

NATIONAL SCIENCE FOUNDATION (NSF)

Advisory Committee for Polar Programs (AC-OPP)

Spring Meeting, March 24-25, 2022

Meeting Held via Zoom

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SUMMARY

Action Items Arising from the Spring 2022 AC-OPP Meeting

1. Items arose for possible inclusion in the agenda of the next AC-OPP meeting (fall 2022):
 - a) A subcommittee or similar vehicle for input on South Pole master planning.
 - b) Follow-up with the subcommittee on DEI
 - c) An ARV DCL letter.
2. Other action items:
 - a) Polar cyber infrastructure

Attendance and Membership

AC-OPP Members Present:

Dr. Meredith Nettles, Lamont-Doherty Earth Observatory, Columbia University, Chair, AC-OPP
Dr. Douglas H. Bartlett, Scripps Institution of Oceanography, University of California, San Diego
Dr. Aron L. Crowell, University of Alaska, Anchorage
Dr. Ryan E. Emanuel, Department of Forestry and Environmental Resources, North Carolina State University
Dr. Patrick Heimbach, Institute for Computational Engineering and Sciences, The University of Texas at Austin
Dr. Allyson Hindle, University of Nevada, Las Vegas, School of Life Sciences
Mr. Steve Iselin, U.S. Navy (Ret), Iselin Consulting Enterprise, LLC
Dr. Vera Kuklina, Department of Geography, George Washington University
Dr. Brice Loose, University of Rhode Island, Graduate School of Oceanography
Dr. Michelle Mack, Center for Ecosystem Science and Society and the Department of Biological Sciences, Northern Arizona University
Dr. Adam Marsh, School of Marine Science and Center for Bioinformatics and Computational Biology, University of Delaware
Dr. Patricia Quinn, Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration (NOAA)
Dr. Sharon Stammerjohn, Institute of Arctic and Alpine Research, University of Colorado
Dr. Eric Steig, Earth and Space Sciences, College of the Environment, University of Washington

AC-OPP Members Not Present:

Dr. Douglas H. Bartlett, Scripps Institution of Oceanography, University of California, San Diego
Dr. Ryan E. Emanuel, Department of Forestry and Environmental Resources, North Carolina State University

AC-OPP Subcommittee, Office of Polar Programs and other NSF staff (presenters and speakers):

Dr. Sethuraman “Panch” Panchanathan, NSF Director
Dr. Roberta Marinelli, OPP Director
Dr. Greg Anderson, Program Director, Arctic System Sciences, OPP
Ms. Renée Crain, Research Support & Logistics Manager, OPP
Dr. Linda Hayden, Director, Center of Excellence in Remote Sensing Education and Research (CERSER); Co-Chair, Polar Sub-Committee on Diversity and Inclusion
Dr. Karla Heidelberg, Antarctic Sciences Program Officer
Dr. Gretchen Hofmann, University of California, Santa Barbara Marine Science Institute; Co-Chair, Polar Sub-Committee on Diversity and Inclusion
Dr. Alexandra Isern, Acting Assistant Director, Directorate for Geosciences (GEO)
Dr. Douglas E. Kowalewski, Section Head, Antarctic Sciences, OPP
Ms. Melissa Lane, Staff Associate for Information Management, GEO
Mr. Timothy McGovern Program Manager Ocean Projects
Dr. Jennifer Mercer, Arctic Research Support and Logistics Manager, OPP
Dr. Karen Marrongelle, NSF Chief Operating Officer (COO)

Dr. Timothy Patten, Deputy Assistant Director, GEO
Dr. Allen Pope, Program Director, Polar Cyberinfrastructure
Mr. Mike Prince, Antarctic Research Vessel (ARV) Project Manager
Dr. Frank R. Rack, Arctic Research Support and Logistics Manager
Ms. Elizabeth (Lisa) Rom, Polar Education Liaison, Division of Ocean Sciences
Ms. Stephanie Short, Section Head, AIL, OPP
Dr. Nancy Sung, Science Policy Advisor, OPP
Ms. Beverly Walker, Science Analyst, OPP

NOTES

Thursday, March 24

Welcome and Introductions; Conflict of Interest (COI) Review
Dr. Nettles; Dr. Marinelli; Dr. Anderson

Dr. Marinelli and Dr. Nettles provided brief introductory remarks. Dr. Anderson briefed the committee on conflicts of interest and the role of Federal advisory committees under the Federal Advisory Committee Act (FACA).

Dr. Marinelli discussed staff updates:

- New Hires:
 - Jennifer Mercer, Arctic Sciences Section, Section Head
 - Allyson Kristan, Office of Polar Programs, Sea Grant Fellow
 - Kimberly Ohnemus, Office of Polar Programs, Science Assistant
 - Carla Haroz, Antarctic Infrastructure & Logistics Section, Operations Manager
 - Kayla Hubbard, Arctic Sciences Section, Science Assistant
- Details
 - Sara Eckert, Office of Polar Programs, Communications Specialist, Office of Legislative and Public Affairs (OLPA)
- Retired
 - Simon Stephenson, Antarctic Sciences Section, Section Head
- Departures
 - Maj. Rachel Leimbach, Antarctic Infrastructure & Logistics Section, Air National Guard (ANG) Liaison

Dr. Marinelli also briefed the committee on NSF's new Technology, Innovation and Partnerships (TIP) Directorate:

- Goal - accelerate the development of new technologies and products that:
 - Improve Americans' way of life
 - Grow the economy and create new jobs
 - Strengthen and sustain US competitiveness
- Includes portfolio of innovation and translation programs

- NSF Innovation Corps (I-Corps™)
- Partnerships for Innovation
- America's Seed Fund
- Convergence Accelerator
- Updates: <https://beta.nsf.gov/tip/latest>

Next, she discussed how OPP can take advantage of TIP:

- Opportunities to partner in advancing polar technology, infrastructure and cyberinfrastructure (CI), science
 - Dear Colleague Letter (DCL) and Ideas Lab on
 - Polar Cyberinfrastructure
 - Engineering Technologies to Advance Underwater Sciences
- Upcoming
 - Polar technology workshop
 - Possible polar technology center
- Emphasis is on fusion and innovation
 - More science
 - Fewer boots on the ground
 - Engage the missing millions

Dr. Marinelli concluded with a discussion of available budget information at the agency and OPP levels for FY20, FY21 and the FY22 request.

Upcoming Field Seasons and COVID-19

Dr. Mercer; Ms. Short; Dr. Kowalewski; Dr. Hindle

Dr. Kowalewski provided a snapshot of the latest deployment data, and outcomes on the Long-Term Ecological Research (LTER) project and the International Thwaites Glacier Collaboration (ITGC). He said there were over 50 science and technical activities scheduled for the 2021-2022 Antarctic field season; 42 were specific science events. Priority was given to field work or where field work involved international collaborations with an expected loss of continuous time series data, or a high risk of instrumentation loss. The number of deployed science events and grantees was reduced for the 2020-2021 field season but rose significantly this past year.

Dr. Kowalewski added that this season the McMurdo LTER team went into the field. It collected and maintained the longest time series record of terrestrial and freshwater ecosystem processes in Antarctica. The McMurdo LTER team was reduced, but successful in all high-priority field work related to stream, lake, and soil sampling to ensure the continuous long-term record is preserved. The Palmer LTER team was also successful and had grantees deployed to complete marine and terrestrial objectives. It expanded the cruise sampling grid to include the tip of the peninsula.

He noted that in November, the 2021 Weddell Seal Science team identified the oldest recorded Weddell mom, age 32. This long-time series data set remains unbroken despite the pandemic as a result of the United States Antarctic Program's (USAP) close coordination with local and national governments through the New Zealand gateway.

Dr. Kowalewski provided an update on the Ross Island Earth Station. The new 43-foot diameter antenna dish has been enclosed and replaces an outdated station, which will increase reliability and reduce maintenance and operation costs.

Dr. Mercer spoke next about Arctic Sciences, which is about to begin the field season. Goals for the season are:

- Catching up on science projects from 2020 and 2021
- Resuming facilities upgrade projects at Toolik Field Station
- Resuming Summit Recapitalization activities

Turning to Arctic field activity and COVID-19, she said some projects were kept running in 2020 and 2021 through remote sampling and using scientists in the area to collect data or keep projects going. There were a large number of canceled and deferred projects.

Dr. Mercer highlighted the following projects that will be going into the field, hopefully for full field seasons, this year:

- Catastrophic Thermokarst Lake Drainage
 - Alaska (Jones — cancelled in 2020, curtailed in 2021)
 - Continuing work started in 2021
 - A combination of remote sensing, field observations, and a lake-drainage experiment are targeted at understanding the causes and consequences of drained Thermokarst Lake basin formation and their broader feedbacks with other arctic system components.
- Research Experiences for Undergraduates (REU) Site, Expedition Science for Students
 - Greenland (Allen - cancelled in 2021)
 - New REU site that will involve a total of eight students each year in an international geologic field experience in Greenland.
 - Spend five weeks at a field site on the west coast of Greenland while mapping geologic structures in the newly established Aasivissuit - Nipisat The United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage site.
 - This project is supported by the Division of Earth Sciences and the Office of Polar Programs in the Geoscience Directorate.

Dr. Mercer highlighted the 2022 Arctic cruises (University-National Oceanographic Laboratory System (UNOLS), US Coast Guard, chartered US vessels and the Canadian Coast Guard):

- Research vessel (R/V) Sikuliaq: High-resolution records of storminess S. Bering Sea — Donnelly (Woods Hole Oceanographic Institution (WHOI))
- R/V Sikuliaq: Western Arctic Boundary Current Monitoring — Pickart (WHOI)
- United States Coast Guard Cutter (USCGC) Healy: US Synoptic Arctic Survey — Ashjian (WHOI)
- R/V Norseman II: Bering Strait Arctic Observing Network (AON) — Woodgate (University of Washington (UW))
- R/V Norseman II: Toxic Algal Blooms — Anderson, Pickart (WHOI)
- R/V Norseman II: High-resolution Multi-tracer Biogeochemical Study — Goni, Juranek (Oregon State University (OSU))

- R/V Ukpik: Arctic Shelf Sediment Pathways — Eidam (University of North Carolina at Chapel Hill (UNC-CH))
- R/V Neil Armstrong: Davis Strait Observing System cruise —Craig Lee (UW)
- Canadian Coast Guard Ship (CCGS) Louis S. St-Laurent (DFO (Department of Fisheries and Oceans, Canada): Joint Ocean Ice Study/Beaufort Gyre Observing System (JOIS/BGOS). NSF- DFO joint cruise — Mary-Louise Timmermans (Yale University)
- CCGS Sir Wilfred Laurier (DFO): NSF-DFO joint cruise related to the Distributed Biological Observatory (DBO) —Jackie Grebmeier (University of Maryland Chesapeake Biological Laboratory (UMD-CBL))

Dr. Mercer concluded with COVID-19 considerations for the upcoming Arctic field season.

- Travel procedures are posted to the Battelle Arctic Gateway
- All research teams should have a written protective plan describing mitigation measures and response to COVID signed by an authorized institutional representative; this plan documents informed consent and shared responsibility of the responsible institution and team members
- Quarantine and testing are required in the following situations:
 1. Travel to Toolik Field Station in Alaska
 2. Use of the Air National Guard (ANG) flights to Greenland
 3. Any travel to Summit Station
- Travelers are required to follow national, state, local, and tribal travel restrictions
- Travelers to Toolik, AK and Greenland are required to be fully vaccinated and boosted per Centers for Disease Control and Prevention (CDC) guidance
- Research teams are responsible for responding to a COVID outbreak in the field

Continuing with COVID-19 protocols for the coming Antarctic season, she listed:

- Continued focus on managing risk
- Vaccination requirements expected to continue
- Physical Qualification changes, if any, will be made in June
- Quarantine protocols will be established as the season starts

Ms. Short continued the presentation and discussed Antarctic Infrastructure Modernization for Science (AIMS):

- Replacing lost lodging capacity is vital
- Re-baseline efforts are underway
- Construction is expected to resume next season

She also discussed the Antarctic approach to COVID-19. Unlike the Arctic, the summer research season doesn't begin for another several months. She noted that COVID-19 related circumstances can and do change. There will continue to be a focus on managing risk. COVID-19 vaccination requirements are expected to continue. In the June time frame, changes to physical qualification requirements will be considered. Quarantine protocols at gateways will be established closer to the start of the season.

Ms. Short provided three questions for the AC to discuss:

- How do we foster robust polar research in times of limited field deployments?
- How can we build resilience in the polar community to mitigate impacts in the future?
- How can OPP and the AC work together to share this kind of information with our community?

Discussion

Dr. Nettles, on behalf of the community, thanked the NSF staff for providing a thoughtful approach to management in a constantly changing environment throughout the pandemic.

Dr. Hindle said she'd be interested in knowing the best projections for when lodging might be coming back into service in McMurdo and how to think about catching up projects. Ms. Short mentioned work being done with the Antarctic support contractor to re-baseline that work. OPP is comfortable about the ability to resume construction next season, given that the gateway in New Zealand is no longer being as restricted on throughput. When the schedule is determined that information will be shared broadly. Her office is working towards a surge in logistics support in the coming season, which would permit a lot of catch up in the next season. There will be much more information in the coming weeks and months.

Dr. Mercer said there will be additional information on the OPP website for the Arctic in the next weeks. It is easier for the Arctic to catch up on science because it's dispersed across the Arctic and there are a lot of vessels going and a lot of projects are working in small communities, coastal areas and across different countries. But there are going to be challenges similar to the Antarctic sites with capacity bed space.

Dr. Marinelli addressed fostering robust polar research in times of limited field deployments. NSF has done much to help existing grantees make it through their funded research with various forms of supplemental support. Also, a DCL is being prepared that will encourage supplemental requests for people who were undergraduates at the time of COVID-19 who have since graduated to apply to be the equivalent of a research assistant in a laboratory, as if they were an undergraduate again to try and make up for lost time and give people experiences that they didn't have the opportunity to take advantage of.

Should COVID come back and prove more challenging than it is now, NSF has a better toolkit for understanding how to work with it and get things done. There have been discussions about how to build resilience into the polar community to mitigate impacts, asking: How do we go about doing polar science differently? Can we do more polar science remotely? The director is particularly interested in whether NSF can we develop technologies that allow data to be gathered efficiently and effectively without as many boots on the ground. This is being pursued through opportunities that will come up in future AC sessions to receive member input. There's no substitute for being there, but there are ways to enrich observations that don't always require one's presence. This is the envelope to push in polar to broaden participation and in partnerships with the new directorate, so OPP will be tilting in that direction to fulfill its mission more effectively and keep people engaged and bring new people into the field.

Acknowledging that the community needs to plan and that it's been frustrating to plan in an environment where you don't know what assets are available, there are plans within the next few weeks to release the DCL for the Antarctic that outlines what's available in the future. There is still a crowded situation in the southern part of OPP's purview. OPP wants to engage in much longer field planning efforts, so there is a decision to do a big push in a certain area, it is not stopped because everything's full. AC members are needed to help OPP engage in that process for how to carve out these long-term big questions and start to make progress.

Dr. Steig asked for more information about what Dr. Marinelli had in mind regarding longer time for field planning. Dr. Marinelli referred the questions to Dr. Kowalewski who said that to deal with the backlog, OPP is not looking at just how to think about the next field season but looking at the existing projects and thinking about those to completion and what parts are no longer relevant to best support projects that already exist. Looking longer term at allocated resources, he spoke about avoiding a situation where a bucket empties and there's a project that wants to fill that, but it doesn't allow for a larger scale initiative that uses multiple resources. OPP is interested in identifying the larger scale projects and resources that will be needed, how that is made available and assuring these resources can be available for the next big idea. Some of that is taking place now in terms of developing a new planning strategy for how OPP accepts field proposals and the process they go through as OPP works with PIs to get a better idea of the field demands and how that might fit existing allocated resources.

Dr. Crowell asked for an example of the cooperation of local communities and indigenous observers in the Arctic and how that enabled projects to be sustained when the field science was curtailed. Dr. Mercer cited work with Greenland's research institutes to deploy local researchers into the field to service instruments or download information. Dr. Rack provided an example from Alaska using the Ukpeaġvik Iñupiat Corporation (UIC) science staff to assist projects and service instruments. At Toolik Field Station there was an extensive remote measurement call to the community. Many people responded and that became a productive way to get research done when it was not possible to deploy in person. Dr. Mercer cited another collaborative project in Greenland with research institutes mapping coastal submarine changes with sea level rise that was able to conduct community meetings in the local language without American researchers present and considerable gains were made on the research. Ms. Renee Crain referenced a successful project in Northwest Greenland, where work is being done with several communities.

Dr. Stammerjohn raised the issue of international collaborations and sharing and leveraging resources in the context of the long-term planning involved in the Big Ideas. She asked about the resources or recommendations NSF has and how to approach that as a community and how to share that information. Dr. Marinelli responded that some agency-to-agency international partnerships are well developed and some less so. At the logistics level, NSF has historically done a quid pro quo. At the proposal level, scientists apply to their own agencies and everybody with funding joins together. Some of the most successful international partnerships are driven at the principal investigator (PI) level, where there's a groundswell of interest in projects, which helps OPP push the relationships it has or needs to develop. There are memoranda of understanding and agreements with international partners that lay out a framework for formalizing that parallel play, where PIs work together to seek funding on a common idea and

agencies agree to review internally and review each other's work. Dr. Marinelli said this would be a good topic for future AC discussions.

Dr. Kowalewski agreed and said a lot is driven by the PI community. From some of the community development, it allows the formation of better relationships. The Natural Environment Research Council (NERC) - NSF relationship has worked well for the Thwaites initiative and understanding where that can go in the future, along with interagency agreements, including with The National Aeronautics and Space Administration (NASA) and Antarctica. Regarding international partners, there are challenges and one of the priorities is to advance science during the backlog and have international partners. Sometimes international partners might have different constraints from NSF. And there could be delays supporting collaborative initiatives. Supplemental funding for some projects might be different with international partners. What OPP can support for supplements might not be the same that some international partners can support, which causes an imbalance. But those bigger initiatives are what OPP is looking to move towards. This has been noted in the [*Mid-Term Assessment of Progress on the 2015 Strategic Vision for Antarctic and Southern Ocean Research*](#).

Dr. Nettles asked about the COVID impact that is not directly field related. She said there is awareness of the impact on young researchers and the cumulative impact on mid-career and senior researchers. She reported that some of her colleagues who are mid-career or senior are talking about retiring early because of burnout. They haven't had the time during the last two years to write the papers, formulate new ideas or write the proposals to keep them and their research groups going. The reason NSF invests heavily in early career researchers is for a payoff over the long term. If these people are out of the pipeline, that's a loss for the robustness of polar research. A lot of people could benefit from a mini-sabbatical or focused writing time or some kind of relief. NSF has been very flexible with supplements. She asked for thoughts from the committee and NSF on ways to support all researchers wherever they are in their career cycle that is not necessarily field related.

Dr. Marinelli noted that universities have tried to provide some breathing room for faculty at a time when their resources are constrained. Supplements have been an important venue. But that doesn't work if you don't have a polar grant and you are early career. NSF has discussed the possibility of helping ease people into polar work by suggesting they think about projects that don't necessarily require a deployment but get them into a cryospheric environment where they can start to do work to repair a broken pipeline. The foundation is also looking for opportunities to broaden ways people can get engaged in polar work. The DCL, which she is hoping will come out soon, will speak to that.

Dr. Mercer said there have been considerable steps toward investing in specific programs. There have been a lot more doctoral dissertation grants, postdoc grants and programs and calls for proposals for those things, as well as solicitations. But the situation will not return to normal. Normal is going to adjust over the next few years and no one knows what that will look like.

Dr. Kowalewski said OPP is involved with the [mid-career advancement solicitation](#). It is for an associate professor to have a sabbatical or build up new skill sets. So, there are mechanisms and

solicitations that are underutilized within geoscience or OPP. Dr. Steig suggested publicizing the mid-career advancement solicitation but said it doesn't address more senior researchers.

Dr. Nettles said one of the biggest stress groups of senior people consists of those who have been running high school and undergraduate engagement programs. Constant rejiggering of how to do their work has been stressful. She asked the AC to think broadly about new approaches to help the situation. NSF is using many different mechanisms in a good way.

Dr. Marinelli said the NSF director has an emphasis on fellowships, primarily graduate and postdoc. There will be a fresh look at NSF funding for the next generation of scientists and rebuilding the pipeline. So, it might be easier to get sustained graduate student support out of NSF now than it has been in the past.

Polar Sub-Committee on Diversity and Inclusion Update

Dr. Hayden; Dr. Hofmann; Dr. Crowell

Dr. Hayden summarized the topics for the presentation and introduced Dr. Crowell, who began with the first two components of the sub-committee's charge:

Part 1: Current state of diversity of the NSF-sponsored polar research community

- Nationally, women and members of minority communities are underrepresented in sciences and technology, based on Ph.Ds. awarded (Committee on Equal Opportunities in Science and Engineering (CEOSE) 2021)
- By self-reported race, gender, and ethnicity these groups are additionally underrepresented as PIs on proposals submitted to OPP, coming in at less than their proportion of US earned doctorates (review of OPP proposals since 2011).
- Since 1987, OPP has given a total of 1,588 awards to Minority Serving Institutions (MSIs) of higher education, or 21% of all awards (7419).
- Most underrepresented of the MSI community are historically black colleges and universities (HBCUs). A review of Polar Programs funding of HBCUs from 1998-2017 revealed that only six awards were made to three HBCUs for a total of \$2,353,792. No current awards to HBCUs were identified.
- Hispanic Serving Institutions (HSI) have relatively strong representation through grants to Arizona State University, University of Arizona, University of California (Santa Barbara and Santa Cruz) and 10-12 other institutions in the Southeast, Southwest and California
- Alaska Native and Native Hawaiian-Serving Institutions (ANNH) are very high, primarily because the University Alaska Fairbanks qualifies in this category
- The Asian American and Native American Pacific Islander-Serving Institutions (AANAPISI) category is the highest, in large part due to the high number of Awards to the University of Washington (Seattle).

Part 2: Efforts by NSF and others to enhance diversity and inclusion

- 2.1 Broadening Participation at OPP
- 2.2 Highlighting NASA's DEI Efforts
- 2.3 Other Agency Models for further study

Dr. Hofmann discussed the sub-committee's third charge.

Part 3: Recommendations

- Identify and recommend the most promising strategies for OPP to pursue to significantly enhance diversity and inclusion in the polar sciences in both near and long-term
- Long-Term Recommendations
 - 3.1.1 Employ the Collective Impact Model Within OPP
 - 3.1.2 Recruit and establish a Program Officer that is responsible for fostering DEI efforts within OPP
 - 3.1.3. Inclusion of Indigenous knowledge and Arctic Indigenous communities
 - 3.1.4. Improvements in the tracking of Broadening Participation efforts in OPP projects

Discussion

Dr. Hayden initiated the discussion with two questions:

- Does the AC collectively have input/feedback on the recommendations as they are presented, acknowledging that these are not yet complete?
- Do you all see any areas missing?

Dr. Marinelli said she is concerned about having one-off opportunities instead of sustained engagement that creates connections within a community and a sense of belonging.

Dr. Hofmann responded that it is an important question and one of the leading edges of inclusion to make communities feel safe and included and that their contributions are welcomed. A sub-committee member not able to attend the AC meeting is expert in the field of intersectionality. Inclusion and creating community are wrapped up in the long-term recommendations of using the collective impact model. An OPP Program Officer can help run these efforts, but also important are workshops and reaching out to communities and asking: What can we do to create more on ramps into polar science and create a sense of community for polar postdocs?

Dr. Steig said there are data on sense of belonging increasing when there's more people who look like you. It is well established in the literature for women and it has to apply to everybody. A lot of the actions being proposed to increase involvement and retention will have that impact on belonging without having to do anything else. Also, there are various groups that have taken on the belonging question in workshops they lead, and the impact is visible. People talk about feeling they belong, and they didn't the last time there was a meeting there, so there's real progress in those areas.

Mr. Iselin said the Department of Defense had mandates for small and disadvantaged business awards from a contracting perspective. That triggered a stand-up office and for every program office that awarded above a certain threshold of contracts, somebody was the liaison with the small and disadvantaged business community and became a touch point who helped train and teach emerging businesses how to do business with the Department of Defense and helped advocate within the Department of Defense. If there were a dedicated person who could look internal to OPP and understand the ongoing science within that community and look externally

to the diverse communities, anyone could reach out to them and share and become known within the community as a touch point to help bring more participation into the office.

Dr. Heimbach said that as an individual or small group, it's hard to make the first hurdle. Building on a potentially successful program, knowing what those success stories and programs are, and learning from those would be powerful. The Texas Advanced Computing Center has advanced computing for social change that involves high school and undergrad level camps. Those programs already have connections to some of these communities. They have educators with little experience how to teach at the high school level but can teach together with people who have that experience who are more knowledgeable in working with high school students. Having a handbook or guideline for how to start with this within polar programs would be powerful to help faculty bridge that first step into making those connections.

Dr. Crowell said OPP has a lot to learn from other NSF directorates that have done programs. NSF has been committed for four decades to broadening participation. Those efforts are happening all over NSF to a degree that's much higher than within OPP. OPP can take advantage of being multidisciplinary and NSF's commitment to diversity. A collaboration is already going on that goes back to a central OPP program officer who could continue the work already being done on the subcommittee and realizing it in a programmatic way.

Dr. Hayden said a learning activity was held with The University Corporation for Atmospheric Research (UCAR) and its support for REUs. They built a community of people who have REU sites and supplements and provide resources for mentoring and feedback on the challenges running these programs. They serve as a model. The subcommittee has discussed if there a way OPP can tap some of the resources and energy in that community.

Dr. Marinelli said there's been a shift from those with all the advantages to be more inclusive. But it's still a small number. Small numbers of people will think about polar research. A much larger number don't understand what it is. Experiential barriers are keeping many people out of geosciences. They don't have experience camping, have never been on a boat and don't know how to prepare to walk on a glacier, which are impediments for many. She asked what can be done to encourage universities to create programs for that introductory pathway, such as special things to get kids interested in the environmental sciences at a formative time.

Dr. Kuklina spoke about indigenous knowledge and the inclusion of indigenous communities. OPP has done great work engaging with indigenous communities and can learn from this experience for diversity and inclusion. Especially when talking about Navigating the New Arctic (NNA), they have a strong emphasis on knowledge co-production. The subcommittee's recommendations state that more efforts are needed. One of the points is to consult formally with indigenous communities; they have different experiences that may be useful, especially in Arctic Studies. The formation of permanent indigenous peoples advisory committee would be an option for better engagement and knowledge.

Dr. Hayden said the larger programs have the ability to run larger REU programs. The Center for Remote Sensing of Ice Sheets (CREGIS) had almost a third of its budget directed towards education and outreach programs. Women composed about 42-63% and underrepresented

minorities about 66-89%. That was an intentional effort to use funds to expand outreach and make significant impact in the communities where we were located. She also spoke about exhibitions at the Science and Engineering Fair to make a larger impact. The bigger budget efforts OPP invests in should be encouraged to reach those same levels of engagement with women, underrepresented minorities and pre-college students. She encouraged thinking big to get big numbers out of these programs commensurate with the amount of money being invested. She also discussed a subcommittee recommendation for a component focusing on college freshmen and sophomores to get them involved in the community early on to learn the platforms, the language and become comfortable with the environment. She also mentioned expanding programs such as the Juneau Icefield Research Program (JIRP) that create research opportunities along with training to become comfortable in those environments.

Dr. Mack said a whole summer commitment to an REU program, or an intensive field course can be too much for students from urban centers or without camping or hiking experience. We could use other Arctic facilities like Toolik Field Station to bring in groups of six or 10 students for shorter experiences to focus exposure to working in the Arctic. This could be done in the shoulder seasons, where the facilities are not at occupancy. In the past the cost has been prohibitive for either graduate or undergraduate classes to go to Toolik, so there may be something OPP can do for small grants focused on experiencing the arctic environment in a soft and well-supported and well-fed atmosphere.

Dr. Marinelli agreed that many kids are not able to take a summer or even four weeks off for an intensive field camp because they've got a job or a child. A pathway is supporting the universities to provide that experience, because a lot of them don't have those assets either; the cost per full-time equivalent (FTE) is huge. If there's an opportunity for a university to key into funding to do that in a fully supportive way and not long term, it could bring people in.

Dr. Jones said talking about a sense of belonging involves retention. He wants to strongly consider training for faculty, leaders and field camp organizers, in addition to preparing students. It is possible to prepare students and there's the possibility of moving into environments in the lab, field or on the vessel that aren't welcoming. Part of training should be recognizing the majority of individuals coming into the geosciences are not going into academia. At NSF there is a mismatch in the community as to what skills leaders, professors and faculty are training students with that are not going to be applicable to what they need if they move into the geoscience workforce.

Ms. Rom said JIRP recently received funding from Pathways into the Geosciences - Earth, Ocean, Polar and Atmospheric Sciences (GEOPATHS) with co-funding from OPP to bring Upward Bound students to workshops in Alaska to learn about glaciology and get field experience in the Juneau area on the ice sheet. She encourages virtual participation because it's less threatening than thinking about diving into a field situation but it's hard to encourage people to come up with a virtual program. Perhaps in the future it will be possible to encourage more virtual experience that gets students started and gets some thinking about this.

Dr. Mercer said an Intergovernmental Personnel Act (IPA) assignee with experience engaging with tribal communities is being recruited in the Arctic section.

Ms. Renee Crain spoke about engagement with tribes. About a year ago, the NSF director had a town hall with tribal leaders to initiate a conversation in response to the Biden administration's mandate that agencies improve their consultation processes. There is a working group that has been together in the lead up to that town hall and OPP has been continuing to work on ways in which NSF can improve formal engagement and consultation with tribal nations. This week, there was a [listening session](#) and a number of others are planned. The focus is on improving consultation and engagement and improving collaborations on research and Science, Technology, Engineering, and Mathematics (STEM) education. It is an opportunity to hear directly from tribes about what they're looking for and includes tribal nations across the country. The working group will provide input to NSF leadership about systematically improving NSF engagement with tribal nations. The Arctic Sciences section has wonderful program officers with adaptive experience in these areas and has been improving the ability to engage and do consultation with tribes and work with researchers working with tribes. Environmental compliance and Office of General Counsel areas have also been staffed up. Collaborators within education, human resources and social, behavioral and economic sciences have funded projects with similarities to projects in the Arctic. There will be more from NSF in the in the coming 12 months that can be highlighted in AC meetings and in the subcommittee.

Dr. Crowell asked for feedback on the feasibility of some of the things the subcommittee is proposing. It includes commitments that are long range and short term, all of which involve institutional resources. The subcommittee wants to make recommendations that are doable.

Dr. Nettles thanked everyone on the subcommittee and said there will be further discussion. She said the discussion is about sustainability in a multiplicity of ways. She described her image of a skeleton with a backbone and ribs reaching out into the different parts of OPP programs and arms reaching out to other parts of NSF. Articulating how that all fits together is going to be a crucial part of the report.

Dr. Marinelli also thanked the subcommittee. To chart a path forward requires a lot of back and forth and hammering out the challenges, because they're not the same as in other disciplines. The mandate has more imperative to it than others because OPP has farther to go. There are things that can be done in the short term with low hanging fruit and things that can be invested in. The question is: What does the portfolio look like and how do we go about building it in a way that's thoughtful and sustainable from a programmatic perspective that also builds that critical mass? The one-off strategy is worrying.

[ARV Updates and ARV Sub-Committee Charge](#)

Mr. McGovern; Mr. Prince; Dr. Heidelberg; Dr. Quinn

Mr. McGovern said he and his co-presenters will provide a brief update on the status of the ARV and the key science drivers for the project, including overall project timeline, stage gates and the current preliminary design phase and efforts for the next 12 months. He will cover the two efforts to solicit interest from industry and academia to act as vessel integrator and vessel operator. They will also discuss efforts to ensure the ARV has strong engagement with the

scientific community and the ability to provide input into vessel development. He began with the project’s goal:

- Purpose
 - Deliver an advanced icebreaking research vessel to support the next generation of Antarctic and Southern Ocean science.
- Technical Scope
 - All necessary elements to take the new vessel from design to delivery.

Mr. McGovern presented the key performance parameters of the new ARV, which greatly exceed those of the Nathaniel B. Palmer (NBP), which were driven by the science mission requirements developed by an AC subcommittee with broad community input.

Parameter	Requirement	Threshold (minimum requirement)
Icebreaking	The capability to independently break ice	≥ 4.5 ft at ≥ 3 kts (Polar Class 3)
Endurance	Maximum endurance without replenishment	≥ 90 days underway
Science & Technical Personnel	Provisions for messing, berthing, sanitation, and scientific workspaces	Crew and ≥ 55 science and technical personnel

Dr. Heidelberg continued the presentation with a discussion of a US strategic vision for Southern Ocean research. A next generation icebreaker research vessel is essential for maintaining a global leadership role in the Southern Ocean. She highlighted examples of the scientific drivers that helped frame the design request and showed a slide with images of Antarctica seasonal sea ice growth and decline and indicated glaciers of concern. Having predictable access to regions of high glacial instability will be key to understanding factors that control how fast and how much sea level could rise. The Palmer has limited access to the target high-priority region in front of the Thwaites glacier due to high ice and this has prevented researchers from obtaining optimal positioning and meeting science goals.

She noted that the Southern Ocean, which plays an outsized role in global carbon cycles and climate cycles, is the meeting point of several ocean currents and an important connector between the atmosphere and deep ocean for the transfer of heat and carbon. Year-round, direct measurements are needed to address uncertainties. Greater coverage is needed to collect more ocean carbon data from regions and seasons that have been historically under sampled, such as the Southern Ocean in the winter, and using those findings to improve ocean models. Hence, year-round capability has been identified as a key performance parameter.

Dr. Heidelberg noted that the Southern Ocean is rich in marine life, including commercially important fish species, and harbors a unique biodiversity that functions as a reservoir for future discoveries. She presented a graphic summarizing the complex relationship between physical, chemical and biological factors that govern ecosystem structure and function. She also showed

an image representative of the need for ecosystem-level science. She pointed to a critical need for enhanced state-of-the-art instrumentation and science capabilities with both enhanced birthing and extended cruise times to support complex interdisciplinary teams studying ecosystem structure around the continent. There's a pressing need for the scientific community to be unified in speaking to the need for a new vessel to maintain strong leadership in the region.

Mr. Prince picked up the presentation to discuss the stage gates or off ramps that all NSF major facility projects are required to pass through before Major Research Equipment and Facilities Construction (MREFC) funding is awarded. He presented a graphic showing the stage gates for the ARV project, starting with a successful Conceptual Design Review (CDR) and NSF director approval to enter the preliminary design phase. The project is about two months into the preliminary design phase. Preliminary design review is scheduled for February 2023, which is the next major stage gate coupled with the director's approval to enter the final design phase. If the many gates to follow are passed, the ship would be delivered to the NSF in early 2030. There's a lot of work to do before we have the ship, Mr. Prince said.

He reviewed the opportunities for NSF to review the design process and the science advisory subcommittee's opportunity to review design documents or reports associated with each of the interim design reviews, providing the AC with recommendations or concerns.

Mr. McGovern continued with a discussion of two market research surveys:

- Vessel Integrator (VI): Single vendor to oversee finalization of the ARV design, shipyard selection and construction, operational testing, and transition to operations.
 - Interested in engaging with a wide variety of organizational types as potential providers, including, but not limited to, for-profit corporations, academic institutions, or other non-profits.
- Vessel Operator (VO): Single vendor capable of performing ARV operational services, including:
 - Maintaining custody of vessel and be responsible for security, regulatory compliance, insurance, port costs, etc.
 - Coordinate and facilitate all maintenance and repairs
 - All crewing and operational support (fuel, food, supplies, minor equipment)
 - Science cruise planning and vessel scheduling
 - At-sea science technical support services (laboratories, on-deck and over-the-side deployments, etc.)
 - Maintenance and operation of scientific instrumentation and equipment

For the first Request for Information (RFI), NSF received seven responses. No academic institutions responded, but competitive acquisition for the integrator effort is possible. The second RFI is still on the street.

He turned next to the communications plan to reach out to the scientific community and the public. He mentioned using the Web, science community engagement efforts, University-National Oceanographic Laboratory System (UNOLS), having the VI participate in scientific meetings, marine technical journals and OPP town halls. It is not just the outflow of information from NSF but receiving input from the community.

Partnering for the project includes government agencies such as NASA and NOAA, the Office of Naval Research (ONR) and Naval Sea Systems Command (NAVSEA). Partnering also includes Council of managers of national Antarctic programs (Council of managers of national Antarctic programs), the British Antarctic Survey and the Australian Antarctic Program and The Australian Antarctic Program.

There will also be two formal mechanisms for the science community to provide input into the design and development:

- Science & Technical Advisors (STAs)
 - 8-10 individuals
 - Broad range of scientific & technical backgrounds, including:
 - USCG icebreaker development & operations
 - Naval Sea Systems Command shipbuilding
 - Academic institution researchers
 - Scientific technical managers
 - Research vessel operators
- Science Advisory Subcommittee (SASC)
 - Dr. Bruce Appelgate, UCSD/Scripps
 - Ms. Alice Doyle, UNOLS
 - Dr. Amy Leventer, Colgate University (chair)
 - Dr. Carlos Moffatt, Univ of Delaware
 - Dr. Patricia Quinn, NOAA/PMEL; AC representative
 - Dr. Clare Reimers, OSU
 - Dr. Deborah Steinberg, VIMS

In summary, Mr. McGovern said the ARV has been strongly advocated for by the scientific community since the early 2000s. It is imperative to continue to support the science in the Southern Ocean and around Antarctica and increase the ability to facilitate critically important research further into and around the Antarctic continent during all seasons by providing a vessel with enhanced capabilities. But the project has not yet been fully approved for funding. Active science and community engagement and support are needed. AC-OPP will play a critical role in whether the project moves forward. The plan developed thus far has set up a solid path towards effectively delivering the next generation ARV. The outstanding question is how to best keep the science community informed and engaged and supportive of the project and he asked the AC for thoughts on how to improve approaches for engagement.

Discussion

In response to a question about the timeline for getting community input Mr. McGovern said the timeline for input is now through the end of 2023 for the current phase. If allowed to advance into final design, a similar subcommittee will be formed, or other members of the community will continue to participate and provide feedback as the design continues towards finalization.

Regarding specific mechanisms for getting input other than through the subcommittee, he asked for the AC's help in looking for ideas.

Dr. Nettles said another venue for input to the effort and outreach to the community is through the AC itself, in addition to the subcommittee. The AC can try to make sure that as new plans are laid out, members are aware of those and have the opportunity to participate and learn and make others aware. Looking farther forward, community involvement becomes important because the people who make the funding decisions need to understand from the science community how important the effort is and that it needs to be a priority. The AC can start doing ground level thinking now about how to continue to articulate those needs within the foundation, outside the foundation and within the community and use the AC to be engaged in that and formulate additional approaches to engagement. She encouraged everyone on the AC to talk about this with the rest of the community, alerting them to opportunities for further learning and updating on the progress.

Dr. Steig suggested a DCL for the ARV, given the scale of investment, to get more input from the community. There's concern that people are not being kept in the loop, which isn't true. But it's easy to miss things with so many emails, but people pay attention to DCLs from OPP leadership.

Dr. Stammerjohn said the community is starting to become aware of the draft plan for the ARV. They're wondering what kind of parameters might get adjusted and how far along is the process. In 2018, the ad hoc subcommittee to the advisory committee was tasked with looking at three requirement reports produced by the community over the last 10 years to re-survey the community and refresh the science mission requirements. They produced a 273-page document detailing the science mission requirements for a new ship. As to what more input can still occur, that's where the AC can help gather feedback from the community. There's a limitation on how much information can be made public. But the key performance parameters of the ship are fairly well set and those would only change if the budget ran too high, or there was guidance from leadership. But within that, there's still much room for input regarding layouts of the labs, organization, the capabilities of the ship, the types of multi-beam systems and acoustic systems. There have been some decisions that had to be made along the way that eliminated some of the capabilities that were in the original science mission requirements. It would take a lot of vocal community feedback to alter those, but it's not impossible.

Dr. Marinelli said there are sacrifices in any vessel design. The vessel may not have everything people want. If you overdesign it, it could get knocked out of MREFC. OPP has to be careful about demands and accept what can and can't be done and look for novel ways to do things. This ship can't do everything the community would want it to do with a price tag NSF is willing to support. Also, the ship is competing with a number of highly competitive and extensive projects desired by other communities, which have strong voices. This community needs to have a strong voice and underscore what science won't get done without the vessel. It's linked to urgent questions facing society in the next 10 to 15 years and the community needs to get behind it — what the vessel will do and what will happen if we don't have it.

Mr. McGovern responded that most ships have a service life of 30 years. The Palmer is 30 years now, and the intention is to continue operating it until the new ARV is delivered. There's a clock ticking on how long the ship can last.

Dr. Quinn said it is sounding like it's not so much using the scientific input to adjust specifications of the ship, but more the importance of the ship. So, we're gathering support basically from the community.

Dr. Marinelli there are design aspects of the ship still at play. These are things that get hammered out as the design goes forward and areas where community input is critical. People with experience working on ships have great ideas on how ships should be configured. And the subcommittee reflects excellent expertise in a number of areas that will be critical for the ship. This is not to say there's no further discussions about how the ship is designed. But certain things cannot be adjusted. Also, gaining more community support is critical. She agreed that releasing a DCL that updates the community on the status of the fleet going forward is probably a good idea. She said she could not release a DCL that asks the community to support the ARV. That's not what DCLs are for; they're mostly informational for the community.

Dr. Quinn asked if there is a way to see what the design of the ship is currently, science wise, without reading the 272-page report.

Mr. McGovern said he could share drawings from the conceptual design review last year. And there will be a new set of general arrangement drawings in the next month or two that will give a fresher look at the ship's status. The subcommittee would be looking at the layout of the labs and the arrangement of state rooms and providing direct feedback on recommendations for changing that.

Dr. Stammerjohn asked if the review of the CDR is made available publicly. Mr. McGovern said he did not think it was a public document.

Dr. Nettles said there has been a big effort to collect community input and members of the AC have participated in that, as have people elsewhere. It is important to make sure community input really has been sought and incorporated throughout the process; communicating that as well may be an important aspect of letting people know where we are, because people forget things and not everyone has been as fully engaged in the discussion that has led to compromises so the ship can be built. The charge to the subcommittee is intended to serve part of that function as a conduit between the community and the project. And the subcommittee is supposed to provide advice on the development of the design, but also advise on impact to the project by other policies at NSF and elsewhere. It's not like there's nothing else that can change; there could still be a change in the length of the ship of 10 feet or something if someone identifies a flaw in design or a better way to do something. It's important for people to understand that it's a genuine opportunity for input, as well as communication back to the community.

Mr. McGovern said 10 feet was added to the ship from the conceptual design version. So, there can and will be changes along the way, many of them coming from the community. He agreed on the importance of keeping the community aware of the level of community engagement in the

process. There's probably a tendency to say that one was never asked for input. He suggested figuring out a way to illustrate how much community input has gone into and continues to go into this development and what recommendations they've provided that have been implemented.

Dr. Marinelli advocated consulting the 273-page [report](#), because of its detail. She found most useful the analysis of current ship operations, what will be needed in the future and how to get there using a framework for thinking about vessel capability going forward. Though produced 18 months ago, it's still relevant.

Geoscience Directorate Updates

Dr. Isern; Dr. Patten; Dr. Stammerjohn

Dr. Isern began with GEO's FY 2022 budget themes, which address climate change, racial equity and recovering from the pandemic. She said the FY 2022 appropriation includes:

- NSF overall increase of +\$351 million to \$8.838 billion
 - Lower than NSF Request of \$10.169 billion
- Climate and Clean Energy receive ~\$45 million more in FY 2022
 - Falls short of FY 2022 Request levels that had large increases for these activities
- Directorate-level FY 2022 allocations still under development

Though the overall NSF budget increase was lower than the President's request, it's still a good increase, she said, adding that the FY 2023 request would be released next week.

Next, she discussed GEO's climate change budget theme:

- Cross-Directorate climate change discussions
- Fundamental and use-inspired research: improve understanding, investigate climate impacts, and develop climate solutions
- Focus on decadal-scale, outcome-oriented research
- Community-centric convergent approach at regional/local scales
- Justice, equity, diversity, and inclusion central to investments
- Developing the next generation climate workforce
- Leverage current investments in climate research and infrastructure
 - Coastlines and People and Navigating the New Arctic

Dr. Isern also discussed the GEO Climate Challenge group which has the goal of delivering meaningful results within a decade. It has assembled six focal areas that build off the recent [System Science report](#) from the National Academies of Sciences (NAS):

- Climate Interventions
- Climate-Driven Extreme Events
- Sea-Level Rise
- Tipping Points
- Cryosphere Change
- Water Vulnerability

Moving to GEO's racial equity budget theme, there is a focus on three areas.

- Fostering Career Development
 - GEOPATHs
 - Non-Academic Research Internships for Graduate Students (INTERN)
- Supporting Positive Cultural Change
 - Cultural Transformation in the Geoscience Community, NSF 22-562
- Offering Leadership Opportunities
 - Geoscience Opportunities for Leadership in Diversity - Expanding the Network (GOLD-EN)

Dr. Isern next discussed the theme of GEO's recovery from the pandemic. GEO is doing all it can in FY 2022 to continue support to the academic community. Those impacts are still occurring, and GEO is doing all it can to mitigate those effects. She encouraged AC members and those they know to spread the word that the best thing is to reach out to program officers to help get the research enterprise back on its feet.

Turning to major facilities updates on:

- Regional Class Research Vessels (RCRV)
 - Three vessels under construction in Louisiana shipyards
 - COVID-19 restrictions have been highly disruptive
 - Schedule has been further impacted due to Hurricane Ida
- Human Occupied Vehicle (HOV) Alvin
 - Delay in certification due to cracks in the syntactic foam, repairs underway.
 - Alvin will resume sea trials in May/June 2022, towards the goal of supporting science at 6500 meters depth.

Dr. Isern said there has been a lot of activity in large-scale NSF and GEO investments. She reviewed:

- Science and Technology Centers
- Harnessing the Data Revolution
- NNA
- Coastlines And People
- Mid-Scale Research Infrastructure
- AI Institutes
- Networked Blue Economy

She next described GEO's mission and vision:

- The Mission of the Directorate for Geosciences is to fund the development of knowledge and technological innovations to:
 - understand and adapt to the changes in our earth, ocean, and atmosphere,
 - accelerate the societal benefits of our investments, and

- train a diverse and inclusive geosciences workforce.
- The Vision of the Directorate for Geosciences is to support groundbreaking discoveries of the products and processes of the earth, ocean, and atmosphere systems from the past to the present and into the future for the benefit of citizens, decision-makers, educators, and scientists.

She also outlined the foundation’s Directorate for Technology, Innovation, and Partnerships (TIP), which will:

- Advance breakthrough technologies
- Address critical societal and economic challenges
- Accelerate research results to market and society
- Prepare the nation’s future STEM leaders

She continued with a discussion of TIP areas where GEO and OPP can interface with TIP.

- Environmental Impacts on Human Health
- Climate Interventions
- Oceans: Energy, Carbon Capture, Mineral Resources
- Solutions and Community-Driven, Place-Based Science
- Geo-Impacts, Mitigation of Nanoparticles, Microplastics
- Critical Minerals, Strategic Elements
- Accelerating to Net Zero: Geologic Carbon Capture.

Dr. Stammerjohn continued the presentation by providing AC-GEO updates. She reviewed:

- NSF’s Learning Agenda
 - Led by Clemencia Cosentino, NSF’s Chief Evaluation Officer, Evaluation and Assessment Capability (EAC) Section, Office of Integrative Activities
 - Stems from the “Evidence Act” & NSF’s Strategic Plan
 - Goal: “bolster NSF efforts to make informed decisions & promote a culture of evidence”
 - Approach: formulate Guiding Questions to generate useful Evidence for decision-making
- Learning Agenda Breakouts
 - Example Question: What are the characteristics of NSF’s portfolio on climate change, & to what extent might this portfolio advance NSF’s goals of equity, discovery & impact?
 - 3 Breakout Groups: climate processes, climate impacts, & climate solutions
 - 3 1-hr Breakout sessions: within assigned climate topic, what does “equity” mean, & how do equity issues reveal themselves?
- Other Briefings & Topics
 - NSF’s “URGE”: Unlearning Racism in Geoscience Vashan Wright: what inspires people to dismantle racism? <https://urgeo.org/>

- NASEM Report: Advancing a Systems Approach for Studying the Earth: A Strategy for the NSF, within & across directorates
- TIP: “use-inspired translational research across the Directorate”
- Two Committee of Visitor (COV) Reports completed: Div. Earth Sciences, GEO Educ & Diversity Program
- Ongoing Topics
 - Climate Equity & DEI (Diversity, Equity, Inclusion)
 - How to promote & support DEI requirements in both Intellectual Merit & Broader Impacts (BI)?
 - How can NSF provide better guidance on Broader Impacts so that it is well supported, well regarded and well-advertised?
 - Could NSF develop programs within the core funding that require an equity lens on research?
 - (Perhaps pair the science question with an equity question & require inclusive interdisciplinary teams)

Dr. Isern concluded by going back to URGE. She asked committee members to look into it. The next AC-GEO meeting will continue this learning agenda activity, which is a pilot idea within NSF. One idea is for community input to the strategies that go to the Office of Management and Budget (OMB). One way to do it is through the AC and breakout groups. There will also be a discussion on TIP with ideas for areas to plug into innovation and partnerships. AC-GEO chair is from a community college and there is representation from tribal colleges and other emerging institutions. The barriers to people getting funding in part is the mechanics of not having access to a Sponsored Research Office (SRO) or an office that can help with processing proposals. There will be a panel with some members from emerging institutions to talk about these barriers and help develop ideas on removing or reducing them.

Discussion

Dr. Nettles said barriers for emerging institutions has also come up in discussions with the AC-OPP subcommittee addressing diversity, equity and inclusion (DEI) and it is exciting to see the GEO panel covered it. Many members would love to watch the panel events.

In response to a question, Dr. Isern said AC-OPP members interested in TIP program ideas can contact her or Dr. Patten. Dr. Barbara Ransom, GEO Program Director, is leading the effort.

Wrap-up

Dr. Nettles; Dr. Marinelli

Dr. McGovern addressed a written question about comparisons of the design for the new ship with other recent research vessels. Dr. McGovern said the ARV is being designed as a replacement for the Nathaniel Palmer, a dedicated research platform. In contrast, many of the new icebreaking vessels have a strong logistics requirement. The new UK ship, the Sir David Attenborough, needs to resupply five stations each season and is designed to carry about 32,000

cubic feet of cargo and aviation fuel. It's more than 400 feet long and has significantly lower icebreaking capability. The Australian ship, the Nuyinahan, is identified as a research and supply vessel. It has similar icebreaking capabilities and endurance as the ARV, but a very large resupply mission and it can carry 96 20-foot containers and is more than 500 feet long. The ARV is in the mid-300 foot-long range and designed to be more nimble. It is a dedicated research icebreaking vessel. It is possible to build a ship as big as an aircraft carrier, but it has to be affordable to operate. The ARV is a good combination of advanced science capabilities. Dr. Nettles said the report she referenced earlier has a section that discusses the other vessels.

Dr. Nettles returned to the issue of building resiliency with Dr. Hindle asking about two potential bottlenecks on the biology side that go towards reducing field footprints, increasing resilience and increasing the potential for data to be collected and analyzed in the United States, instead of the field. One is continuing to build biobanks; an idea well established in other disciplines and exists in biology also. But it is absent in many subfields of biology that work in polar regions. The other is about what shared scientific support could be possible in other disciplines. She asked if the successes in Greenland, where local resources were deployed to help fix instruments, could be applicable in other places. There might be a way to suggest to research groups working in similar areas, both geographically and scientifically, that there might be some incentives for groups on their own to determine where they could merge shared resources and reduce field footprints.

Regarding the biobanks, Dr. Heidelberg there was recently a large workshop about the concept of a biobank specifically for Antarctica. A report was received this week from the workshop with recommendations. OPP is looking at the recommendations and determining next steps. It also helps address the mandate for providing access to resources for people doing projects that don't require fieldwork. It is something OPP is looking at seriously.

Dr. Mercer referenced the Greenland research community augmenting field teams during the pandemic, adding there is a lot of effort incorporating traditional knowledge and co-production in Arctic communities across the board, not just in Alaska. At Summit station, with the recapitalization, OPP is looking for ways to reduce the human footprint on the station in terms of renewable power, less human interaction and automated types of measurements.

Dr. Nettles said these fits with discussions about other types of data reuse analysis in ways that are not field based. One of the ways BI is talked about is collecting these data that will be useful for other researchers and to analyze later. Sometimes that data could be more thoroughly explored. It's interesting to think about how to do that in a biological way. It is a broader issue that the AC can continue to discuss in several topics as cross cutting, including the data management aspect tomorrow during discussion of cyber infrastructure.

Dr. Marinelli said that regarding sharing people resources, the office has done that historically with folks maintaining instruments and assisting with time series. One benefit is a lot of cross training, professional development and the development of a broader suite of skills. A drawback is you may not be providing someone who doesn't have that experience with the ability to deploy and gain it. There is a line that one has to be careful of.

Dr. Nettles said it is an interesting debate and has happened in geophysics. There's a tension between a more professionally collected data set and providing on-the-ground experience for new scientists.

Dr. Hindle said she wants as many trainees to get field experience as possible and asked if there is a way in the logistical planning phases, particularly over the next few years, to solicit advice from the community as to where they could economize by collaboration.

Dr. Heidelberg said that has been done on an ad hoc basis. This year and last year there were team members who, when their project ended, stayed on and joined other groups to increase the manpower without somebody else having to go through quarantine. Contractors were also used to help fix and reset equipment for another year of data taking. That is being done as much as much as possible to clear the backlog as fast as possible to get back to some normality.

Dr. Hindle said that is a great solution in the near term and asked if it is top down. That is, does NSF identify the overlap and suggest to the communities or identify more potential overlaps by taking the question to the community and having them make additional suggestions that NSF hasn't considered? She liked that idea and is happy to discuss it and figure out how to best leverage those ideas.

Dr. Nettles and Dr. Marinelli guided members in preparations for the next day's meeting and made plans for offline communication about invitees for a DEI follow-up discussion.

Friday, March 25

Polar Partnership with Office of Advanced Cyberinfrastructure

Dr. Pope; Dr. Heimbach

Dr. Pope began the presentation with a discussion of goals and outcomes, which he listed as:

- Share information of current OPP-OAC collaborations
- Communicate/discuss approach to future opportunities
- Get input during discussion session:
 - Research community building/bridging
 - Building CI capacity in Polar science
 - Disciplinary areas of focus

To assure everyone is on the same page, Dr. Pope discussed the meaning of the term cyberinfrastructure:

- Cyberinfrastructure consists of computational systems, data and information management, advanced instruments, visualization environments, and people, all linked together by software and advanced networks to improve scholarly productivity and enable knowledge breakthroughs and discoveries not otherwise possible. (Stewart et al, 2010)
- NSF views CI holistically as a spectrum of computational, data, software, networking, and security resources, tool and services, and computational and data skills and expertise that can be seamlessly integrated and used, and collectively enable new, transformative

discoveries across science and engineering. (Transforming Science Through Cyberinfrastructure)

Dr. Pope displayed a diagram from the Office of Advanced Cyberinfrastructure (OAC) that represented CI for platforms or facilities, integrative CI that connects the facility level with the individual researcher level and the science level CI, which could be data infrastructure, software and workflows, research, education networks, cloud resources and services, computing resources, gateways, hubs and services, which researchers use directly.

Next, Dr. Pope explained ACCI's charge:

- ACCI advises the NSF Office of Advanced Cyberinfrastructure (OAC) within the Directorate for Computer & Information Science & Engineering (CISE) OAC supports CI resources, tools and related services such as:
 - supercomputers, high-capacity mass-storage systems,
 - system software suites and programming environments,
 - scalable interactive visualization tools, software libraries and tools,
 - large-scale data repositories and digitized data management systems
 - networks of various reach and granularity
 - an array of software tools and services that hide the complexities and heterogeneity of contemporary cyberinfrastructure while providing ubiquitous access and usability
 - education & training at various levels

He also discussed examples of how OPP is cooperating with OAC:

- Findable Accessible Interoperable Reusable Open Science Research Coordination Networks (FAIROS RCNs) NSF 22-553 | Deadline April 12, 2022
- RCNs: Fostering and Nurturing a Diverse Community of Cyberinfrastructure Professionals NSF 22-558 | Deadline April 25, 2022
- Pathways to Enable Open-Source Ecosystems (POSE) NSF 22-572 | Deadlines May 12, 2022 & October 21, 2022, | Webinar March 23, 2022
- Training-based Workforce Development for Advanced Cyberinfrastructure (CyberTraining) NSF 22-574 | Deadlines May 16, 2022 & Jan 19, 2023
- DCL: Pilot for the Allocation of High-Throughput Computing Resources (HTC) NSF 22-051
- DCL: Research Coordination and Planning Opportunities for Directorate for Geosciences in Artificial Intelligence NSF 21-022
- [EarthCubeCall for Notebooks](#)

Dr. Pope closed by reiterating the idea from yesterday about a DCL and an ideas lab around OPP and OAC cooperation and presented questions for discussion:

- In the joint session with the ACCI, the group identified the reality of two largely distinct communities (i.e., Polar & CI) which are currently bridged by a small number of ambassadors, while also setting a goal of working towards a continuum of practitioners across polar & CI.
- There are opportunities that each community can provide each other, and they can blend expertise for mutual benefit.
 - How would you characterize the relationship between the Polar and CI communities? And how does this inform approaches to community-connecting activities?
 - How would the AC like to be involved in helpful build collaborations between the Polar & CI communities? What don't you know that is holding you back from building these Polar-CI collaborations?

- Capacity-building: How do we help create CI specialists in the domain/polar sciences (e.g., machine-learning polar scientists)?
- What particular polar/disciplinary focus areas might benefit from CI applications & collaboration?

Dr. Heimbach said he was impressed by the different solicitations and initiatives over the last year or so that speak to what has been discussed, especially workforce development and trying to get people acquainted in the domain sciences with what's going on and advanced cyber infrastructure.

Discussion

Dr. Nettles commended Dr. Pope and others responsible for running office hours presentations for people interested in getting involved in polar CI to open that up to a broader range of people and said the initiative should be continued. She asked for an update on NSF's thinking about moving forward on such approaches as a polar-specific research coordination network or an ideas lab type initiative.

Dr. Pope said work is underway on an ideas lab and a DCL to work on community building and direct applications. This is to target cooperation that already exists, such as polar-CI cooperation to help people who don't necessarily know future colleagues in the polar sciences, or the CI practitioners, to help them meet each other through a variety of mechanisms. Questions include: Are there particular CI applications that would be transferable across a broad range of polar sciences and vice versa? Are there particular polar science questions that could be a test case for different CI applications?

Dr. Kuklina said the last meeting was useful for researchers and for workers in remote communities. She also discussed the question of how local communities could access these kinds of materials because usually those who conduct subsistence activities are geospatially aware and good with allocating important features, for example, landscapes or infrastructure. She raised the question of how to build connections between remote communities and people who can do machine learning, for example, which would be an important step for the development of CI because often remote communities would not know what capacities are available and what technologies exist. Building connections between different disciplines and between communities and specialists is important.

Dr. Heimbach said one aspect of this fits with the push towards open science, which is part of the solicitation, and the ideas of what open science means and where it can go. He referenced workflows that underpin the ability to have access to the data and the compute infrastructure and that part of the community may not have their locally available compute resources. This is where the cloud becomes increasingly important and moving from what's called data as a service, where you download the data, to where you have analysis as a service, and you no longer need all the infrastructure locally; it's the CI that does this for you.

Dr. Marinelli said that in discussions about how to bring polar CI interests, data interests and modeling interests together, OPP has emphasized creating new partnerships where the distances between disciplines can be great and where the need to bridge areas of expertise to create new

synergies and new opportunities is high. The hope is to produce not just new CI ideas, but new teams to think in a creative way about how to address polar problems. Those not accustomed to speaking that language have a lot to gain from this partnership; there's an open door and a willingness to create new ways of doing science.

Dr. Nettles said everyone is looking for the connection point, who to talk to. That's what Dr. Pope is getting at in putting an emphasis on supporting existing teams across domain science and CI and helping facilitate the formation of new teams. There is a challenge of getting that first connection made. It's also related to the point Dr. Heimbach made about workflows that underpin the ability to have access to computing resources and analytical capability because even on the level of highly skilled undergraduates who own a laptop, trying to get them up to speed to work with Notebook in the classroom takes significant effort. To connect with the challenges that Dr. Kuklina outlined for making all this work, we need that workflow that we can connect people into at the same time as connecting to expertise on the human side of CI. In thinking about new solicitations or DCLs, those are the sort of cultural/technological pieces that are important to address. Also, getting a few more sets of groups connected will help accelerate the whole process. There may be a need for getting several use cases off the ground so other people see it and understand how they can do that.

In response to a question from Dr. Marinelli, Dr. Pope explained how ideas labs work. You apply as an individual rather than as a team that's already created. An ideas lab solicitation goes out and states the general topic and general questions. People who are interested apply and say what skills they bring to bear and their approach to cooperation. A group of participants is selected. The ideas lab is a weeklong intensive workshop for those participants, often in person, but sometimes virtual, where they meet each other and start developing new teams as part of the ideas lab. They identify how they can work together and by the end of the week have a preliminary proposal. They form teams and work with mentors over the course of the week and get feedback on how those ideas are developing. By the end of the week, they have a preliminary proposal that is reviewed by the program that put out the ideas lab. A subset of those gets invited to submit a full proposal within the next couple months, which generally has a high success rate. Dr. Pope added that he got into cyberinfrastructure through the EarthCube program, where there was a Geoscience Paper of the Future program that offered to teach how to document code and share code and share your data and get a publication out of it. And all this is an inviting community. There are great resources available through the EarthCube community, through Earth Science Information Partners (ESIP) and many others that look at successful polar EarthCube awards as places to start that community building.

Dr. Stammerjohn asked about two examples. In the first, an individual wants to apply for an ideas lab, which is followed up with a workshop where these ideas, connections and partnerships get solidified such that at the end of the mentoring period, concrete objectives have been identified for a proposal that leverages the partnership. In another example she proposed an ecologist interested in looking at spacetime patterns of Antarctic krill who does not have access to physical sea ice data and the ways sea ice data could get served up from satellites in a spacetime context that's relevant to a krill biologist.

Dr. Pope explained that the ideas labs are convened by NSF and have a broader theme and bring together about 30 people and there might be five to 10 teams created. But the exact scoping is left open. If a researcher has a particular use case but is not quite there yet, the person could apply with a workshop or planning proposal if interested in building their own collaboration.

Dr. Heimbach said one of the successful initiatives that came out of IceCube is Pangeo. It's highly interactive and dedicated to helping people learning these workflows and standardized access to data wherever they reside. Whether analyzing a satellite data set or reanalysis data set, all you need is a set of Jupyter Notebooks. This would be a community to connect to and they have discourses online where people will respond to inquiries.

Dr. Nettles said that if the AC is saying it thinks something like this sounds like it would be helpful for connecting polar science with CI, that's input Dr. Pope and his team can use. There's probably scope for proposals from PIs to do something not totally dissimilar; for example, if part of it is to introduce members of different communities to each other and facilitate discussions, some people in the community who aren't involved but want to get involved could put together a proposal to run a workshop. She asked members if they would like to see something focused on your domain area of expertise but brings in appropriate CI experts to have that conversation and whether it should be geoscience-wide or polar specific.

Dr. Crowell said one use case is the interaction between people and the biogeography of the Arctic. Where are subsistence resources and the latest information on populations of animals and distributions? That approach is both for people on the ground now but also in terms of archaeological studies. He is thinking of doing work looking at the distribution of archaeological sites in relation to the biogeography of the Gulf of Alaska. Another use case in social sciences involved the fact that a lot of the information about the history of peoples of the North is in archives and developing ways for connecting everything from exploration texts and historical observations and photographs and archival resources in a way that is accessible to a broad user base who wants to search those for educational purposes or research, whether they're in communities or scientists looking to put data together that is inaccessible, because it's in text records in many different archives. Regarding the second part, Dr. Crowell said he was thinking about digitization with an access platform that aggregates information from multiple archives worldwide relating to polar exploration and natural history, with information on contacts with indigenous people and relationships with communities in the north going back 150 to 200 years.

Dr. Marinelli said some of the examples are similar to what quantitative geographers do, looking at layers of data that relate to humans —biological data, biogeochemical data —and creating maps that merge characteristics to pull science questions from. Getting entry into that community is not as difficult as it can seem. We're just scratching the surface of the kinds of creativity that can be unleashed when you get folks together that have very different tool sets and a common desire to work together to do innovative science.

Dr. Heimbach said in oceanography there is some disconnect between how we think about physical data and biological data, which are sometimes videos of fish at a certain place and how to analyze and merge those and query them jointly. Also, he asked about TIP and whether there is technology innovation development to accelerate innovation in miniaturizing technology for

measurement. He said there is increasingly the ability to simulate the polar regions but we're running behind the development in the computer hardware that's increasingly driven by industry requirements. In five to 10 years, the hardware might be increasingly at odds with how we write models today.

Dr. Kuklina mentioned students trying to do covalent use analysis and how it takes about two years to get to the point where they can do coding and then they need to defend their thesis and find a job. She asked about NSF working with corporations.

Dr. Heimbach agreed and said the workflows are changing rapidly and what's around today has not been around five years ago. The teachers at universities are at odds with the students and what they should learn. He asked about educational models to bring students up to speed with state-of-the art workflows that will not be taught by the senior faculty.

Dr. Crowell asked about doing a proposal in that area. Regarding the geography question he asked earlier, he pointed to expertise in geographic information systems (GIS) and the analytical use of GIS and asked if all the data can be easily accessed for large areas.

Dr. Pope welcomed future discussions with AC members and workshop attendees.

[Prepare for meeting with the NSF Director and Chief Operating Officer](#)
Dr. Nettles; Dr. Marinelli

Dr. Nettles and Dr. Marinelli led the AC through the process of developing a list of questions and talking points to use at the committee's upcoming meeting with the Director and Chief Operating Officer.

[NSF Director and NSF Chief Operating Officer](#)
Dr. Panchanathan; Dr. Marrongelle; Dr. Nettles

Dr. Nettles welcomed Dr. Panchanathan, who expressed his appreciation for the committee's service to NSF.

He said NSF sees itself as an agency that emphasizes innovation and is constantly looking at whether it can we do things better and make things more accessible and inclusive. He emphasized the importance of making opportunity available everywhere, including the polar programs and polar locations. He recounted his trip to Antarctica and meeting a graduate student in the field who was passionate and committed, working so hard with so much dedication for the advancement of science.

Dr. Panchanathan also spoke about TIP, the first new directorate in 30 years, which he said points to getting the geography of innovation exercised everywhere in the nation and accessible to everyone. He expressed his gratitude to the AC members for engaging with the technology innovation partnership and said their advice is exceedingly valuable.

Turing to the FY 2022 budget, though it was not as high as what you would have wanted, it showed interest in investing in science and the future of science. The last two years of increases were about as high as it could have been. This is a great beginning, but we have a lot more work to do.

Dr. Nettles said inclusion and expanding opportunities to all is a focus of several parts of the AC meeting, including the Subcommittee on Diversity and Inclusion, and the use cases the AC is putting together in partnership with CI, which dovetail with those discussions.

Dr. Crowell briefly reported on the work of the subcommittee, which he said appreciates NSF's decades-long commitment to diversity goals and substantial investments in broadening participation. At the same time there's a compelling need and exciting opportunities for growth and change in these areas at OPP, which is reworking its priorities. One of the advantages of being a multidisciplinary geography-based program is that OPP can work with other directorates and see exciting success stories in other areas. One of those is Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science (INCLUDES). The subcommittee likes that program's collective impact model for multi-institutional collaboration and equity strategies. The subcommittee is developing recommendations for immediate actions and longer-term initiatives within OPP and will be looking for support from NSF leadership and said the subcommittee hopes it aligns with the director's priorities and vision.

Dr. Panchanathan said the central pillar of the three pillars he talks about is ensuring accessibility and inclusivity, so it is very aligned with the vision of NSF. He added that talking about the missing millions of talents being brought to the forefront needs to be incorporated into every facet of what we do at NSF. Asking about why we are where we are with inclusivity revealed things that we should address right away. If you look at MSIs, R2 institutions, other R1 institutions and tribal colleges are not part of the mix. It takes a lot of investments by an institution to develop the infrastructure. If you agree that ideas and talent are everywhere, for those ideas to be formulated in a way that they can succeed and prevail in the gold standard merit review requires a huge step to be taken that counts on the infrastructure that some universities are able to invest in. We are therefore trying to see how we can address that issue and are about to launch a program called Grant-Ed to provide support for those institutions and researchers without access to the proposal development activities so they too can take their ideas and compete and therefore bring about more inclusion. As institutions get more engaged in research awards, they will develop the infrastructure that comes with it. But it is still not enough, he said, adding that he is looking at what else should be done.

Dr. Stammerjohn highlighted a success story from the field, describing her involvement in the recent expedition to the Amundsen Sea in West Antarctica, a jointly funded US-UK endeavor involving the international Thwaites Glacier collaboration and an OPP-funded project called Artemis to study ocean ice shelf interactions. She highlighted NSF support of cutting-edge technologies and the Nathaniel B. Palmer. She said the AC is looking forward to the new Antarctic research vessel.

Dr. Steig asked how to best advocate for the resources needed to accelerate the rebuilding and modernizing of the infrastructure in Antarctica. He also said the community is feeling pressure to reduce the number of people in the field. In places where the science is happening, field access is needed. The research infrastructure is needed to get to those hard-to-reach places. Being asked to reduce our numbers in the field feels contradictory with the need to increase access and diversity.

Dr. Panchanathan said he agreed, adding that the sense is more access, not less access. The ARV was put in the design phase because there is this need. Regarding what resources need to be brought to bear, that is a complicated discussion; whenever resources are talked about, there are multiple expectations for the amount of research that gets put in. The voices of the scientific community and the academies have done a great job outlining the importance of some of these activities that need to be put in high priority mode. NSF listens to the academies, the AC and the scientific community. NSF tries to reflect that in its own conversations about overall strategies it wants to pursue. His mode of operation has been let's not wait for the funding, let's start working towards what we need. And let's keep working for the funding at the same time. This is an effort that will be ongoing, and everyone's support is needed. NSF does not have any lobbying but if you have good ideas, you can make the case for investments. Regarding Dr. Steig's last point, he said the interest is not to reduce anything. The interest is to ask the best way of increasing access and the optimal way of doing it. NSF is not taking a unilateral position that there needs to be fewer boots on the ground.

Dr. Nettles said so much of the science in polar programs is aligned with NSF goals and administration priorities and there are so many burning questions of high global impact that we're looking for ways to accelerate the work we can do. Optimization is a critical part of that.

Dr. Panchanathan said NSF is looking at partnerships and has constant conversations with NASA and the Department of Defense (DOD) to collectively bring these things to a higher level of awareness. This is important for scientists all across the nation.

Dr. Mack discussed permafrost soils and coastal sediments that reside in the Russian Federation and play an outsized role in the global carbon cycle, which cannot be excluded from an understanding of the biospheric feedbacks accelerating climate change. We know the current geopolitical situation with Russia is changing rapidly and now is not the time to predict how this is going to impact NSF-funded scientists doing work in Russia or with Russian colleagues. But it is of great concern. Dr. Mack asked about NSF's vision and international engagement and collaboration in this time of heightened security challenges.

Dr. Panchanathan said his third pillar is global science leadership, which is not one nation leading and others following. Every nation has a shared imperative, where people who come together with shared values work together to achieve the best outcomes. Every week he has at least one or two international conversations. He is a scientist at heart and science is global. That's why there is an Office of International Science Engineering, a cross cutting office that leverages what's happening in the nation in various scientific disciplines and enhances and enriches that by global collaborations and energizing global thinking in the directorates. NSF is augmenting the resources for the Office of International Science and Engineering. So, that's the position relating to specific countries and specific situations that we are in. He is concerned

about what's happening, but that's an individual perspective, he said, and NSF is a Federal agency. The president takes positions on behalf of the nation. There are constant conversations with the White House and the National Academies and there is a recognition of the importance of science. But they are also making sure to contextualize all this. The specific examples the AC provides are helpful, but he does not make the decisions. He is hoping for a good outcome because science is a great diplomatic tool and good science can be pursued only when we are able to bring all perspectives from all parts of the globe.

Dr. Nettles said she appreciates the director's support for continuing science and science collaboration internationally and domestically and that the AC sees very strongly the value of science within diplomacy and keeping those scientific channels of communication open at difficult times and appreciates his conversations with colleagues internationally and within the administration.

Dr. Panchanathan praised the leadership of GEO and OPP and predicted achieving greater heights.

NASEM Mid-Term Assessment

Dr. Kowalewski; Dr. Marsh

Dr. Kowalewski said the National Academies published a strategic vision for Antarctic and Southern Ocean Research decadal report in 2015, identifying three main science priorities:

- Strategic Priority I: How Fast and by How Much Will Sea Level Rise?
- Strategic Priority II: How Do Antarctic Biota Evolve and Adapt to the Changing Environment?
- Strategic Priority III: How Did the Universe Begin, and What Are the Underlying?
- Physical Laws That Govern Its Evolution and Ultimate Fate?

Discussing each priority individually:

- Strategic Priority I:
 - Priority I science questions are urgent, complex, and essential to global adaptation planning, requiring research initiatives that are ambitious in vision and funding.
- Strategic Priority II:
 - The mid-term report suggested that progress is inadequate to reach the scale and scope of the vision described in the 2015 report. NSF was encouraged to stimulate the initiative through community and partnership building, multidisciplinary training, and resource sharing.
 - ANT needs enhanced outreach and communication to the scientific community about NSF support for Priority II research areas.
 - Call for a focus on larger, interdisciplinary research programs for sequencing, assemblies, annotations, and verification of genomic products vs. small team efforts
- Strategic Priority III:
 - CMB research at the South Pole has been flourishing for many years, contributing to our understanding of the origin of the universe, and strengthening the scientific leadership of the United States in this field.
 - The scientific community has made significant progress in the design of CMB-S4, considered the global future of CMB research.

Dr. Kowalewski also discussed the cross-cutting recommendations and improving two-way communication between the community and OPP. He noted some of these opportunities were mentioned yesterday. Some are opportunities to advance the diversity and inclusion mission. These are often underutilized from the ANT community as PIs are unaware some of them exist. ANT can do a better job communicating these opportunities, he said, and asked for suggestions from the AC.

In conclusion, he offered questions for discussion:

- How can the AC facilitate messaging from NSF to the community on future activities that support the priorities?
- How can the AC best provide community feedback to OPP?
- How might the community leverage the GEO Innovation Hub and NSF/OPP-Relevant Programs to support the strategic priorities and cross-cutting recommendations?
- How might we align the mid-term recommendations with the subcommittee report on Diversity and Inclusion in Antarctic or Polar Sciences?

Dr. Marsh continued, noting that the executive summary is a good overview of the recommendations. The report highlights the differential in progress among the three major objectives. He would put progress at the Thwaites Glacier and glacier program at the top of the list as a successful program, with success defined as the scientific progress made through all research endeavors integrated and applied to that system. He asked AC members with knowledge of the program what made it so successful. Dr. Kowalewski added the idea of optimization. Knowing there are certain limitations on resources and finances, how was this a successful project and how can we model some of those efficiencies to other priorities?

Discussion

Dr. Stammerjohn was on a research expedition with the International Thwaites Glacier Collaboration (ITGC) as collaborating partner through Artemis. It was taking the nuts and bolts of ITGC, which is about better understanding ice interactions and processes contributing to the change happening in real time. Added on was a biogeochemical ecosystem component. It demonstrates OPP's capacity to do cross-discipline translational research and to partner with an internationally funded endeavor. There's a lot of lessons that can be learned from this partnership and the three field seasons during COVID-19; a lot of areas could have gone better. She encouraged the community to identify those. Although the ITGC and its collaborating partners have been hugely successful, the challenges and where there can be improvements might get overlooked. The change is happening at such a pace that it doesn't look like there is the infrastructure to keep up.

Dr. Kowalewski said many of the 21 recommendations focused on the logistic side. The Antarctic science section did not task the committee with analyzing logistical capability. He was trying to focus the conversation on what can be done to better communicate with the community. It might be good to have a conversation on how to better use that communication between OPP, the AC and the community. Logistics will come up with the following presentation on Antarctic fieldwork. But here we're looking how we can better communicate with the community if we're creating new DCLs.

Dr. Marinelli said it is difficult to look at science without looking at logistics. The committee did not have full awareness of all the other pulls on logistical capability. Coupled with that was the onset of COVID-19. It has generated frustration within the science community, which we understand. OPP staff have tried as hard as they can to get field work done. That said, there are things that get in the way when you don't have assets you need. There's rarely a week without something happening. She said OPP appreciates the community's frustration and asks for patience.

Dr. Steig said the community appreciates and understands the challenges NSF faces. He is incapable of honestly expressing to people that he is trying to reach out about how to get involved because he does not know the answer to timelines of two, five and 20 years.

Dr. Marsh said the Thwaites project is a focus on a well-defined system. You bring a lot of people a lot of resources to bear upon that problem. And in this case, they produce great results. The Cosmic Microwave Background (CMB) is a similar category. You have a large community of astrophysicists behind that objective that can use parts of that data. And that unification of objectives and goals leads to more rapid progress. In genomics, there are much more different views. The comparison between the through progress on the three areas is apples to oranges. We need a greater degree of collaboration or organization around a model system for a select few months. If you're studying on a single system and generating lots of data, that is cross cutting to other projects, that data exchange and flow opens up opportunities for data science driven inclusion of more PIs remotely handling, moving and using the data in novel ways that may not have been envisioned. The collaborative system model opens up more DEI opportunities with a data science focus. The genomic area becoming more collaborative around a model system would offer computational biology driven inroads for other peoples of diverse backgrounds and from diversity institutions to participate in at least the initial phase in some aspect of polar regions.

Dr. Kowalewski said he is working to build funding partnerships with the Division of Integrative Organismal Systems (IOS) and Molecular and Cellular Biosciences (MCB) for co-reviewed proposals and some can be large initiatives.

Dr. Marinelli said OPP is aware of the extent to which COVID-19 has caused a gap in the ability to attract and retain early career researchers who lack prior polar experience. There will be a lot of work to rebuild that pipeline and attract more people. The COVID-19 backlog and accumulated stressors it's putting on the system and the need to work with the community to make them aware has caused OPP to think five to 10 years out about what's open and not open and how to allow people to plan for longer range, large projects while supporting the science that is also important but not necessarily big. OPP will be coming to the community for ideas and what the community thinks the big new initiatives are in both polar regions. She also acknowledged the massive amount of work done by the research support folks in the Arctic and the Antarctic infrastructure and logistic folks in dealing with the surprises in the last year and a half.

Dr. Kowalewski asked about a role for the AC to provide some of that community feedback to OPP and how the AC help communicate future activities to the community supporting some of the initiatives.

Dr. Marsh recommended the AC designate a point of contact who would focus on that problem task and figure out what the distribution route would be.

Dr. Kowalewski spoke about resource limitations for field work and sometimes financial limitations. How might we better leverage the GEO Innovation Hub and some of NSF GEO-relevant cross cutting programs to support the strategic mission and especially the diversity, inclusion or community development cross cutting recommendations from the National Academies report.

Dr. Nettles stressed the importance of encouraging those who want to get involved in polar science or might be good people to get involved in polar science, to talk to the program officers at NSF. It can seem intimidating for someone who doesn't already have those relationships. And yet, cyber infrastructure has welcoming, and supportive people focused on bringing in new scientists. Dr. Nettles also added that virtual office hours are good for getting people engaged, to ask questions and not be the only one on the line with your program officers. She encouraged members to publicize and support webinars and office hours. Turning to earlier discussions about geographic focus, she advocated trying to strengthen ways to connect with work that's done outside the geographic polar regions that is relevant to polar research disciplinarily. It could be a strategy to bring a broader, more diverse group of people into polar science without necessarily having the hurdle of sorting out a five-year down the road field deployment at a time when logistics are extremely constrained.

Dr. Marinelli said OPP has talked about how to retain early career individuals, maintaining capability in research and introducing new people to polar research by funding polar life work, not necessarily in the Arctic or the Antarctic, but, for example, with mountain glaciers. This would be to have a workforce with the skills to do the work that is more tuned when things become more open. There are times building and testing equipment does not require going to a certain ice sheet, yet it's still relevant to polar work. This has been discussed as a way to build capability at a time when it's difficult to deploy.

Dr. Steig said he became comfortable talking to program managers not by having someone tell him you can call them, but by meeting them at workshops.

Antarctic Fieldwork

Mr. Kowalewski; Ms. Short; Mr. Iselin

Mr. Iselin said that as AC members listened to the upcoming presentation, they could think about whether the committee has a role to help advise on how to optimize research done through scarce resources and whether there are other ways the committee can help on becoming more efficient at managing critical resources.

Dr. Kowalewski began the presentation on science at the South Pole and deep field camps in Antarctica with science activities that often require the most challenging and complex support. He briefly reviewed the science done in each of the four South Pole sectors. The Dark Sector supports long duration astrophysics experiments and the South Pole Telescope (STP), Background Imaging of Cosmic Extragalactic Polarization (BICEP) array and the Ice Cube Neutrino Observatory. He also discussed the Atmospheric Research Observatory in the clean air sector. Additional deep field sites include the West Antarctic Ice Sheet Divide (WAIS Divide).

Ms. Short continued with a discussion of Antarctic logistics and the necessary interconnected web of logistics capabilities bounded by physical and technical constraints, with the South Pole Station fuel delivery as an example. COVID-19 has significantly disrupted this web of logistics, including the backlog of work resulting from two seasons of significantly reduced deployments that will heavily tax an already constrained system. A DCL will be published soon providing details about anticipated limitations in the ability to support new field work in certain sectors. She discussed three major anticipated pinch points.

Referring to a comment from the last session re positioning the community to better understand lead times and resource constraints, she said the DCL is not a once and done communication. Other communication tools are being developed to help and she asked for feedback on the heat map periodically updated for big logistics drivers in Antarctica. A prospective participant guide is also being prepared as one-stop shop for those unfamiliar with doing work in Antarctica to find information about logistics capabilities and information such as lead times for proposals based on the complexity of field work or logistics resources.

Next, she discussed a strategic path forward:

- Implement a robust science prioritization framework
- Develop Master Plans for stations, the deep field, and major logistics platforms with broad community engagement
- Initiate the Antarctic Infrastructure Recapitalization program

Circling back to master plans, she said it provides a critical opportunity to engage more fully with the Antarctic science community. Master plans define the desired future state of physical capabilities, are based on lifecycle cost analyses and consistent design principles, rely on stakeholder engagement and change as science needs change. Master plans are in place for Palmer and McMurdo and a master plan for South Pole Station is in the early stages of development. This type of planning is envisioned for mapping the future of key logistics platforms, like overland traverse capabilities, and for bringing cohesion to the locations and capabilities of deep field camps.

In conclusion, she provided three key questions:

- How can we work together to share this kind of information with the community?
- How would the Advisory Committee like to be involved in Master Planning efforts?
- How can we ensure the most impactful science receives support when logistics are constrained?

Discussion

Dr. Nettles expressed her appreciation for the presentation and Dr. Marinelli said a master plan can help shape the kind of science that gets done on the continent and in the surrounding environments and encouraged engagement in the process.

Ms. Short added that the combination of master plans, which set the future of infrastructure and logistics, with a dedicated funding line to achieve those master plans, are a tremendous opportunity. Her office is eager to understand how the AC can and would like to help and how the AC can help OPP engage the entire community in the effort.

Mr. Iselin said one possibility could be an AC subcommittee that could work with Ms. Short and the team to collect input from the AC writ large and be a sounding board.

Dr. Stammerjohn said there used to be something along the lines of an oversight committee for the research stations and research vessels. Those were phased out a couple years ago.

Ms. Short said OPP used to host user groups through the Antarctic Support Contract and those were disbanded. We very much hear the need for community engagement to guide where we're going. OPP is looking to the AC and others for how to engage the community going forward. She appreciates the frustration about wanting more investment. Master planning with the community in an environment where we have a programmatic funding line, presenting an exciting opportunity. OPP is not focused on just working off the backlog over the next two years; we want to set ourselves up robustly for the future and respond to concerns and criticisms.

Dr. Nettles said she understood some of the user groups were disbanded because they had become less useful in not broadly looking at the overall plan. It seems like through the Antarctic Infrastructure Recapitalization (AIR) Program effort there could be a working group, either through this committee or elsewhere, similar to that for the ARV, that has the knowledge and the broad base to look at the master planning effort.

Ms. Short agreed, adding that for the ARV, OPP is leveraging a subcommittee but also other methods and modes of input. AIR is envisioned as an ongoing conversation with the community and an ongoing renewal and refresh of where the stations are going and what the logistics capabilities are. The master plan will include where the field camp focus should be in the coming five to 10 years and what the logistics capability should look like. OPP wants to engage with the AC and will seek other opportunities, including design Charettes and engaging the Academies in workshops and reporting. As the Blue Ribbon Panel in 2012 reported, we can't support robust science by doing it the same way we've always done it, so OPP wants to work with the AC to understand what areas NSF needs to explore for doing things differently in leveraging new ideas and new technologies.

Dr. Marinelli said the program of Antarctic Infrastructure Modernization for Science (AIMS) and AIR will allow modernizing stations and implementing science in a more effective and efficient way. It may seem NSF is putting a lot of money into recapitalizing things that may not seem like the number one science priority. But if this step is not taken the stations will degrade to a point where the ability to carry out science is even more impeded. OPP is viewing these as parallel, essential and complementary activities. But the science has to lead. As we engage the

community, we want to understand not just what the buildings needs to look like, but why they need to look a certain way. Because it's the science drivers that will attract the investment, which is overseen by the board, and the board is interested in the science.

Dr. Marinelli also addressed how the science prioritization process will make use of the 2015 strategic priorities findings and whether this report will become a regular decadal Academies-lead process. She said there is a need to have decadal type surveys. It is a challenge to have a decadal survey in polar research, because the variety of disciplines is so vast. How one goes about it has to be carefully considered so there is representation from many disciplines and perspectives. Regarding overall prioritization for a given asset, at the South Pole for example, McMurdo and Palmer Station are constrained by logistics and operational capabilities. We have large projects competing against one another, some in similar fields and some in different fields. And it begs the question, How do you decide which one goes forward? Questions that come into play are: Because somebody was first in line? Because somebody's community prioritizes it? Because an administration decided one type of science is more important than another? Some might be more feasible than others. Some can be done in other places. There are lots of different ways to think about it. So, to help OPP think about this question — not to actually do the prioritizing —and help develop a framework in which to evaluate what projects go forward, the office is convening a high-level group within NSF involving agency partners to help think about a framework for evaluating some of these decisions and come to conclusions based in a robust analytical framework. The goal is to include many different perspectives and evaluate urgency, science, value, science payoff and so on. This is mostly a framework to help think about the different very large challenges coming our way and to figure out which ones go forward, and which ones have to stand in line a little longer.

Mr. Iselin said the offer is to find ways to improve two-way communications with the AC and to participate in the master planning. He said he was willing to be involved in a subcommittee on master planning.

OPP's International Engagement
Dr. Sung; Dr. Mercer; Dr. Mack

Dr. Sung began with an overarching picture of NSF geopolitical roles at both poles. She listed what the poles have in common, contrasting that with the geopolitical situations of each pole, which are very different.

In Antarctica, several countries have made territorial claims, but the Antarctic Treaty System (ATS), signed in 1961:

- Recognizes no territorial claims
- Is consensus-based
- 1961: Preserved for peaceful scientific purposes
- 1982: Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)
- 1991: Protocol on Environmental Protection prohibited mining

Dr. Sung said the treaty does not expire in 2048, as is sometimes claimed. A majority cannot out vote a minority, but one party can block action, and sometimes does. The protocol on

environmental protection states that in 2048, one party can call for a review and possible revision. But the consensus process means that, for example, while one party could call for a review of the mining ban in 2048, nothing can be changed without the consent of all of the consultative parties.

Turning to US domestic policy regarding Antarctica, she said world class science is the primary expression of the US presence in Antarctica. In 1982, NSF was directed to manage year-round occupation of the South Pole plus two coastal stations. NSF manages:

- Three year-round stations
- Scientific research
- Operational and logistics platforms

She added the US has made no territorial claims, though it has reserved the right to do so. But McMurdo and Palmer are located within claims made by other countries.

ATS, she said, is considered the first arms control agreement, as it prohibits military activity for military sake and prohibits nuclear detonations and storage of nuclear waste on the continent. It also provides for open inspections of all national facilities on the continent and vessels in Antarctic waters. The most recent inspection by the US took place two years ago at three stations in the Ross Sea area. On these inspections NSF provides know-how and experience on environmental compliance and operations, and logistical support.

Moving to the Arctic, the situation is different; there are eight nations with sovereign territory in the Arctic:

- Canada*
- Denmark*
- Finland
- Iceland
- Norway*
- Russia*
- Sweden
- United States*

*Littoral states

Whereas Antarctica has no permanent human inhabitants, about 4 million people live in the Arctic, roughly 10% of whom are indigenous, and there is no overarching treaty governing the Arctic. But the Arctic Council is the leading intergovernmental forum, promoting cooperation among the eight Arctic nations and Arctic inhabitants.

The Arctic Council sprang in part from international engagement by the scientific community. In addition to the eight Arctic states, there are six permanent participants representing the indigenous peoples of the Arctic. There are 38 observers, including 13 non-Arctic states and other groups. And there are six Arctic Council working groups on which NSF staff serve. And the Arctic Council does not handle any military security issues. The US Secretary of State serves as the US representative at Arctic Council meetings every two years. The chair of the council rotates every two years among the Arctic nations and the US last held the chair in 2015 through 2017. The chairmanship now belongs to the Russian Federation. As a result of the Russian

invasion of Ukraine, the Arctic Council has paused all official meetings of the council and its subsidiary bodies until further notice.

Dr. Sung said the four drivers of US Arctic policy are well-being, stewardship, security and Arctic-Global Systems. The US national strategy for the Arctic is expected to be updated soon. Science, she said, is a key part of US Arctic policy.

She added that the Arctic Research and Policy Act of 1984 (ARPA) called for a comprehensive national research agenda in the Arctic and set in motion the Arctic Research Commission (USARC) and the Interagency Arctic Research Policy Committee (IARPC). The former represents non-government interests and provides recommendations to the US government on research gaps and priorities. NSF is the only Federal agency with an official role in the commission. The latter is a working group of the National Science and Technology Council (NSTC). IARPC coordinates US government research and codifies national Arctic research policy into five-year action plans.

IARPC recently released its new five-year plan. Its four priority areas are community resilience and health, Arctic systems interactions, sustainable economies and livelihoods, and risk management and hazard mitigation.

The Arctic Council's Agreement on Enhancing International Arctic Scientific Cooperation, ratified in 2018, represents recognition by those nations with sovereign territory in the Arctic of the need to collectively ease the barriers to scientific cooperation. It recognizes the importance of science for decision making in the Arctic and creates a framework for scientific cooperation with a focus on access to research infrastructure and data.

The US has a science and technology collaboration agreement with Russia that is up for renewal in 2026. The US has also had a basic science agreement with the Russian Academy of Sciences since 1994. Russia's level of international collaboration has suffered since 2014, with the annexation of Crimea, when the US and other countries stopped many scientific collaborations. So, even with these agreements, the timing isn't always ideal to pursue anything beyond very small-scale PI-to-PI projects.

In 2021, US-Russia high-level alignment-building began. Discussion was initiated by Russia, in the context of its chairmanship of the Arctic Council, calling for more international research collaboration in the Arctic and 'activating' the aforementioned Arctic science agreement. The Biden administration also sent a climate envoy to Moscow to discuss cooperation, so there was high-level alignment on both sides. Since half the Arctic is in Russian territory, it makes sense to work together so data and predictions are more complete, leading to better informed policy, she said.

This is where NSF has a chance to do science diplomacy when it makes the most sense—with compelling science on the PI-to-PI level, while contributing to a higher-level foreign policy goal.

Dr. Mercer continued the presentation with a look at collaborations with Russia. The future of these collaborations is unknown, she said, but she reviewed the long-standing projects and collaborations with Russia. She listed the NSF-Russia collaboration topics as:

- Natural Science: climate-induced biome shifts.
- System Science: fire influences on boreal forests, their recovery and ecosystem feedbacks; Arctic carbon flux.
- Arctic Observing Network: monitoring ocean change in the Eurasian and Makarov Basins, strengthening the Global Terrestrial Network for Permafrost, sampling of Arctic rivers, tracking carbon, water, and energy balances.
- Social Science: Sustainability and resilience of Russian Arctic communities, including those of Indigenous Peoples, impact of marine transportation routes on remote Arctic communities, and urban sustainability in the Arctic.
- Navigating the New Arctic: climate adaptation of biotic and abiotic systems and social responses in the Russia Yamal region, community vulnerabilities to changes in sea ice and economic expansion, impact of extreme weather events on social-ecological systems.

There was also cooperation in the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAIC) project and the Akademik Tryoshnikov vessel is used for work on the Nansen and Amundsen Basin Observational System.

Regarding multilateral cooperation she listed:

- International Arctic Science Committee (IASC)
- Forum of Arctic Research Operators (FARO)
- Belmont Forum

Also, NSF expects institutions to direct PIs to State Department guidance, which is currently that American Citizens should not travel to Russia. The upcoming Arctic Science Summit Week Summit (ASSW) has excluded all representatives of Russian entities or organizations from the meeting. For FARO, there was a decision to pause Russia's membership for the time being. Russia has not been listed as a member of the Belmont forum for at least the last year.

She said the word "pause" is used regarding Russia, noting the uncertainty and unknowns right now. She is hoping more guidance will come soon. But for now, OPP is working with the community to pause its efforts and see what happens. It is being looked at as three different categories: projects that are already funded to work in Russia or have been working in Russia for years with plans to go into the field this season; proposals currently under review to work in Russia; researchers and PIs planning to submit proposals for review.

For projects currently planning to go into the field, people are directed to work with their institutions. There is State Department guidance on its website that discourages American citizens from traveling to Russia. That should be considered, and researchers need to work with their institutions on whether or not it's a good idea to go to Russia. For current projects, OPP's logistics team, The Arctic Research Support and Logistics (RSL) Program team and science program officers are working with project PIs to determine alternative paths for the research similar to what was done for COVID-19. For proposals under review, the science program officers are working individually with PIs to discuss what makes the most sense as far as

submitting new proposals. Though there's no prohibition against submitting a proposal to work in Russia, there are not deadlines, so it is worth pausing to see what the guidance will be.

Discussion

Dr. Mack said she spoke with colleagues associated with currently funded Russian projects and each voiced humanitarian concerns and compassion, and concern about the emerging trend towards international isolation of Russian scientists. Some projects have been going at a lower level of data collection by Russian collaborators and logistics providers. In some projects, replacement parts, repair and calibration of equipment will soon be urgently needed. In addition, transfer of hard drives containing large datasets may not be possible.

For field campaigns, many grants funded at the beginning of the pandemic are at their end. PIs can't get back to Russia for a tear down of the project and a return of equipment. People are concerned for their safety if they travel to Russia. Overall, we're at the brink of loss of continuous long-term records in the Russian Arctic. Projects are ending before the final experimental data can be collected and the equipment can't be retrieved. As of today, there was still a pathway for transferring money to some of Russian logistics providers, but not others. We can't ship anything from Russia and her fear is that export is probably now not possible for the next decade. Currently, all mechanisms for sample export are shut down. Russian logistics providers are losing almost all their business and in the absence of international user day payments, they may not survive.

People are also worried about planning to submit grants. Dr. Mack said she'd share what she heard today with those who have expressed concern to her.

Dr. Mercer clarified that program officers cannot determine whether people may travel, it is the responsibility of the institution. People should refer to State Department guidance for American citizens. Regarding those with Russian passports, there are additional risks that U.S. citizens do not face.

Dr. Nettles expressed distress over the violence and said the people she has spoken with have compassion and empathy for colleagues in Ukraine and Russia. There is concern about how to interact with collaborators in Russia for fear of exposing them to unwanted scrutiny. She amplified the concern about the decision not to allow most Russians to participate in the Arctic science summit week, as some Russian participants were not representing the Russian government. All of this has a potentially large impact on the Indigenous Peoples of the Arctic who, in almost every case, did not choose their state of citizenship and with whom it may be important to maintain research contacts. The National Academies have issued a statement not wishing to cut off communication with Russian scientists, many of whom have spoken out against the war, as have other academic organizations.

Dr. Mercer said that regarding ASSW not allowing Russian participation, these are international organizations. If Russian scientists were allowed to participate, participants from some other countries would not be allowed to participate, thus attendance numbers would decrease further.

Dr. Nettles said the message today is that scientists would support trying to maintain open lines of communication with individual scientists in Russia for the sake of humanity.

Dr. Sung pointed out that many European countries have been draconian in their response, understandably. Canada has been a little less so and our government is considering what kind of response is appropriate, recognizing that if relationships are cut off, years of progress will be lost.

Dr. Marinelli said it's very helpful to understand the impacts. There is active ongoing dialogue between NSF and other government entities about how to handle these situations. As the situation evolves, if there is a consensus and clear guidance, we will hear it. But for now, checking the channels you've been advised to check is the most immediate thing you can do in guiding your activities.

Dr. Mack asked if there is a role for a US-NSF funded scientists support group for this period. It would share the information that Dr. Mercer had, to ensure that the necessary information is shared with all who need it, and to discuss how to proceed.

Dr. Marinelli said NSF will not be developing new guidance to share; it is following guidance from the State Department and is in contact with the Office of Science and Technology Policy (OSTP) and other science bodies with an interest in the region and a concern about the outcome of the conflict. It might be helpful for PIs to support one another to gain a broader understanding of what's at stake. NSF has at times considered developing estimates for the cost of disrupted grants.

Dr. Mercer said her section has provided no new policy and no specific direction; rather it was guidance and suggestions. Dr. Mack said that helps her see her role better; she can, as a private citizen, give guidance for people who have asked about travel.

Dr. Mercer said to push PIs to have those discussions with their institutions. If somebody has an emergency, such as if they're detained or need a medivac, it is the institution's responsibility.

Dr. Stammerjohn said the ongoing OPP Section office hours where information is provided could be a forum for providing up to date information, not support or advice or recommendations. Office hours are generally held every few months, but this can change if there is new information to share.. And there's nothing stopping the community from exchanging information about their experiences more often.

Dr. Sung said that if any policy changes or other information is received that is actionable, for example, if the US says private citizens are not allowed to contact private citizens in Russia, NSF will convey this in office hours or other public announcements.

Dr. Nettles reiterated that even without new information, office hours that demonstrate NSF engagement can be useful and reassuring in a time of high anxiety in the community. It's not a policy issue, but a question of having people know there's specific places they can go. Partly, it

is anxiety management and redirecting people who may not have heard the message the first time. She encouraged another office hours opportunity or an FAQ. Ukrainian scientists are, of course, suffering tremendously under the current situation. She expressed sympathy and concern for the community's colleagues in Ukraine, and the situation of indigenous people there as well.

Wrap-up

Dr. Nettles; Dr. Marinelli

Dr. Nettles and Dr. Marinelli listed possible open issues and topics for future meetings, citing:

1. A subcommittee or similar vehicle for input on South Pole master planning.
2. An ARV DCL letter
3. Possible joint CEOSE/AC-OPP meeting
4. Explore strengthening ways to connect with work done outside geographic polar regions but relevant to polar research as a strategy to bring a more diverse group of people into polar science.
5. Further discussion of high-level collaborations OPP has in place to facilitate polar science.
6. Follow-up with the subcommittee on DEI
7. The approach to supporting ship research beyond a new vessel in the pipeline

Of these, Dr. Nettles said the main items requiring further action are Numbers 1 and 6. She will summarize the main feedback from the AC for the DEI subcommittee and circulate that by email for comment or further revision and transmit that back to the subcommittee as it works to complete a draft report. Dr. Marinelli said substantial follow-up items are Numbers 1 and 2.

Dr. Marinelli said its on OPP's list of things to do to make more public where we are and how we're going to handle the many demands on the oceanographic research portfolio in the Southern Ocean and working with working with the AC to understand whether we're answering the community's concerns and have the letter pitched to the right questions. There's a lot of interest in the ARV, but not as much understanding as to where we are in the process and how we're approaching oceanographic research. There needs to be more contact with the community to bring them along.

Dr. Nettles said polar cyber infrastructure is clearly an ongoing discussion that we want to pursue also between meetings.

Dr. Heimbach said he wanted to follow-up with those who expressed examples for case studies. He will bring this to the ACCI and there could be an option for a subcommittee on one or several of these topics.

Dr. Stammerjohn added that new use cases could be added for how to interface with TIP.

Ms. Walker spoke about the fall AC meeting, which will be virtual. Scheduling will be in early to mid-September, before member terms expire, so there will be one more meeting with the committee as currently constituted. She also reviewed the process for recommending new members.

Dr. Nettles thanked the AC members for their service, as well as Dr. Marinelli and Ms. Walker. Dr. Marinelli also thanked the committee, Ms. Walker and Dr. Nettles, as well as everyone who gave presentations.

The meeting was adjourned.