August 16, 2020

Federal Input Synthesis

Introduction [1]

Agencies were asked to provide input on 1) critical issues where federally-funded science and engineering research can provide knowledge to promote good decision-making at all levels related to the Arctic and 2) the organization and structure of the Arctic Research Plan (2022-2026) and how it might be developed to better meet and communicate the science needs and plans for the Arctic. Agencies that submitted comments include: Department of Defense; Department of Energy; Department of Interior; Department of Transportation; Department of Health and Human Services; National Aeronautics and Space Administration; Department of Commerce; National Science Foundation; Smithsonian; US Arctic Observing Network Board; and U.S. Coast Guard. The direct input from the Federal agencies, summarized here, complements the synthesis of information from Federal documents included in the Federal Strategic Documents Synthesis.

How to Use the Synthesis

This document is a synthesis of the main, current research themes and organizational comments presented by federal agencies for the development of the next Plan. This document should be used to inform the Plan Development Workshop and as an aid to drafting teams. The synthesis has two sections: 1) a synthesis of input related to the organization of the Plan and specific comments related to process and structure of the Plan and of IARPC Collaborations; 2) a synthesis of critical research areas that should be considered in the next Plan. This synthesis does not represent a consensus on the plan organization, structure, or content, it relays ideas put forth by one or more of the aforementioned agencies.

Section 1: Plan Organization and Structure

Maintain from Previous Plan: Maintain the structure of policy drivers and research goals as well as a detailed description of how research aligns with policy drivers and agency-specific research priorities.

Changes for New Plan: The Plan should focus on what is new and different from the last Plan. Consider opportunities for applied research and research that supports decision making (for example, that can help assess risks and impacts and apply/evaluate options for mitigation/adaptation) while also ensuring that fundamental research remains a priority. Include a greater emphasis on operational research. Create a more streamlined Plan that focuses on strategic drivers and cross-cutting foci that address fewer, highly interdisciplinary efforts with a focus on meeting stakeholder needs. Emphasize diversity, equality and inclusion activities for researchers, stakeholders, and communities. Increase stakeholder input and access to outcomes. Include health discussions on Covid 19. Integrate health and well-being into other objectives and activities. Link objectives to National Security objectives, programs, and concerns. Elevate charting and mapping needs in the Arctic.

Funding: IARPC should support efforts that fall between agency missions and consider what it takes to be able to more effectively share non-federal data.

Community Engagement: The way that IARPC engages the broader community of scientists and stakeholders is not evident in the Plan itself. Encourage interactions with stakeholder communities across the United States and internationally. There is also a need for a more directed IARPC role in sustained northern community engagement especially in coordinating science communication and supporting co-production

[1] This document was prepared by Sorina Stalla for the Plan Development Steering Group

processes. Develop an Indigenous engagement strategy that includes an Indigenous Engagement Coordinator position within the IARPC Secretariat. The Plan should promote community-driven research and community-based observations and collaboration teams should encourage and compensate Indigenous participation There is a need for increased involvement from Arctic communities specifically on health objectives and research.

Policy Drivers[2]*:* Consider that current drivers do not capture key aspects of stewardship or Indigenous community involvement and protections.

Goals: Focus on goals that can be collectively accomplished and allow for aspirational research goals. Consider reducing the number of top-level goals. Include specific actionable goals relative to agency missions and policy directives that incorporate goals of agencies. Goals should include ocean components and interactions of ocean with atmosphere, sea ice, and land.

Performance Elements: Consider what style and format the performance elements should be. For example, how specific they should be, how many there should be, and if there is the option to update them throughout implementation.

Collaboration Teams: Review existing teams and re-evaluate the purpose of teams to ensure agencies come together with the research community to identify needs and opportunities, with the goal of making progress towards the performance elements. Teams should focus on interdisciplinary topics and cross-cutting collaborations. Realign collaboration teams to match new Plan goals. Allow teams to define questions under objectives as their meetings are held. Consider eliminating or reorganizing the Environmental Intelligence (EI) Team to allow for greater synergy across other teams. Lead agency POCs should be more easily identifiable.

Section 2: Plan Content

Monitoring, Observation, Modeling and Forecasting: Improve modeling, and earth systems analysis. Invest in long-term observations and monitoring to advance predictive capabilities. Improve ability to connect observations across scales and support activities that leverage existing observatories. Develop platforms that enable year-round observations on land and sea ice, in the Arctic Ocean and related seas, and implement comprehensive monitoring of the marine environment to support regional climate models. Improve data collection, modeling and dissemination of weather as well as forecasting/prediction and earth systems analysis, and research on weather and ice forecasting. Develop regional ecosystem forecasting in conjunction with sustained in situ monitoring of physical and chemical oceanography. Measure, monitor, model, and predict the Arctic and its processes as an interconnected system. Increase monitoring and observing in shoulder seasons.

Environmental and Arctic Systems Change: Increase understanding of the drivers of Arctic change and the impacts of high-latitude change on lower-latitude systems. Increase understanding and predictive capabilities of the rapid pace of environmental change in the Arctic. Understand to what extent changes in Arctic regions are driven by local versus global influences, and what the impacts of high-latitude change on lower-latitude systems are. Research on coupled Arctic biogeochemical processes and their regional and

[2] For a fuller discussion on policy drivers see Policy Driver White Paper

global impacts. Research on how the Arctic cryosphere will change under a range of potential future conditions. Research on how Arctic surface energy budget will be impacted by changes in sea ice, atmospheric structure, aerosols, clouds, and their interactions under current and future conditions. Enhance understanding of boundary conditions and processes between ocean, ice, land, and air. Understand boreal peatland/wetland system changes and reactive transport modeling of groundwater–surface-water–ice water dynamics and interactions.

Atmospheric Science: Address quality of reanalysis efforts in the Arctic. Improve understanding of the details and processes controlling Arctic cloud microphysical and macrophysical properties. Improve understanding Arctic aerosol properties. Increase understanding of Arctic tropospheric state. Increase understanding of surface-atmosphere interactions. Assess linkages between Arctic atmospheric processes and lower latitudes and enhance fundamental understanding of the key physical and chemical processes driving Arctic weather and climate and impacting the rate of climatic change at high latitudes.

Indigenous Engagement: Develop a framework for Indigenous and local community engagement in research that supports understanding environmental change and impacts to food security. Invest in co-production science that holistically responds to environmental unknowns and community needs. Build capacity for research in northern communities including projects that co- produce knowledge, Indigenous scholarship, STEM education, and building of local research infrastructure.

International Cooperation and Partnership: Better support and incorporate international cooperation/efforts into the Plan. Continue coordination on radar observations and integration of data sets. Improve research access to the Arctic, including increasing safety and environmental stewardship. Conduct interagency synthesis on data from The Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOASiC) and conduct activities around MOSAiC data. Continue cooperation with Greenland including integration of in situ and satellite measurements, as well as NASA-ESA-led international coordination on changes in methane emissions from Arctic permafrost.

Education: Support activities that use Arctic research to strengthen STEM education.

Emissions and Pollutants: Research on expected changes to the chemical cycling dynamics of toxins and other shorter-lived species (such as mercury and short-lived climate forcing compounds) to better formulate a holistic approach to environmental stewardship and the promotion of ecosystem and human health.

Erosion, Permafrost, and Infrastructure: Work on coastal shoreline mapping, erosion prediction and enhancing understanding of permafrost thaw and engineering standards. Identify patterns of change and areas of infrastructure risk. Research to support Arctic infrastructure design. Monitoring and understanding the impact of declining permafrost and nearshore ice on winter transportation, coastal erosion, and community flooding. Conduct research on methane emission from thawing permafrost. Assess linkages between open-water and nearshore/coastal processes, including glacier retreat. Develop resilient infrastructure and platforms.

Energy Development, Shipping, Hazard Response and Mitigation: Monitor, assess, and conduct targeted research on Alaska's natural and man-made hazards to improve public safety and reduce risk and economic losses. Support research related to monitoring increases in Arctic vessel traffic and the potential

impacts of such traffic to protected marine species, particularly those at risk of vessel strikes. Produce assessments that focus on the location, quantity, and quality of mineral and energy resources, including the economic and environmental effects of resource extraction and use.

Technology: Develop cyberinfrastructure. Leverage potential of AI and Cloud computing to support satellite observations of land and sea ice to create informative data products, while strengthening coordination among existing sea ice prediction tools on the local, regional, and basin-wide scale to support navigational safety. Enhance navigation systems. Utilizing 'omics as a new method for conducting research. Support technological advancements in high performance computing, cloud computing, artificial intelligence, machine learning, visualization and decision support tools. Develop and apply use of marine, surface, and aerial autonomous devices so observations of atmospheric and oceanic profiles (and their interface) can be observed simultaneously.

Community Resilience and Cultural Resources: Research related to the interconnections of people, and natural and built environments. Research related to the history, cultures, languages, and well-being of arctic residents and Indigenous Peoples.

Community Health: Support health research in light of Covid 19. Support integrative approaches to human health that recognize the connections among people, wildlife, the environment and climate. Support research on mental health and well-being. Support research on environmental health that focuses on health metrics within Arctic homes and within Arctic communities. Continue monitoring and improvements to occupational health in the Arctic the use of tele-medicine in the Arctic.

Ecosystem Changes, Species Management, and Ice: Research to support wildfire forecasting and management. Research on ecosystem changes that will help inform the management of wildlife, fish and habitat, especially regarding species of particular concern. Increase understanding of the structure and function of Arctic marine ecosystems to 1) quantify their role in regional and global climate systems, and 2) identify potential for sustainable economic development. Support research on rapid change in the Bering Sea. Study the impacts of sea ice changes on the biology of the Arctic region.

Convergence Research and Socio-Ecological Systems: Support basic research on understanding processes in social and natural systems. Support research that takes a convergence approach.

Water Resource Management: Address new and pressing social challenges of water resource management and related emerging ecological concerns especially as it relates to changing patterns of glacier runoff.

Data Management: Improve Alaska geospatial data collection, mapping, modeling and visualization tools to help build communities of practice among scientific, Indigenous, and policy experts around shared interests and concerns. Include a stronger emphasis on open data sharing and code model sharing.

National Security and Defense: Research that supports Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR), domain awareness, maintaining and enhancing operations in the Arctic environment, training and range sustainment, and human performance in the Arctic environment.