainable management. This Administration is committed to strengthening the relationship between the Federal Government and Tribal Nations, which includes advancing equity for Indigenous and Native American people, including American Indians and Alaska Natives. IARPC endeavors to implement these commitments by listening to and learning from Indigenous communities and ensuring that IARPC agencies meaningfully consider their views. We have worked with our Federal agencies to ensure there is an understanding and a process to conduct regular, meaningful, and robust engagement with Tribal officials. IARPC went to great lengths to hear and incorporate the opinions of Indigenous individuals and organizations in the development of these Federal research plans.

The 2022-2026 Arctic Research Plan differs from earlier collaborative plans in the creation of a Foundational Activity entitled "Participatory Research and Indigenous Leadership in Research". Implementation of this plan is not based upon a one-way flow of information from the Federal Government and researchers to Indigenous communities, but true engagement, community participation, and co-production of knowledge. Such partnerships in research can yield immediate benefits in terms of research findings, and can also enhance capacity building and better communications among agencies, researchers, and community members.

Conclusions

It is in the U.S. national interest to understand Arctic processes and their impacts to the global system. The Arctic scientific community is very strong and collaborative. The Federal agencies leading Arctic research are making important contributions to help the people of the U.S. and the world prepare for an uncertain future, but one that is certainly different from today. Our nation must continue to invest in Arctic research as the Arctic is demonstrating an outsized effect on the global climate system. The benefits are clearly far greater than the cost. We must also place greater emphasis upon convergent science that draws together relevant scientific, engineering, and social science disciplines to resolve the more complex or sophisticated challenges confronting our communities. Collaborations across agencies, with non-Federal collaborators and with Indigenous communities should be a priority.

I thank you again for holding this important hearing and allowing me the opportunity to testify. I look forward to your questions.

Biography of Larry Hinzman, Ph.D.

Dr. Larry Hinzman serves in the White House Office of Science and Technology Policy (OSTP) as the Assistant Director for Polar Sciences. He is also the Executive Director of the Interagency Arctic Research Policy Committee (IARPC) and is leading the effort to implement the 2022-2026 Federal Arctic Research Plan. Dr. Hinzman recently served as the President of the International Arctic Science Committee and as the Vice Chancellor for Research and Professor of Civil and Environmental Engineering at the University of Alaska Fairbanks (UAF). He served as the Director of the UAF International Arctic Research Center from 2007 to 2015.

His primary research interests involve permafrost hydrology. He conducted hydrological and meteorological field studies in the Alaskan Arctic continuously for over 35 years while frequently collaborating on complementary research in the Russian and Canadian Arctic. Dr. Hinzman's research efforts have involved characterizing and quantifying hydrological processes and their inter-dependence with climate and ecosystem dynamics. He has served as a member of the U.S. National Academy of Sciences Polar Research Board. Dr. Hinzman is strongly committed to facilitating national and international partnerships to advance our understanding of the Arctic and Antarctic systems.

Dr. Hinzman earned B.S. degrees in Soil Science and Chemistry from South Dakota State University in 1979, followed by an M.S. degree in Agronomy with emphasis in remote sensing from Purdue University in 1981. Dr. Hinzman began conducting research in Alaska that same year, eventually earning a Ph.D. in Soil Physics from the University of Alaska Fairbanks in 1990.