

# Advisory Committee for Polar Programs (AC-OPP)

Fall Meeting, September 23-24, 2021

Meeting Held Online

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## Summary Minutes

### Action Items Arising out of the Fall 2021 AC-OPP Meeting

1. Items arose for possible inclusion in the agenda of the next AC-OPP meeting (spring 2022):
  - a) Discussion on security, including Russia and data openness
  - b) Discussion on working with university risk management offices.
  - c) Update on NNA’s response to the Kawerak, Inc. letter with possible discussion of connecting indigenous and scientific knowledge systems.
  - d) Meeting with the DEI subcommittee
  - e) Further discussion of COVID-19 impacts
  - f) Results from a study underway of differential impacts
  - g) Infrastructure upgrades and support for future large science projects at the South Pole
  - h) Updated information on TIP Directorate
2. Other action items:
  - a) Groundwork for a subcommittee with ACCI, including identifying next steps

### Attendance and Membership

#### AC-OPP Members Present

Dr. Meredith Nettles, Lamont-Doherty Earth Observatory, Columbia University, Chair, AC-OPP

Mr. Raymond V. Arnaudo, Department of State (Ret), member, Advisory Committee, Environmental Research & Education

Dr. Douglas H. Bartlett, Scripps Institution of Oceanography, University of California, San Diego

Dr. Aron L. Crowell, University of Alaska, Anchorage

Dr. Michael D. DeGrandpre, Department of Chemistry and Biochemistry, University of Montana, Missoula

Dr. Ryan E. Emanuel, Department of Forestry and Environmental Resources, North Carolina State University

Dr. Mark Flanner, University of Michigan  
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. 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  
Dr. Abigail Vieregg, Kavli Institute of Cosmological Physics, Eckhardt Research Centers, University of Chicago, IL

#### AC-OPP Members Not Present

Dr. Amanda Lynch, Institute at Brown for Environment and Society, Brown University, Providence, RI  
Dr. Adam Marsh, School of Marine Science, University of Delaware  
Dr. Thomas Weingartner, College of Fisheries and Ocean Sciences, University of Alaska Fairbanks (Ret)

Office of Polar Programs and other NSF staff (presenters and speakers)

Dr. Roberta Marinelli, Director OPP  
Ms. Jessie Crain, Antarctic Research Support Manager, Antarctic Infrastructure and Logistics Section (AIL), OPP  
Ms. Renée Crain, Research Support & Logistics Manager, OPP  
Dr. Linda Hayden, Director, Center of Excellence in Remote Sensing Education and Research (CERSER).  
Dr. Alexandra Isern, Acting Assistant Director, GEO  
Dr. Rebecca Keiser, Chief of Research Security Strategy and Policy, NSF  
Dr. Douglas 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. Sethuraman Panchanathan, NSF Director  
Dr. Allen Pope, Program Director, Polar Cyberinfrastructure  
Ms. Stephanie Short, Section Head, AIL, OPP  
Mr. Brian Stone, Chief of Staff, Office of the Director (OD)  
Ms. Beverly J. Walker, Science Analyst, OPP

Thursday, April 29

## Welcome and Introductions; Conflict of Interest (COI) Review

Dr. Nettles; Dr. Marinelli; Ms. Renée Crain

Dr. Marinelli thanked everyone involved in planning the meeting and introduced herself as the new OPP Director. Dr. Nettles welcomed Dr. Marinelli and introduced herself as the new AC-OPP Chair. She welcomed the AC members and other attendees and thanked Dr. Thomas Weingartner, the outgoing chair, for his service, including leading the writing of An Overview of Advisory Studies for the Office of Polar Programs and moving to completion the subcommittee Report of the Ad Hoc Subcommittee on the U.S. Antarctic program's research vessel procurement; and thanked Mr. Paul Sheppard, Executive Officer, OPP, for helping with leadership transitions.

The committee turned next to the COI review. Ms. Renée Crain said the advisory committee is subject to the Federal Advisory Committee Act (FACA) and highlighted relevant elements.

Dr. Marinelli discussed the following staffing changes:

### New Hires

- Roberta Marinelli — Office of Polar Programs, Director
- Douglas Kowalewski — Antarctic Sciences Section, Section Head
- Mike Prince — Antarctic Infrastructure & Logistics, Antarctic Research Vessel (ARV) Project Manager
- Rainer Amon — Arctic Sciences Section, Program Director, Arctic System Sciences
- Olivia Lee — Arctic Sciences Section, Program Director, Arctic Observing Network
- Kelly Brunt — Arctic Sciences Section, Program Director, Arctic System Sciences
- Xoco Shinbrot — Arctic Sciences Section, The American Association for the Advancement of Science (AAAS) Science and Technology (S&T) Policy Fellow

### Acting

- Renée Crain — Arctic Sciences Section, Acting Section Head

### Details

- Kelly K. Falkner — Office of Polar Programs, Department of State

### Retired

- Andrew Backe — Front Office Integration Team, Management & Program Analyst

### Departures

- Lizbeth Sanchez — Antarctic Infrastructure & Logistics Section, The Hispanic Association of Colleges and Universities (HACU), Summer Intern

Dr. Marinelli continued with a presentation of publicly available budget information at the agency level for FY20 Actual, FY21 Enacted and the FY22 Request.

## COVID-19 Impacts and Backlogs

Ms. Renée Crain; Ms. Short; Dr. Kowalewski

Ms. Renée Crain discussed the approach to the pandemic response for the Arctic Sciences Section:

- Goal-based approach:
  - To protect the health of program participants and prevent the spread of COVID-19 to the Arctic, particularly to communities and research stations, while assisting researchers in meeting their original project goals to the extent possible given constraints imposed by the COVID-19 pandemic
- Process:
  - Contractor supported projects followed regionally specific travel protocols
  - Test before leaving home
  - Quarantine
  - Test at the beginning and before departing for the field

Ms. Renée Crain outlined the following pandemic travel restrictions:

- Alaska: Project participants must follow Federal, State, local and tribal regulations and guidelines and obtain informed consent from any remote communities that might be impacted.
- Greenland: Limited commercial travel with vaccine and testing requirements. NSF negotiates Air National Guard flight entry and requires a double quarantine and multi-test process.
- Vessels: Dependent on vessel and port of embarkation e.g., a 14-day quarantine and 2 tests are required before boarding Sikuliaq.
- International: Dependent on country entry/exit allowances.
- Vaccination status: Does not alter travel protocols due to breakthrough infections and unknown efficacy duration.

She noted that her office will continue to evaluate reasonable travel protocols for 2022.

Ms. Renée Crain next presented a graphic showing Arctic field projects by year, from 2019 to 2021, broken down by in-field; postponed; and remote sampling, non-deploying. In 2019 there were about 130 research projects going to the field. In 2020, there was a dramatic impact from COVID-19 on field work and only a small number of projects made it to the field. In 2021, field work was able to take place in over 80 projects. She anticipated two to three more years before catching up on the science. Program officers (PO) made about \$2.4 million in supplements to research grants. She anticipated about 120 field projects in 2022.

She said at Summit Station in Greenland many facilities became buried in snow and had to be excavated in 2021. The 109th Air National Guard went to a high tempo of operations to certify

pilots, engineers, and navigators for the Arctic and Antarctic field seasons. New construction and redevelopment plans are behind schedule and that will continue in 2022.

Ms. Renée Crain said communication with the community is an important part of managing the impacts of COVID-19 and outlined the following examples:

Travel Protocol Presentation

February 24 office hours

July update for Alaska protocols

Live Q&A Sessions

Battelle Arctic Research Operators (ARO) held live Q&A sessions prior to each flight period to Greenland

Individual Communication

POs and contractors communicate with all groups on an individual basis

Dr. Kowalewski continued the presentation discussing the Antarctic Science Section response, noting that:

- Over 50 science and technical activities are scheduled for the 21-22 field season: approximately 30 on the Continental side & 20 to the Peninsula side.
- The Research Vessel / Icebreaker (RVIB) Nathaniel B. Palmer (NBP) and the RV Laurence M. Gould (LMG) will operate out of Punta Arenas, Chile.

This 2021-2022 season, activities were prioritized on a tiered system. The highest priority was field work involving international collaborations with an expected loss of continuous time series data or possible instrumentation loss. The number of science deployers is trending upward but remains roughly a third the number from the 2019-2020 field season. Dr. Kowalewski also discussed the number of Antarctic field projects, noting the impacts in the 2019-2020 field season.

Dr. Kowalewski said some of the major Antarctic science and grantee impacts pertained to field work, including the McMurdo Long-Term Ecological Research (LTER) project, which will have a crew this season that is 25 percent of baseline. The Palmer LTER will be on a cruise and have no work at Palmer station. This follows a year where there was no LTER grantee work in the 2020-2021 field season. The long-term continuous data set is at risk for significant interruption. The International Thwaites glacier collaboration is behind schedule. This year, two limited teams were deployed from the four that were intended. And there is a Thwaites project that has not yet been in the field.

The IceCube Neutrino Observatory upgrade was unable to complete refurbishment in 2020 and 2021 and the team is losing a second field season this year. For the Cosmic Microwave Background (CMB) project's South Pole Telescope Background Imaging of Cosmic Extragalactic Polarization (BICEP) array the loss of one field season was challenging. The BICEP deployment of the new receiver has been delayed until 2022-2023.

Beyond field work, the Antarctic Artists & Writers (AAW) program and the Polar Teachers and Researchers Exploring and Collaborating (PolarTREC) program have been suspended since the start of the pandemic. The Ice Core Facility and Polar Rock Repository have had limited access or no access and there may have been delays in sample access.

Looking forward, Dr. Kowalewski outlined the following challenges:

- Funding challenges as awards bump against supplement caps
- Scientific backlog is substantial
- Deep field challenges
  - South Pole and LC-130 constraints
  - Fuel reserves (West Antarctica)
- Expected significant impacts to vessel-supported science

He also outlined successes from the pandemic:

- Supported science each season
- Diversification of science methods: more non-field work and use of existing data sets
- Building the polar science community and increasing diverse participation
- Integrated approach to challenges between Antarctic Infrastructure and Logistics (AIL) & Antarctic Sciences (ANT)

During the pandemic there has been increased communication with the public, including continuing virtual office hours and the new OPP newsletter.

Ms. Short continued the presentation with the goals for the 2021-2022 season:

- Avoid irreversible damage to long-term science activities and infrastructure
- Ensure all three U.S stations continue to operate safely and are resupplied for the 2022 winter period.
- Continue to manage COVID-19 risks

Turning to deployments, she said the 2021-2022 season will see the second year of significant reductions. She noted that physical qualification guidelines now require COVID-19 vaccination. The Antarctic continues the isolation and quarantine protocols implemented last year. And there is still a struggle with border restrictions. The season is underway and winter flights (WINFLY) have been completed.

Regarding the border situation, there are requirements for managed isolation and quarantine run by the New Zealand government. They're being supportive, but their isolation space is limited, even for the country's own returning citizens. Approval was received this year from Chile to run a land-based isolation facility for deployers that frees up the vessels used last year for quarantining. There are also significant budget impacts from isolation and quarantine.

Currently the Palmer Station turnover crew of about 30 is in managed isolation in Chile. For McMurdo and South Pole station there are about 200 main body deployers now in isolation in New Zealand and about 125 people at the continental US location getting ready to deploy to New Zealand. After an unprecedented but successful air-only resupply last year, vessel resupply to

McMurdo is required in the coming season. A cargo vessel and a tanker will be deployed and LC-130s and crews will be on the ice again.

The Palmer pier rebuild is moving forward this season with protocols to do that safely. Construction of the Ross Island Earth Station (RIES) in McMurdo is being completed with partners in the National Oceanic and Atmospheric Administration (NOAA) to reduce reliance on the Black Island antenna. Also, the Antarctic Infrastructure Modernization for Science (AIMS) project at McMurdo is delayed for a second year.

Ms. Renée Crain highlighted the polar postdoc program, which awarded 17 new postdocs, and the newly revamped program while Dr. Kowalewski mentioned a new hire who's cutting across the poles and is working on cyberinfrastructure.

## Discussion

Dr. Loose asked about AAW and PolarTREC and if their suspension had been for considerations other than COVID-19 and their future. Dr. Kowalewski said it had to do with getting people into the field, but it allowed the programs to think about the synergies between PolarTREC and AAW. The solicitation for managing Polar Science, Technology, Engineering, Arts, and Mathematics ([Polar STEAM](#)) was released two weeks ago. There are no expected deployments in the Antarctic for the next season but it's going to be stronger and have connections between the artists and writers and PolarTREC. Ms. Renée Crain added that OPP is looking at whether teachers from PolarTREC could deploy to the Arctic in the next field season.

Dr. Nettles asked about budget impacts on projects being proposed now and how to be thinking about proposal submission. Dr. Kowalewski said the budget for ANT is the same moving forward. The program is encouraging non-field work proposals. Also, the Antarctic program is encouraging data reuse. There are papers ready to be written on the amazing samples that were collected. It takes some of the stress away from managing additional fieldwork, but still allows and supports early career scientists who need to find academic jobs.

Ms. Renée Crain added that the Arctic, especially in office hours, is emphasizing data reuse and other types of non-field work proposals. A good amount of field work can be handled in Alaska and Greenland. People are not being discouraged from new proposals that involve fieldwork in the Arctic.

Dr. Marinelli said it is important for OPP to represent its costs as well as the costs at universities for keeping people on for longer, managing vessels and expenses associated with supporting crews and technicians who otherwise can't go to the field but don't necessarily have things to do at those home institutions. Re the postdoc program, OPP is discussing a potential release of that solicitation again, possibly with the same kind of emphasis on no field work. One question is whether two years is long enough for a postdoc, and she asked AC members to provide insights on what NSF should be thinking about to manage these programs and support the community.

Dr. Bartlett asked if the demographics of people submitting proposals during the pandemic changed. Ms. Renée Crain said there has been a slight uptick in proposal submissions recently.



Though she did not have numbers available, she thought more people were producing publications and developing proposals. Dr. Bartlett asked about demographics; Ms. Renée Crain said she'd try to find and distribute that information.

Dr. Marinelli said it isn't possible to track the papers and some of the demographic data are incomplete because it's voluntary. She said recent information from the Directorate for Biological Sciences (BIO) looked at proposal trends over the last few years, including during COVID-19, with and without deadlines and there was no pause in proposals over the COVID-19 time period. But information is not available on who is submitting those proposals. Demographic data are starting to emerge, and the National Academies of Sciences (NAS) is addressing this issue in terms of the impact of COVID-19 on groups not well represented in the sciences. Dr. Kowalewski added that it would be interesting to look at the demographics within the postdoc research fellowship to see if that's changing and how that differs from traditional solicitations. Dr. Nettles said those with caregiving responsibilities for young children or older parents are not able to submit as many proposals and write as many papers, whereas others have been able to focus on those kinds of activities effectively. There may be a correlation with the demographics checked off on a box at NSF, but it probably doesn't capture the whole picture. Dr. Steig said the faculty are doing fine but the graduate students are not. Since they're not leading the proposals, NSF is seeing that impact directly, but it's there. There's going to be a serious gap in people's readiness to take on postdocs and become principal investigators (PI).

Dr. Marinelli said she saw the same at Oregon State University. It wasn't just getting into the field, it was not being able to get into the lab, not being able to interact with colleagues and the positive feedbacks graduate students need to feel they're making progress. Not having that positive feedback has a productivity impact and an emotional impact. Her university used special scholarships and financial assistance, which typically wasn't available through an NSF grant but through foundation funds and, in some cases, university funds. Ms. Renée Crain said NSF is limited in the information it can share about proposals it receives. But NSF funds research on these kinds of social science questions. In the Arctic social sciences program, seven rapid awards were made to study the impacts of COVID-19 in the Arctic for community health, anthropology, anthropological questions, economics, social psychology and government. She estimated that certain parts of social behavioral and economic sciences are receiving proposals to look at these impacts from COVID-19 on academia and other things. This is something worthy of an NSF grant to better understand these impacts and see peer reviewed publications that can bear out the impacts to caregivers and graduate students.

Dr. Marinelli said the hiring pauses at universities haven't helped. Everyone's trying to dig out and the persistence of COVID-19 and navigating the surprises is prolonging that planning and ability to get back to a semblance of earlier operations. This discussion is helpful in terms of the communities OPP needs to care about and nurture going forward.

Dr. Flanner said postdocs are having a more difficult time finding longer-term career options and he supported lengthening the typical postdoc time by about a year to flush through this backlog of young professionals seeking longer-term options in the sciences. Dr. Quinn agreed, adding that at NOAA she knows of a postdoc who became a mother who left because it was too much stress. Reducing that stress could involve lengthening their terms. Dr. Marinelli said

organizations like the American Council on Education are doing surveys within universities to look at COVID-19 impacts and there will be more research findings coming out, but it's generally not specific to disciplines. Across disciplines the impacts vary widely. Those in Health and Human Sciences doing longitudinal studies are in a different category from those doing fieldwork in polar regions, which are different from those in cinema departments that require interaction on stage to complete their work.

Dr. Mack said there's a now group of students and postdocs set for two years who haven't been able to engage in American Geophysical Union (AGU) or the Ecological Society of America meetings; if they do engage, it's very limited. Other directorates at NSF have done things like incubator type meetings that bring people together in a creative atmosphere that's got moderators, where early career scientists are engaged. She asked if there is a need to turn away from traditional annual meetings towards these more stimulating meetings focused on early investigators to pull together this group of people that has missed out on this critical communication phase. Something for polar and particularly something for Arctic scientists could be powerful.

Dr. Steig highlighted the work of the glaciologist community. The West Antarctic Ice Sheet Initiative meeting, which has been going on for 25 years, is led by early career people and it's getting a lot of participation. They made it a hybrid meeting and have been so successful they worry it's too oriented at early career people and that some senior people are losing out. He encouraged everyone to reach out to young leaders doing that and talk to them about their success.

Dr. Nettles said there was discussion at the last meeting about the danger of losing a couple of years of cohorts who haven't been able to go through the standard cycle. In the undergraduate program at the university now, only the senior class has ever been through a full fall-spring academic cycle. With a typical two-year postdoc right now, people who started two years ago haven't been through any of the normal ways of networking and being at meetings. This discussion touches on ideas of how to bridge people to give them the skills they need to move on. It's undergrads who don't know whether they want to go to grad school and the grad students needing more support and probably more time and the postdocs needing more support and more time, in addition to the faculty. Maybe we've identified a few places where some effort can be focused both by us as community members and within the organization.

Dr. Marinelli said NSF invites COVID-19 impact statements now for tenure and promotion files but possibly not for results of prior support. OPP might want to think about whether to encourage inclusion of information in new proposals about why they are where they are and why they are writing this proposal now, given this backlog of work. It is something to think about as a community and maybe to go back to NSF and ask if this is a logical thing to do. It's recognizing that the COVID-19 impact is not a one- to two-year thing; it is longer term.

## Liaison Update: Committee on Equal Opportunities in Science and Engineering (CEOSE)

Dr. Emanuel

Dr. Emanuel said CEOSE's upcoming October meeting will be its first since the last AC-OPP meeting and he provided some background information about the committee:

- Congressionally mandated advisory committee to NSF (20 members)
- Advises NSF on policies and activities intended to “encourage full participation of women, minorities, and persons with disabilities in scientific, engineering, and professional fields.”
- Biennial Report to Congress – Activities, Progress, Recommendations

He added that the [last Biennial Report](#) was delivered to Congress two years for the period 2017 to 2018. It recommended “increase[d] support for place-based, implementation research projects that are grounded in and engage local communities.” The report highlighted Navigating the New Arctic (NNA) as an example of this work. The 2019-2020 report, “Making Visible the Invisible,” is to be delivered this month. It includes a high-level summarization of some of the data discussed this morning. The new report should be submitted by the end of September.

Dr. Emanuel also reviewed other CEOSE activities:

- Discussions with NSF Leadership on Vision 2030 (National Science Board (NSB) Strategic Plan)
- Discussions with National Center for Science and Engineering Statistics (NCSES) on demographic data and trends for Science, Technology, Engineering, and Mathematics (STEM) training & workforce
- Receive presentations & reports on relevant topics (e.g., COVID-19 impacts, Open Science, Capacity-Building for Minority Serving Institutions (MSI))

## Discussion

Dr. Nettles asked about approaches to supporting scientists especially impacted by COVID-19. Dr. Emanuel said there has not been discussion of recommendations, but these same themes, especially concerning work and life balance during this period, were discussed at length. It is likely these ideas will be distilled into recommendations for the next report.

Dr. Crowell asked about overall progress or changes between the recently published report for 2017-2018 and the one about to come out. Dr. Emanuel said there won't be anything surprising or unusual. Some of the demographic data that are being tracked may not be granular enough to answer questions of interest to the community. For some very small minority communities the numbers are so small that the statistics are suppressed in the summaries. He added that the report does not provide a breakdown by discipline or by directorates.

Dr. Steig asked about making it a requirement for funding that minority serving institutions or people from underrepresented groups are involved. He said this kind of top-down mechanism may be needed to make real progress. Dr. Emanuel said he was not sure if the recommendations in the latest report will address that but there is a focus on inclusive leadership in science and

focusing more on the structures of how these projects are organized and who is and isn't involved in the research in ways that are bigger than how the broader impacts (BI) are construed for that project. This idea of promoting leadership in an inclusive way may start to get to this. Dr. Steig said his idea was explicitly not about BI but about how to involve people in the science and provide opportunities they might not otherwise have. He added that the Subcommittee on Diversity and Inclusion may have discussed this. Dr. Emanuel said more granular data exist at NSF and some of the subcommittee's work is involved with exploring that for disciplines of relevance to this community.

Dr. Nettles suggested parallels with shipboard research outside the polar regions, where there is a focus to make sure teams that lead that work talk about bringing on younger scientists or those from another field who have not been in those kind of leadership positions. Maybe there's a way bridging for postdocs might extend into faculty explicitly taking an approach that helps provide training in those aspects of leadership.

Dr. Marinelli asked about partnerships to build relationships in the community. There are efforts to bring individuals into our field that might not otherwise discover it. This is a field largely born of discovery and the discovery can be remote. Building more structure around that possibility and building longer-term relationships is another way to create opportunity and a scaffolding on which we can expose more people for a longer time to work in polar regions.

Dr. Emanuel said a liaison position that helps facilitate community engagement in research is a promising model and something he has begun to take back to the CEOSE community and elevate as a potential example of a promising practice. This community of research has a lot to share with researchers and other disciplines about how to make that happen. Dr. Nettles said she was excited about the liaison possibility being something Dr. Emanuel is working on with CEOSE.

#### [Liaison Update: Advisory Committee for Cyberinfrastructure \(ACCI\)](#)

Dr. Heimbach

Dr. Heimbach said the Advisory Committee for Cyberinfrastructure (ACCI) advises the Office of Advanced Cyber Infrastructure (OAC), which is within the Directorate for Computer and Information Science and Engineering (CISE) and cuts across all NSF directorates, supporting 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 discussed an example where data sources come in from large-scale instruments that need to be available in real time and accelerate the science you can do with those data.

There are three ACCI subcommittees, all with topics relevant to OPP:

ACCI Subcommittee 1: *Reproducibility and Sustainability*, opportunities:

- Research
  - 2.1 Support research in reproducibility essentials
  - 2.2 Support improved provenance capture and replay
  - 2.3 Support advanced reproducibility testing
  - 2.4 Support holistic approaches to advancing trustworthiness
- Infrastructure
  - 3.1 Enable standardized research delivery
  - 3.2 Promote community software stacks
  - 3.3 Establish a Research Software Engineer career track
  - 3.4 Establish a digital asset management plan
- Programmatic
  - 4.1 Establish reproducibility training and certification
  - 4.2 Elevate reproducibility priorities in project funding and review
  - 4.3 Support specific funding for reproducibility
  - 4.4 Start a working group on reproducibility policies, tools, practices
- NSF-wide
  - 5.1 Establish a reproducibility initiative

ACCI Subcommittee 2: *CI Research and Innovation*

- Theme 1:
  - Robust data harnessing and domain dependent CI prototypes
- Themes 2 and 3:
  - Trust and Explainability for artificial intelligence (AI); Machine Learning across the CI for Science & Engineering (S&E)
- Theme 4:
  - Deeply Network-aware scientific workflow management systems, software-defined cyberinfrastructure and intelligent networks
- Theme 5:
  - New models and paradigms for S&E discovery based on AI; Enabling Virtuous Cycles
- Theme 6:
  - Enabling simulation-based science to fully harness Computing of the Future; novel computational algorithms, languages, programming paradigms

ACCI Subcommittee 3: *Learning and Workforce Development*, deliverables:

- Report Findings: Synthesize, analyze, and summarize the recommendations of the NSF CI Workforce2020 workshop report with other community workforce findings.
- Results of Survey: Based on NSF CI Workforce2020 report and synthesis of community reports, create survey for all NSF-funded PIs to gauge their awareness and needs.
- Recommendations:
  - Highlight references of workforce in the President's Council of Advisors on Science and Technology (PCAST) 2020 report: Recommendations for Strengthening American Leadership in Industries of the Future.

- Provide recommendations on how CI professionals can be included in the skilled technical workers referenced in the executive summary of the report.

## Discussion

In response to a comment from Dr. Nettles, Dr. Heimbach distinguished science at the poles and polar science. Similarly, Office of Advanced Cyberinfrastructure (OAC) distinguishes between supporting the science community broadly with cyberinfrastructure and doing research in emerging hardware and new algorithms.

Dr. Marinelli asked what constitutes limits in CI research. Dr. Heimbach said the ability to increase computational resources has not been paired with algorithms to fully harness new access scale computing capabilities. He spoke of developing software abstracted from the hardware layer to be more portable. This will require attention to algorithmic development that may require complex models to be developed from scratch. Dr. Marinelli said this presents a challenge of training to take on that frontier. Dr. Heimbach agreed, noting that it will require training at the graduate student level but also interaction with professional scientific programmers to develop software that has this abstraction layer to actually harness new computer architecture.

Dr. Loose asked about crypto and the migration towards cheap power where it's easy to cool server farms and whether that industry is at the point where it's driving some of the technology development and whether there is research into library infrastructure that's specific to crypto or whether they're taking advantage of these technologies. Dr. Heimbach said he didn't know but noted the National Center for Atmospheric Research (NCAR) supercomputing facility moved to Wyoming because it was able to cut its energy price but also because of the ability to cool. Improving the resolution of models requires bigger computers and there is an increasing recognition that in 10 years' time, the algorithms and the hardware should be designed in a way that limits the underlying carbon footprint. It might be a good suggestion to look at crypto currency and how it is working this problem.

## Preparations for Joint Session with ACCI

Dr. Pope; Dr. Nettles

Dr. Pope provided a number of definitions of cyberinfrastructure drawn from a literature review and an NSF report<sup>1</sup>, noting that the word can mean different things to different people:

- “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.”

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<sup>1</sup> Stewart et al. 2010 - What is Cyberinfrastructure? What Is Cyberinfrastructure? from “Our Cultural Commonwealth” The Report of the American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities and Social Sciences. Revolutionizing Science and Engineering Through Cyberinfrastructure: Report of the National Science Foundation Blue-Ribbon Advisory Panel on Cyberinfrastructure.

- Cyberinfrastructure is an interoperable and collaborative system incorporating many technologies (advanced computing; storage, networks, and services for data-intensive science; trustworthy, reusable, and sustainable community software and middleware for computation, visualization, and collaboration; digitally-enabled observatories and scientific instruments; robust and reusable data management tools; and more) to provide a coherent end-to-end functionality in support of applications.
- Cyberinfrastructure encompasses the sharing of common resources, functions, and expertise among institutions and disciplines, as well as lowering the barriers to entry for the development, provisioning, operations, and use of (new) applications. (Atkins et al. 2003)
- Cyberinfrastructure comprises both technical and human aspects. This includes training programs, scholarly exchanges, and community organization to enable the productive use, sustainable maintenance, and effective governance of these systems. (Atkins et al. 2003)

Dr. Pope turned next to defining polar cyberinfrastructure:

- Brings the above systems and technologies to bear on Arctic and Antarctic applications. Polar Cyberinfrastructure is / should be embedded in the way polar scientists work, supporting the full range of polar research requirements and goals. Polar Cyberinfrastructure foci are included in the Arctic Research Opportunities and Antarctic Research solicitations.
- The Polar Cyberinfrastructure program collaborates with all NSF Offices and Directorates, including OAC, by aiming to incubate and encourage polar submissions to relevant solicitations across the Foundation, including Cybertraining, Cyberinfrastructure for Sustained Scientific Innovation (CSSI), Harnessing the Data Revolution (HDR), EarthCube, and others.

Dr. Pope said OPP POs gathered to talk about polar CI priorities and ongoing areas of collaboration and developed the following points:

- Importance of terms / using the right language – e.g., data, information, knowledge, wisdom, and more.
- NSF supports computing & data facilities. Further possible resources like CloudBank & distributed computing resource, & others
- In addition to OAC-supported computing facilities, NCAR resources the polar community interacts with include computing, model outputs, code, & more.
- Co-funding on polar-related CI awards has increased from ~\$0.5 million in 2015 to ~\$7 million in 2019 and spiked to ~\$20 million in FY21.
- Transition to a CI-reliant world: connectivity, cloud computing, edge computing, security challenges, and more.

Dr. Pope also discussed arctic data and data sovereignty and how a one-size-fits-all approach is challenging:

- Disciplinary, knowledge systems, international context
- Arctic Data Center is a unique approach in NSF
- Challenge: how to link in with international Arctic efforts in the data space?
- Social science data & Indigenous Knowledge have been somewhat overlooked

- Data sovereignty & Indigenous Knowledge – Collective benefit, Authority to control, Responsibility and Ethics (CARE) principles. How are we using and sharing these data? How do data sovereignty issues fit in our federal data policies?

He also highlighted how cyberinfrastructure can broaden participation in polar sciences:

- How do we get public and students to understand the polar regions when they will not have opportunity to go there? CI tools provide access
- Current Mechanism supporting this: Improving Undergraduate Science Education: Education and Human Resources (IUSE: EHR); Discovery Research PreK-12 (DRK-12); Advancing Informal STEM Learning (AISL)
- Research Experiences: Polar Data in the classrooms; Coding and data analytics; Database access
- Virtual Learning: Virtual Field Trips & Intelligent Tutoring & interactive modules
- Public Engagement: Planetarium Shows; Museums; Telepresence; Current data & research; Virtual tours of polar stations; Virtual reality (gamification)
- Access and equity is the challenge, especially in the Arctic and with rural communities

Dr. Pope turned next to the [Polar Technology Conference](#):

- Bring together: polar scientists, tech developers, state and fed agencies, non-governmental organization (NGO) - looking at challenges impeding polar research and operations
- Originally started in 90's by Antarctic, focused on ops & science support in such extreme environment
- Re-vamped in 2019/2020 and brought in Academia
  - A lot of interest – but it's also everything
  - Comms, technology and resources in engineering spaces, big data methodologies
  - How to make open to everybody but not too broad so as lose a sense of community
  - Consulted with OAC's Kevin Thompson
  - Goal: exposing polar PIs to solicitations and funding opportunities outside of polar.
    - Limited OPP funding opportunities
- Future support needs to be re-examined as it is a lot of work to pull together.

In closing, Dr. Pope reiterated some of the items Dr. Heimbach discussed about the OAC:

- Under the Computer and Information Science and Engineering Directorate
- Supports and coordinates the development, acquisition, and provision of state-of-the-art cyberinfrastructure resources, tools and services essential to the advancement and transformation of science and engineering.
- Supports forward-looking research and education to expand the future capabilities of cyberinfrastructure specific to science and engineering.
- Supports the exploration, development, and deployment of a wide range of cyberinfrastructure technologies within a highly interoperable and collaborative ecosystem.
  - Advanced computing, networks and services for computational and data-intensive science and engineering research



- Trustworthy, reusable and sustainable community software for science and engineering
- Robust and reusable data tools to aid all research communities in their management and use of digital information.
- Supports training programs, scholarly exchanges, and virtual organizations to enable the productive use, sustainable maintenance, and effective governance of these systems.
- Collaborates with all NSF Offices and Directorates to develop models, prototypes, and approaches to research cyberinfrastructure

## Discussion

Dr. Nettles said the goal of the upcoming joint session with ACCI is to accelerate engagement of polar science with the cyberinfrastructure group, particularly in the context of OPP and OAC. She underscored that cyberinfrastructure doesn't only mean you have an interest in this if you are running extremely big jobs on a supercomputer with a vast volume of data or a very complicated model. It also includes the other pieces that have been highlighted. The joint session is divided into sections of data and interoperability and a blue skies perspective, of what we wish we could do and how to relieve pain points, without thinking it is something they already know the answer to or is too trivial. The AC for CI would like to hear from within the domain about what we are trying to do so they can also imagine where they can go to connect with us and be informed by the challenges and opportunities out there.

Dr. Marinelli underscored Dr. Nettles' comments, saying that what AC-OPP members might think is elementary may not be and it is important to develop a common language. This is an opportunity to start developing that language and interoperability with CI. Also, the ACCI is eager to hear what OPP's challenges are because opportunities for innovation.

Dr. Crowell asked about data sovereignty and Indigenous Knowledge being incorporated into cyberinfrastructure and asked for specific examples of what's been done so far and if there is a strong connection to the Arctic Observing Network (AON) or another category of information, which would be ideal for Indigenous place names. The University of Alaska, Fairbanks, is compiling Indigenous place name data sets in the State and they are packed with local information about Indigenous landscapes and Ecological Knowledge. Dr. Pope distinguished social science data and Indigenous Knowledge. From the social science perspective, the Arctic Data Center has a working group, which includes people from the broader community, to discuss how to better serve the social science community and handle social science data and training. Regarding how polar CI is supporting Indigenous Knowledge, that is something it is working on. There has been encouragement for more cooperation between the Arctic Data Center, the Exchange for Local Observations of and Knowledge of the Arctic (ELOKA) project, and the NNA office to amplify efforts and knowledge between different parts of already supported NSF projects.

Dr. Loose asked how EarthCube relates to the CI division and the Geosciences (GEO) Directorate, which has been successful at pushing out technologies and software. They're putting cloud computing into the hands of educators and scientists working with datasets that are scraping the edge of big data. They seem to be the ones with NSF support pushing this forward.

At the same time, progress in cloud computing seems to be coming primarily from private entities. He described using a Python library where the Geographic Information System (GIS) files were previously hosted by an NGO and the NGO became defunct and that broke the Python library. But Amazon Wireless Services (AWS) started hosting those same files. He asked where the majority of the cloud computing capability will be housed, if there will be a dependency on access that those companies provide and if there is discussion within NSF about a nonprofit or public or government-based counterpart to some of the private technologies. Dr. Pope said a lot of the scientific community believes commercial providers are so user-focused that it is easy to onboard and use these tools from the startup. There are lots of other supported computing resources more attractive to more experienced users that are supported by NSF. But there's more of a barrier to get there. Sometimes it's easier when the commercial providers have the data researchers want to use. Bringing together storage and compute is being talked about a lot. In terms of EarthCube, there's a working group with people from OAC and across GEO, including multiple polar representatives, to get a breadth of perspectives. But the future direction has not yet been decided.

### Joint Session with ACCI

ACCI and OAC; AC-OPP and OPP

The joint session to foster growth at the intersection between cyber infrastructure and polar research identified examples of cyber infrastructure solutions in response to science needs and discussed challenges faced by polar science that might be overcome by innovative developments in cyber. During the session's first part, participants offered examples of successful partnership. This was followed by a discussion of NSF-supported CI that might benefit the polar research community. Participants also sought to identify approaches for strengthening links between the two offices. The session concluded with a discussion of next steps.

### Wrap-up and Preparing for Director's Visit

Dr. Nettles; Dr. Marinelli

Dr. Nettles commented that the ACCI seemed excited about and interested in exploring challenges in polar science as cases for their work. There is potential for engaging with them to leverage their expertise and for polar to become better educated as a community to take advantage of CI advances. She referred to the discussion in the joint session about potentially putting together a working group to move forward with figuring out how to get some of these projects off the ground.

Dr. Crowell asked if there is a mechanism for a PI submitting a proposal to get plugged into cyber. Dr. Pope said that when PIs present a one-pager and request to talk about it, that's the stage he would suggest it fits in CSSI or in HDR, for example, but he is open to better ways to handle that. Dr. Crowell said it is not standard for proposers to be asked for that type of summary before writing a full proposal. The question is how people see the possibilities. Dr. Pope added that more information is being included about these other solicitations at office hours, both Arctic and Antarctic, to get people thinking of those possibilities. Dr. Marinelli said they needed something akin to a dating service. Dr. Nettles asked if incubator-type meetings provide exposure to people in different parts of the polar community to expertise from cyber

infrastructure. Dr. Crowell liked the dating service analogy, adding that many first-time proposers don't look at different solicitations to see where their project fits in and don't think broadly about the other connections that could bring a collaboration.

Dr. Heimbach said Research Coordination Networks (RCN) are a compelling route to get a community organized and moving to the next stage with a well thought out proposal. For cross disciplinary, we don't know how we're going to fit and what we're going to do or how we're going to talk to each other and our directorates, but there is a limited amount of funding to get that discussion going. Dr. Pope added that there's a new type of planning grant NSF is rolling out with a new version of the Proposal & Award Policies & Procedures Guide (PAPPG) in the next couple of months that is slightly different from RCN. Dr. Marinelli said if there is a set of questions compelling enough to gather people around, a mechanism can be created to fund it. It doesn't have to fit in any one area. Many of the questions being discussed are likely occur more broadly in GEO and BIO. Having something broader based could be facilitated, although it may not focus on the remoteness of polar, she said, noting the absence of satellites and other kinds of infrastructure. She suggested focusing on problems in polar where real progress can be made and then asking if it is broadly translatable to other parts of science and other parts of NSF.

Dr. Nettles asked Dr. Marinelli to discuss plans for the new Directorate for Technology, Innovation, and Partnerships (TIP). Dr. Marinelli said TIP has a lot to do with what was discussed in the joint session. It envisions things like the convergence accelerator, Innovation Corps (I-Corps), Small Business Innovation Research (SBIR) and public private partnerships. There is a suggestion for three divisions within the directorate. One is about is developing an innovation ecosystem with polar science for how we handle data and information. Another is technology frontiers, with lots about infrastructure and how data are collected and transferred. The other is translational impact, or how the science gets translated into useful things in other sectors.

## Friday, September 24

### Security and International Relationships

Dr. Keiser; Dr. Nettles

Dr. Nettles noted that that previous AC-OPP meetings raised questions about the security of Federally funded research in the context of maintaining dynamic international collaborations, issues related to cybersecurity and the resilience of research activities for scientists engaged with projects in Russia. She introduced Dr. Keiser, the first Chief of Research Security Strategy and Policy at NSF, who was invited to address some of these issues.

Dr. Keiser said she was appointed in March 2020, noting that her position is separate from the Office of International Science and Engineering. Her concern is issues caused by improper foreign government interference, which is challenging for NSF. It requires partnering with others to understand improper foreign government interference. NSF can address what is causing this in

the system and what policies can be put into place to deal with it. She said NSF's science and security goals are to:

- Maintain the vibrant science and engineering community which relies on collaborations both globally and domestically
- Promote the norms, principles, and values of openness, transparency, and reciprocal collaboration
- Balance the open environment with the needs of security
- Better understand the risks, including the scale and scope
- Take action to mitigate risks
- Share knowledge and best practices

Turning to international engagement, she showed the top 25 countries where NSF awards showed international activity in FY '21. China is one of the largest international partners, with 133 awards, following behind Italy (180), Japan (192), France (330), Germany (384) United Kingdom (392) and Canada (439). She discussed the number of awards coded for collaborative international activity, where there is active engagement by that international entity as part of the award, not just an NSF researcher doing research in another country. It is mostly the same top countries. Though the numbers are lower, it is about 30 percent of NSF awards. This is about 12 percent of awards where there is international collaboration.

Dr. Keiser described international collaboration as having the following features:

- International scientific research collaborations with transparent and reciprocal exchanges for mutual benefit
- Leveraging of complementary skills, facilities, sites, and resources
- Exchange of personnel when clear intellectual contributions are identified, and organizational affiliations and sources of funding are transparent
- International collaboration benefits the scientific enterprise

She emphasized this is not improper foreign government interference and is encouraged and stressed that improper foreign government interference does not equal international collaboration

She said research security matters and NSF must make sure the integrity of the research ecosystem is trusted so the research that comes out of it can be trusted. Basic research underpins America's ability to sustain its position as an innovation leader, its economic strength and national security. Also:

- We need to maintain our robust research ecosystem while also recognizing the risks inherent in a changing geopolitical situation
- International collaboration is essential to pursuing the frontiers of science
- Diverse domestic and international talent is a great asset to our research and engineering enterprise

She added that research security is founded in research integrity. Freedom of inquiry and openness and transparency are as important as accountability and honesty. These elements all work together in concert with each other.

Dr. Keiser summarized NSF's research security goals as:

- Research Environment
  - To maintain the open and collaborative research environment.
- Community
  - To foster the vibrant science and engineering community which relies on collaborations both globally and domestically.
- Integrity
  - To promote core norms, principles, and values including openness, transparency, and reciprocal collaboration.

She also outlined the risks to the scientific research enterprise:

- Conflicts of Interest or Commitment
  - Nondisclosure to employer or to funding agency
  - Unmanaged conflicts create risks
- Breaches to Research Integrity
  - Violations of responsible and ethical conduct of research
  - Actions that undermine peer review and funding decision processes
- Threats to National Security
  - Actions that undermine research and related resources threaten U.S. leadership in emerging science and technology
  - Actions that divert research in critical and emerging technology areas to advance potential adversaries' military and intelligence capabilities
- Threats to Economic Security
  - Actions that coopt research and misuse related resources weaken the innovation base and threaten economic competitiveness

There is also risk associated with foreign government talent recruitment programs. She said contracts can stipulate quotas for publications, outside funding, patents and recruitment of other foreign researchers and provided the following definition:

- A foreign government sponsored talent recruitment program is an effort organized, managed, or funded by a foreign government to recruit science and technology professionals or students (regardless of citizenship or national origin).

She also noted that some recruitment programs threaten the transparency, openness and integrity of scientific research by directing or encouraging inappropriate behavior of recruited employees of U.S. academic research organizations. She said there is draft legislation that could prohibit researchers from participating in malign foreign government talent recruitment programs. Another version of the legislation prohibits participation in foreign government talent recruitment programs from four countries. Currently, there is no policy or law prohibiting researcher participation in these programs, if it's disclosed. Some programs require signing contracts that look like employment agreements. They're signed by someone who is a full-time employee of a U.S. institution. Some concerning clauses include the requirement for a full-time employee of the U.S. university to obtain large amounts of research funding for the foreign university, often with a quota on the amount of research funding that needs to be obtained. There's also a requirement to file patents registered to that foreign university, with the number of patents often specified. NSF advises exercising caution before signing such a contract and

coordinating with one's home institution, making sure there is a legal review of contracts prior to signing.

Turning to mitigating risks, she said acquiring and managing a Federal research grant comes with great responsibility. The protection of academic research relies on individuals to uphold core principles and values of the grant-making process. She emphasized:

- Accountability and honesty
  - acknowledge errors and correct behaviors that can call the research into question.
- Merit-based competition
  - ensure a level playing field where the best ideas and innovations can advance.
- Impartiality and objectivity
  - protect against improper influence and distortion of scientific knowledge.

Dr. Keiser turned next to transparency, openness, and fair competition. Disclosure is key and NSF has clarified its requirements to disclose:

- All sources of current and pending support, foreign and domestic
- All current professional appointments outside of the individual's proposing organization, foreign and domestic, including any titled position whether or not payment is received
- Post-award information
- Foreign collaborations in major facilities

She also discussed National Security Presidential Memorandum 33 (NSPM-33):

- Addresses why research security and integrity are important and outlines their key elements
- Establishes federal department and agency roles and responsibilities related to research security
- Contains requirements such as:
  - Disclosure of key information to federal agencies
  - Establishment of a research security program for institutions receiving >\$50M in federal funding

NSF is working on guidelines for implementation of NSPM-33, expected to be completed in November, that provide more clarity on what is meant by a research security program and disclosure.

A companion document to NSPM-33 covers recommended practices to strengthen the security and integrity of America's science and technology research enterprise, which:

- Offers recommendations that research organizations can take to protect the security and integrity of America's research enterprise.
- Emphasizes that research security helps ensure that open international collaboration and foreign contributions can continue to be critical to the success of the U.S. research enterprise.
- Encourages research organizations to demonstrate organizational leadership and oversight, and to manage potential risks associated with collaborations and data.

Research security, integrity and maintaining openness requires the research community, research organizations and the U.S. government to get beyond compliance into thinking about ways to work together, she said.

Dr. Keiser noted the Office of Science and Technology Policy (OSTP) is set to release implementation guidance in November. The guidance will focus on:

- Disclosure Policy — ensuring that federally-funded researchers provide their funding agencies and research organizations with appropriate information concerning external involvements that may bear on potential conflicts of interest and commitment;
- Oversight and Enforcement — ensuring that federal agencies have clear and appropriate policies concerning consequences for violations of disclosure requirements and interagency sharing of information about such violations; and,
- Research Security Programs — ensuring that research organizations that receive substantial federal R&D funding (greater than \$50 million annually) maintain appropriate research security programs.

Regarding actions NSF is taking to ensure the integrity of Federally-funded research, Dr. Keiser listed:

- Creation of new NSF position, Chief of Research Security Strategy and Policy (CRSSP)
- Improved transparency/clarification for disclosure
- Process for reviewing and routing post-award information
- Changes to NSF Employment Requirements and mandatory science and security training for NSF employees
- Risk assessment and analysis
- Communication and awareness with the scientific community
- Coordination with USG interagency partners

Dr. Keiser concluded with a discussion of the next steps for NSF in research security:

- Continue outreach and collaboration with the research community, federal science agencies, and the law enforcement/intelligence community
- Consult with the research community on the type of guidance and tools that might be helpful to put in place for NSF reviewers
- Share and collect feedback from the research community on NSF's enhanced research security policies and procedures
- Develop external training for the academic research community
- Leverage data and analytics to support research security

## Discussion

Dr. Nettles said there's a challenging balance between the fact that most people are not doing anything wrong and should keep pursuing their international collaborations and the few people who may deliberately be doing something wrong, plus the people who may accidentally not be doing the right thing and trying to keep too many people from freaking out and supporting the importance of security so we don't wall off our research.

Dr. Marinelli proposals may include questions as part of the information the PI submits, but the threat assessment is constantly changing, and the average PI is not going to be tuned to the threat of the week. She asked about creating a context in which PIs can provide information. Another concern is asking the community to layer information into proposals to a point where it becomes as much work as developing the proposal itself. She asked how to socialize research offices to be attuned to this when many of them don't operate in this realm.

Dr. Keiser responded that researchers are expected to focus on their research and doing it with integrity. The main risk of concern is some of these talent recruitment programs and the contracts that must be signed. When entering into international collaborations, researchers can ask themselves the questions outlined earlier and make sure they can readily answer them. Disclosure has two aspects. One is the responsibility of the research organization to address potential conflicts of interest, so NSF wants to make sure they have all the information they need to make sound funding decisions. If someone is being funded to do the same work by someone else, we need to know if someone is being funded for nine months out of the year and they're proposing to NSF for nine month's worth of work. So, NSF is not layering on additional requirements, but can do better. NSF is working on being consistent in requirements across funding agencies and in the way that this information is submitted. There is a working group co-chaired by NSF and National Institutes of Health (NIH) looking at harmonization of these requirements. An effort being spearheaded by The Association of American Universities (AAU) to look at ways to put in effect a better common format for submission of proposals.

Dr. Viereggs said NSF has enabled international collaboration in a way that those at the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD) cannot or choose not to, especially with China. We have Chinese collaborators and collaborate in a way that is nice and mutually beneficial. She hopes that as disclosures are more formalized upfront that we don't go to the lowest common denominator across agencies. Dr. Keiser responded that other agencies might have particular restrictions NSF doesn't want and is not interested in restricting international collaboration.

Dr. Keiser said that any requirements or policy changes go out for public comment first and NSF has to respond to all comments. If there's anything that might restrict someone in the community, NSF will change it.

Dr. Bartlett said academia operates in a porous environment where ideas flow freely and whatever measures are put in one research group, the folks down the hall may operate differently. There is an opportunity for ideas that we're developing to seep into other groups and from there to other countries. He asked how to better control that. Dr. Keiser said it was important to distinguish between fundamental research and applied research on technology developments. Fundamental research should remain open, and the results open to everyone, when the researchers are ready. She worries about threats to pre-publication research and data leaks. If there's a formal international collaboration with countries that are competitors and it's in the fundamental research stage, there needs to be clear agreement among all parties that pre-publication research remains within that research group. If it doesn't, that needs to be addressed. A partnership needs to be dissolved if something ends up getting out. There is a different lens for applied work. She said there is a need to use the existing system much better and make it much



clearer. She echoed the JASON group's position that the current system, with export control and classifications, needs to be used better and clarified.

Regarding disclosing funding sources and Dr. Keiser's comments about fairness and an even playing field, Dr. Loose asked if NSF's primary concern is making sure funding is being distributed equitably, or if this is the most effective way to track down IP leakage. He asked about internal investigations on behavior patterns, or the modes of operation that lead to the greatest IP leakage. He also asked about foreign nationals as faculty members, saying it is great to be able to apply to NSF together for funding. But it is not possible to collaborate with the Naval War College with these same Chinese colleagues.

Dr. Keiser said disclosure information enables good funding decisions and the ability to determine if a researcher is committed to other research projects and will not have the capacity to perform. When you sign a contract and a foreign university has the IP rights, NSF needs to watch for that. IP leakage overall in fundamental research is not as much of an issue. But leakage of pre-publication information is an issue. NSF has not figured out how to best contain and control that and has to figure it out with research organizations in the U.S. Dr. Keiser said she is a member of the G7 research, security and integrity working group and is hoping to develop best practices.

Dr. Nettles referenced the [JASON report](#) and the [NSF response](#). She said the report provides a lively description of the history of international collaboration. Dr. Nettles also said more discussion about security is needed at future meetings, including Russia and data openness. Dr. Marinelli said after the forthcoming announcements Dr. Keiser referenced there will be a diverse response from universities with different understandings and capabilities. It would be helpful for AC-OPP members to think about how these requirements will be handled by their institutions and give that feedback to NSF. OPP can track that and make sure the different perspectives AC-OPP provides make it into that feedback process.

Dr. Nettles asked if that can be done through a list of questions or feedback over the coming months and for OPP or another office to take that input and determine who might come to talk with the AC again to discuss issues not covered today, particularly related to Russia and the Arctic ministerial. Dr. Marinelli said an AC-OPP subgroup could prepare a paper on concerns and potential responses re these issues but said that currently there is not enough specificity regarding what how NSF is going to approach this. It might be better to wait until the new directive comes out.

Dr. Nettles agreed and said it should be flagged as an agenda item for the spring. Dr. Marinelli added that there are many individuals who don't understand the security risks they may present or could have the appearance of presenting if, for example, they do NSF work abroad and engage in wide-ranging scientific chats. In many cases they do not report that in their proposal and their university is not tracking their movements to respond to an NSF inquiry. Dr. Nettles responded that many value the fact that their employer doesn't track all their movements. Dr. Marinelli said that's particularly true in the research-intensive institutions where PIs routinely have large blocks of time to do research; having consistency among agencies in approach will be important.

## Prepare for Meeting With the NSF Chief Operating Officer and Chief of Staff

Dr. Nettles; Dr. Marinelli

Dr. Nettles and Dr. Marinelli led the AC through the process of developing a list of discussion topic to pose to the NSF COO and Chief of Staff during their upcoming appearance before the committee.

## NSF Chief Operating Officer and Chief of Staff

Dr. Marrongelle; Mr. Stone

Following Dr. Marinelli's introductions, Dr. Marrongelle said the NSF Director, Dr. Sethuraman "Panch" Panchanathan, regrets he cannot attend. She and Mr. Stone expressed their appreciation for the AC's work, following which Dr. Nettles called on AC members for their comments and questions.

Dr. Heimbach recapped the joint session with ACCI and asked about the emerging funding models to work, for example, with commercial providers to enable access, which, if done well, leads to democratizing data access and data analysis to a broad range of the community at their universities. Dr. Marrongelle responded that NSF program solicitations include opportunities to partner with nonprofits and private industry, including in data analytics. This would fall within the realm of what TIP can help accelerate and move forward with new funding opportunities. She encouraged the AC to think about where existing funding opportunities fall short and where there is a need for something more specific, whether a program or a change to existing policies, to encourage more partnership on the analytic side for the democratization of data.

Dr. Nettles added that the AC has been focusing on an effort to enhance diversity and equity and inclusion in the polar sciences, with a subcommittee now working on a report. One of the goals is to identify and recommend strategies for OPP to enhance diversity and inclusion in the polar sciences in the near and the long term. Dr. Crowell added that the subcommittee is characterizing the current state of diversity in the NSF-sponsored research community to examine existing efforts and identify and recommend new programs and reviewed some of the topics the subcommittee is looking at, noting that it expects to have a draft report in the spring.

Dr. Marrongelle said diversity and inclusion have always been a bedrock at NSF and more recently it has been cementing its work in this area. The NSF's Missing Millions has ignited NSF to coordinate activities across the foundation. She expressed appreciation for including and working with MSIs. GEO has been supportive of Inclusion across the Nation of Communities of Learners that have been Underrepresented for Diversity in Engineering and Science (INCLUDES) and there are fantastic programs within GEO that have focused on broadening participation in the geosciences. The Directorate for Social, Behavioral, and Economic Sciences (SBE) has a [Build and Broaden program](#) that is looking to build capacity at MSIs in the social, behavioral and economic sciences. Also, the Directorate for Education and Human Resources (EHR) has programs that work with Tribal Colleges & Universities (TCU), Hispanic Serving Institutions (HSI) and Historically Black Colleges and Universities (HBCUs). There may be opportunities there to partner and connect. Mr. Stone said there are at least four executive orders

NSF is responding to will flow down for things we do with the research community. He added that it is helpful to identify barriers NSF can focus on.

Dr. Steig asked what NSF is thinking about doing that is specifically oriented to helping all universities address diversity, not just MSIs. Dr. Marrongelle said CEOSE uses the term Invisible Millions to address that. MSIs support students in ways that don't always happen at predominantly white institutions. And CEOSE has pointed out that it is not that we are missing students in the pipeline, but they are invisible on many campuses. What NSF has been doing to help institutions meet the visions they have around diversity, equity and inclusion has been a central topic of conversation within NSF, as well as what we need to be doing differently, along with the responsibility of the institutions. There are programs like ADVANCE, which is focused on creating an environment where women in the sciences can thrive on college campuses. That program has also evolved to focus on underrepresented minority females and there are some nice success stories. This is where NSF needs to collectively do more thinking about what happens when NSF funding ends. On many campuses the work in diversity and inclusion happens in the fringes of our budgets. The next step is taking on the hard conversations on our campuses about what we stop doing so this work is central.

Dr. Nettles asked about the possibility of a NSF-wide assessment of effective approaches, beyond programs like INCLUDES and Geosciences Opportunities for Leadership in Diversity (GOLD). Dr. Marrongelle responded that NSF is doing this and said there will be more coming out over the next several years that brings together what has been learned, with a consistent, consolidated communication plan for getting that information out.

Dr. Vieregge asked about security and international collaboration. Getting the science done in many fields, especially for OPP, requires international collaboration. At some other agencies, the policies and the way things are set up, stifles international collaboration in a way that damages the science. She expressed hope that NSF continues what it's doing and that the science doesn't get lost. Dr. Marrongelle assured Dr. Vieregge that international collaboration is very important to the director and everyone else and NSF will continue to emphasize that in the years ahead and is not backing away from international collaboration. It is, she said, a tension point for everyone.

Dr. Stammerjohn said polar science is inherently international and needs to rely on international collaborators with regards to logistics and asked how, in the era of increased security, logistics will be evolving in that realm. Mr. Stone responded that NSF's position is that it's not an either/or, it's all the above. Both domestic and international talent are needed, and NSF and the administration are committed to continuing all international relationships. Security concerns are more about disclosure and making sure people are being upfront about the things they're doing. NSF continues to have active collaborations with China. NSF's focus has been on activities concerning to people and not have it constrain logistics collaborations. NSF is trying to keep the focus on education and partnering with institutions and not get into the position where program officers do enforcement. We need international partnerships to do the large-scale work we do in Antarctica and all over the world and we're committed to that.

## GEO Assistant Director Updates

Dr. Isern

Dr. Isern said NSF is very fortunate re the FY '22 [budget request](#) to Congress and she provided the following highlights:

- The budget requests \$10.17 billion for NSF, representing a 20% increase to:
  - Enhance fundamental research and development;
  - Address racial equity in science and engineering;
  - Address climate science and sustainability research;
  - Strengthen U.S. leadership in emerging technologies; and,
  - Construct additional major research facilities.

The increase is historic for the agency. It will put NSF in a different category of agency, with shifts in expectations in accountability. The geosciences increased about 19%. TIP has been approved by the House and the Senate. Elements from the Directorate for Mathematical and Physical Sciences (MPS), Computer and Information Science and Engineering (CISE) and the Office of Integrated Activities will move into the new directorate, GEO had a small part of a program that will move. She said \$500 million is being put into TIP, plus \$364 million that has been moved around for a total of \$864 million.

Dr. Isern outlined GEO's FY '22 budget themes:

- GEO is an important contributor to national research priorities of:
  - Climate Change
  - Racial Equity
  - Recovery from the pandemic

Drilling down on the points above, she began with the climate change budget theme, noting that the agency's budget increase was in large part for climate.

- GEO's U.S. Global Change Research Program (USGCRP) investment themes:
  - Ocean's Role in Climate Change and Climate Solutions
  - Terrestrial-Climate Interactions and Water Sustainability
  - Cryosphere and Climate Change
  - Forcings and Feedbacks
  - Earth System Predictability and Resilience
- Strategies and Approaches:
  - Long-term investment in research and infrastructure
  - Coastlines and People (CoPe) and NNA
  - Interagency partnerships
  - Cross-Directorate efforts - CISE Climate Modeling, TIP
  - NSF-wide Climate Change Coordinating Committee (C4)

Dr. Isern added that FY '22 sets the stage for some big, bold ideas that will hopefully be put into place in '23 and beyond. CoPe and NNA will continue, and GEO will be looking at how to augment them. Interagency partnerships will be critical. There has been a lot of cross-directorate discussion and all directorates have a footprint in climate and clean energy. C4 has done a lot of work assembling white papers framing where NSF can go in the climate space.

- Climate Change Coordinating Committee (C4):
  - Anticipate healthy FY '22 budget for climate change research
  - Knowledge to action on a decadal scale with holistic view of Earth System
    - Foundational Research on Climate Change
    - Mitigation and Adaptation
    - Impact, Risk and Resilience
    - Observations and Modeling
    - Cultural Transmission of Climate Change Beliefs

Next, she highlighted racial equity, a critical budget theme in GEO. There is a strong justice, equity, diversity and inclusion group well integrated with activities on the NSF level, such as INCLUDES, but with some specific GEO-led programs:

- Racial Equity Budget theme
  - Removal of barriers to participation in the geosciences
  - GOLD
  - Improving Undergraduate STEM Education: Pathways into the Earth, Ocean, Polar and Atmospheric & Geospace Sciences (GEOPaths)
  - New activity on climate change and social justice to build diverse and inclusive research ecosystems that focus on institutional transformation on inclusivity

Another budget theme is recovery from the pandemic:

- Help the academic community recover
- Resumption of field campaigns
- Research support (Rapid Response Research (RAPID)/ Early-concept Grants for Exploratory Research (EAGER))

Dr. Isern also touched on recent investments, including a just released announcement for \$29 million in research hubs for studying coastal hazards through the coastlines and people program.

- Research Hubs to study coastal hazards and find new solutions
  - CoPe
- Science and Technology Centers to Address Critical Societal Problems
  - Center for Oldest Ice Exploration (COLDEX), OPP
  - Learning the Earth with Artificial Intelligence and Physics (LEAP), Division of Atmospheric and Geospace Sciences (AGS)
  - Center for Chemical Currencies of a Microbial Planet (C-CoMP), Division of Ocean Sciences (GEO/OCE)
- Convergence Research for Grand Challenges
  - NNA

Turning to the recently released U.S. National Academy of Sciences, Engineering and Medicine (NASEM) study, Next Generation Earth Systems Science at the National Science Foundation, Dr. Isern highlighted its recommendations:

- Create
  - Create sustained next generation Earth Systems Science initiative that furthers scientific understanding of the Earth's systems and supports solutions to Earth systems-related problems.

- Remove
  - Remove barriers to convergence research, including facilitating engagement with stakeholders and building transdisciplinary teams.
- Integrate
  - Integrate diversity, equity, inclusion, and justice in all aspects of next generation Earth Systems Science, including determination of research priorities, evaluation of research activities, and workforce development.
- Promote and support
  - Promote and support collaboration, instrumentation, cyberinfrastructure, and data-sharing activities among facilities for production of convergence research for next generation Earth Systems Science.
- Provide
  - Provide leadership in the computational revolution by expanding resources (e.g., hardware, software, data analytics, and skilled workforce) and ensuring equal access to them.
- Promote and support
  - Promote and support development of the workforce for next generation Earth Systems Science, including undergraduate and graduate students, scientists, and engineers looking to engage in convergence research.

She encouraged AC members to view the [full report](#).

The fall AC-GEO meeting, October 13-14, will focus on diversity, equity and inclusion, with a presentation from the lead investigator for Unlearning Racism in Geoscience (URGE). The other focal point will be a learning agenda framed around the NSF strategic plan, with four high-level questions. From that, 10 other areas of focus are being looked into. She said this is well connected to the Office of Management and Budget (OMB), which wants to hear more stakeholder input around this learning agenda. One of the questions in that learning agenda is:

- What are the characteristics of NSF’s portfolio on climate change, and to what extent might this portfolio advance NSF’s goals of equity, discovery and impact?

The exercise will provide critical data-driven input from the AC Advisory Committee that can feed back to OMB.

Dr. Isern concluded with a list of upcoming funding opportunities:

- October 18 NSF Graduate Research Fellowship Program (GRFP)
- October 20 Paleo Perspectives on Climate Change
- November 03 EAR Postdoctoral Fellowships (EAR-PF)
- November 12 Ocean Sciences Postdoctoral Research Fellowships
- December 06 CoPe
- December 08 Industry-University Cooperative Research Centers Program (IUCRC)
- February 02 Frontier Research in Earth Sciences (FRES)
- February 07 Mid-Career Advancement (MCA)
- February 07 Office of Polar Programs Postdoctoral Research Fellowships (OPP-PRF)

## Discussion

Dr. DeGrandpre asked if different criteria are being used for RAPID and EAGER for COVID-19-related issues. Ms. Renée Crain said supplements to existing awards were used and there were some specific codes to track COVID-19 impacts and there were a number of RAPIDs in the arctic social sciences program to address that emerging situation. Dr. Isern said for her part there was a lot of tracking to report back on investments. Dr. Mercer said she was not aware of any changes in the mechanisms or the criteria.

Dr. Bartlett asked about how researchers can best prepare for TIP and better translation of their work to societal impact. Dr. Isern said there will be information soon about how to be best positioned, but there will be multiple entry points, from workforce development and training and through investments in translation and innovation. More information will be available at the next meeting, she said. Regarding programs moving to TIP, which Dr. Bartlett also asked about, Dr. Isern said she can prepare a list.

Dr. Nettles asked for an update on the assessment underway of where OPP fits into the NSF structure. Dr. Isern assured the AC that no one thought OPP was doing a bad job. OPP has specific expertise that isn't well held at the rest of the agency. With a lot of leadership changes happening, it was a good time to do an assessment of how to better integrate OPP and OPP science because all disciplines are covered in OPP. The process is beginning to start framing what those outcomes will be. It's going to be a nice outcome and a place to get in front of the director how outstanding OPP is. No one before has looked at finding the optimal construct.

## Antarctic Research Vessel (ARV)

Mr. McGovern; Dr. Stammerjohn

Mr. McGovern said that after more than two years of development and much dialogue, the ARV proposal was finally submitted to the director for approval. Due to strong support from leadership at all levels, ARV was admitted as the conceptual design phase of the Major Research Equipment and Facilities Construction (MREFC) process on June 2. He also listed other major milestones:

- May 28, 2021 – Committee on Radio Frequencies (CORF) recommendation to advance ARV to the Conceptual Design phase
- June 2, 2021 – NSF Director approves ARV advancement
- July 1, 2021 – Mike Prince hired (Intergovernmental Personnel Act (IPA) assignee) as ARV Project Manager (50%)
- August 18, 2021 – 100% Conceptual Design Review (CDR) Project Execution Plan (PEP), ARV Performance Specification and General Arrangements (drawings) delivered to NSF
- September 20-23, 2021 – Conceptual Design Review

Leading up to the final submittal and approval of the ARV proposal, some key modifications were made to the requirements. After outreach to the science community to assess demand for

some elements of the ARV, some significant cost driving elements were eliminated from the proposal. Mr. McGovern listed these and other noteworthy changes:

- AC Subcommittee Report
  - NSF: Elimination of helicopter deck and moon pool
  - Threshold vs Objective requirements
- Operational Model discussion
  - Commercial Contractor-operated
  - University Contractor-operated
  - Cooperative Agreement
  - Other approaches?

Mr. McGovern said three key performance parameters that the new vessel must have were identified:

- The capability to independently break ice (> 4.5 ft at > 3 kts (Polar Class 3))
- Maximum endurance without replenishment (> 90 days underway)
- Provisions for messing, berthing, sanitation, and scientific workspaces (Crew and > 55 science and technical personnel)

He also discussed other requirements the ARV must have:

- Maximum vessel draft to allow for docking at Palmer Pier
- Capacity to transfer 60kgal Antarctic diesel to Palmer Station
- International Maritime Organization (IMO) Polar Code Compliant
- Accommodate > 15 standard 20' containers
- Full science operational capability in 4-8' seas (SS4)
- Routine underway operations 8-13' seas (SS5)
- Underwater Radiated Noise meets modified ICES 2009 criteria

Mr. McGovern said a Conceptual Design Review (CDR) was held to examine readiness to advance to the next design phase and he provided the panel membership:

Ms. Pam Clark - Chair

Senior Project Manager, Woods Hole Oceanographic Institution

Project Management Sub-Group

- Dr. Paula Bontempi - Lead
  - Dean, Graduate School of Oceanography
- Mr. Nick Browne
  - RSV Nuyina Project Manager, Australian Antarctic Division
- Capt. Doug Russell, USCG (ret)
  - UNOLS Executive Secretary, University of Washington
- Capt. Tim Schnoor, USN (ret)
  - Office of Naval Research – Contract Support
- Dr. Sharon Stammerjohn
  - University of Colorado & OPP Advisory Committee member

Technical Sub-Group



- Mr. Stewart Lamerdin - Lead
  - Director of Marine Operations, Virginia Institute of Marine Science
- Mr. Jeffrey Koleser
  - Senior Ship Concept Manager/Advanced Surface Ship Concepts, NAVSEA
- Dr. Amelia Shevenell
  - University of South Florida
- Mr. Randy Sliester
  - Ship Operations Manager, British Antarctic Survey (BAS)

The CDR panel considered technical design, scope, cost, and schedule for the baseline risk management. He said it is premature to discuss any outcomes from the panel, which is still working on its final report, which is due October 8, following which the NSF ARV team will provide an additional review and documentation to GEO leadership and ultimately to the Office of the Director. A Facilities Readiness Review Panel will examine the CDR report and determine whether a recommendation will be made to advance the project to the preliminary design phase, and the Director would make the ultimate determination. The Facilities Readiness Panel is scheduled for November 15 with work hopefully beginning on the preliminary design phase by mid-December.

Moving forward, each design phase has new requirements, new levels of development for the project execution plan, more advanced vessel designs and more detailed vessel designs. Though there is still a long road, there has been fantastic progress this year.

#### Discussion

Dr. Loose asked about the operational model and how the design is proceeding agnostic to the operational model and whether this process is still conceiving of a possible business model where the private contractor builds the vessel to the design specs set out by NSF or whether it's true that because this is moved to the MREFC design stage, eventually NSF is going to request a budgetary allocation for the construction and then the operation part is separate. Mr. McGovern said construction funding would come from Congress and would be a line item through the MREFC budget. OPP would continue to cover the operational costs will cover the costs of development through the different design stage gates. The operational model, regardless of how it's ultimately determined to be operated, whether a university or commercial company, that will come out of operations and maintenance. As to potentially leasing a vessel, it has been determined NSF will be the owner of the vessel.

Dr. Loose also asked if the moon pool and helicopter deck are officially removed from the design and Mr. McGovern said they are. Regarding the moon pool he said the ship must be built around that feature. It's a significant cost driver and the community did not support its inclusion. Dr. Loose said the helicopter deck is a big change to the operational capabilities of the of the vessel and its ability to stage and, potentially, navigate. He said there are many examples of how icebreakers use helicopters. Mr. McGovern said the Nathaniel B. Palmer R/V has a helicopter deck and said supporting helicopters requires hangars large enough to house two helicopters because of the requirement to self-rescue and specialized aviation fuel tanks and fire suppression

systems. Each helicopter cruise adds an extra million dollars or more to the cruise. With the lack of use and the infrastructure and maintenance required there wasn't a strong enough case for it. However, the helicopter platform has evolved to an unmanned ariel vehicle (UAV) platform. UAVs are a growing tool in the Antarctic. He also confirmed for Dr. Marinelli that the helicopters in McMurdo can't fly over water but added that he works with the Department of Interior to make sure there's qualified pilots and that helicopters are outfitted to work over water.

Dr. Stammerjohn said the science mission requirements and the critical parameters were thought about within the context of what's driving the science, particularly in Antarctica and where we need to go. She said it is encouraging the icebreaking capability is going to be able to go deep into the Ross Sea, the Weddell Sea, the Amundsen Sea and to East Antarctica. She also asked about ship and station support before the ARV comes online. Dr. Marinelli said she is concerned about going down to one vessel. There's the issue of supplying Palmer Station but there's a lot of potential research in the areas where the Gould has traditionally been able to trave that are still in high demand. She worries that not signaling concern will signal to the community that the door is closed on that. She said OPP needs to focus strongly on solutions for supplying Palmer station. There will be ice strengthened vessels coming into the fleet through the regional class RV program. They are not strengthened to the extent the Gould is and there remains the issue of the cost of transiting and how those other vessels are tasked. OPP will start looking at potential solutions in the very near future and looking at opportunities that come through the new emphasis on climate change for other opportunities that can be leveraged. We wouldn't want just one vessel to look at all the problems in the Pacific or the Atlantic and we need to think similarly about the polar regions, particularly given national security interests.

Dr. Bartlett asked if the ship will have a walk-in cold room and access to a walk-in freezer. Mr. McGovern said the 2019 subcommittee report recommended walk-in freezers and it is being factored into the conceptual design. But moving forward, the goal is to continually engage with the community and users and make sure the requirements are appropriate. Dr. Bartlett also asked about the choice of propulsion considering the environmental impact. Mr. McGovern responded that the door has not been closed to different types of propulsion or power systems, including hydrogen. But fuel source availability and the ability to maintain these systems must be considered, as the ship is working mostly out of South America.

Dr. Loose asked if the glaciology community or the experiences of the Information and Telecommunications Technology Center (ITTC) program have revealed anything about how to stage logistics when working intimately with ocean icesheet interactions and if the loss of helicopter capabilities will impact that, given that programs might be a potentially important component of future research. Mr. McGovern said ARV anticipated operating approaches include supporting field camps and installations of remote on-ice and iceshelf work. We are thinking in those terms, he said, but we've only done four helicopter cruises on the NBP. There are other mechanisms to continue supporting remote fieldwork on the ice shelves. BAS has a new ship, the RRS Sir David Attenborough, an enormous science and logistics vessel to supply five stations in the Western Antarctic and NSF is close partners with them. If there were a logistics need to support a camp like that, or field like that, in many ways that's like what we're doing with the Thwaites Glacier project. They're providing some remote field support while

we're off doing the science expedition on the NBP. So, there are there enough opportunities to collaborate that we'll be able to support the demand, either ourselves or through partnerships.

Dr. Nettles said she also questioned the decision not to include a helicopter deck: one of the most valuable things for glaciology work has been to be able to get the helicopter close to a glacier where the only way you can get onto the glacier surface is with a helicopter. But she also acknowledged the issues of cost and usage.

Dr. Steig said lack of helicopters is not the particular issue for the Thwaites glacier project, it's the weather and there's equipment they have been trying to get there that could not get there by helicopter. He also said NSF cannot support the demand. Demand is lessened because NSF can't support it. This goes back to how many ships are needed. He estimated that half the major discoveries that involve researchers in the Antarctic, when it comes to fringing ice shelves and so on, have required international collaboration and that's also true of the British who have worked with the Koreans. Dr. Nettles said there are things researchers want to do but if it adds another million dollars per cruise, it's hard to coordinate that in a way that you get the helicopter on there and then have the dozen investigators be able to use it, so it is worth thinking about from both of those directions.

Dr. Loose asked if the million-dollar cost is just if you choose to staff the vessel with pilots and so on, but not for the deck itself. Mr. McGovern said cost was for chartering two helicopters, pilots, maintenance, personnel, fuel, etc. In response to a question from Dr. Nettles about the day rate minus helicopters Mr. McGovern said for his office it is an annual rate and it would be a premature estimate. Dr. Nettles said a chat comment noted a deck requires annual maintenance and inspection.

## Risk Management and Education Strategies

Ms. Renée Crain

Dr. Nettles added a discussion of risk management as an agenda item and asked Ms. Renée Crain to provide an update to the AC. Ms. Renée Crain said OPP takes the risks of polar fieldwork very seriously and has robust risk management practices within the Arctic and the Antarctic. But engaging with the research community proactively is one of the best ways to mitigate those risks. In 2014, the Arctic had a workshop with station operators, researchers, graduate students and other Federal agencies to talk about Arctic field safety risk to generate a community of practice. OPP wanted to continue and make it more of a polar discussion and the hope is to have another in-person meeting with researchers from the Arctic and the Antarctic, including contractors and other stakeholders in field safety risk management. In the meantime, there are to be mini workshops that might feed into a larger workshop. The first topic is crevasse safety risk management for projects that either move through or conduct work in crevasse areas. She said that Dr. Crowell and Dr. Nettles participated in the 2014 workshop and have championed continuing this discussion and others on the AC are encouraged to contribute ideas or be part of organizing committees. She outlined the virtual workshop held in June:

- NSF Co-Sponsors: Jessie Crain, Renee Crain, Jennifer Mercer
- Organizing Committee: Alison Banwell, Zoe Courville, Kate Koons, John Stoddard, Martin Truffer, Lizz Ultee

- Expert Presenter: Steve Smith, Experiential Consulting LLC “Near-Misses are Telling you Something – Are you Listening?”
- Workshop Discussion Topics:
  1. Standard Operating Procedures and Lessons Learned from Other Programs
  2. Team Makeup/Diversity/Democratizing Power
  3. Staffing/Certification/Insurance/Liability
  4. Culture of Safety in Polar Programs
  5. Improving Risk Management in OPP
- Workshop report in draft, will be shared fall 2021

This workshop covered standard operating procedures used in both polar regions and lessons learned throughout the program. Topics included how teams are constructed, whether there should be a vetting process, staffing, certification, insurance and liability. The culture of safety, changing the culture toward a more proactive, open and engaged discussion around working in crevasse regions, with an opportunity for participants to provide recommendations to NSF. There was discussion about different kinds of training and better sharing of information across research teams, moving away from the model where the PI is a single point at the apex of the project, where they have all the information and access to the tools, instead creating a flatter structure where everyone feels empowered to discuss or raise concerns about safety and everyone’s learning and sharing information. A final report is to be finished this fall. More mini workshops can be done on other topics such as small boat use, wildlife encounters in the field and other broadly applicable topics.

Ms. Jessie Crain said it was exciting to bring a diverse group of participants together and interesting to hear from Arctic and Antarctic participants and to bring in field guides and safety experts to understand some of the good practices and how everyone can learn from those, which is important because the field teams can be isolated. The forthcoming report will hopefully have recommendations for how the office can help better support the community of researchers.

Dr. Mercer said safety is an important topic for her and she comes at it from her role overseeing field work on the Greenland ice sheet and having conducted research in highly crevassed areas in Greenland and Antarctica. Researchers can and do conduct research safely in this type of environment. That rightfully comes into question whenever there’s a tragedy. The community has lost two well-known colleagues, who she said were both close colleagues and friends of hers to crevasse accidents in the last five years. The goal is to perpetuate the conversation, create a community of practice and develop standards of practice to keep everyone safe. With ice sheet degradation migrating inward, there are research groups who’ve never had to consider crevasse safety in the past. Also, expanding the research community through different initiatives, there is a need to make sure the discussions and the lessons learned are at the forefront of planning.

## Discussion

Dr. Nettles, who said she participated in the workshop, noted that much of the discussion was quite general about approaching risk in fieldwork before we go there, including work with universities and the culture of risk management. Much of the discussion could have been ported

somewhere else and would come up with small boats, etc. That would be an interesting aspect to track moving forward.

Dr. Stammerjohn asked about international collaborators, noting that, for example, BAS uses a different model and asked if there are different models being discussed. Also, she asked if a safety officer or an expert in crevasses is contracted through NSF or the awardee and if there was discussion about a hybrid type. Dr. Mercer said there were a few participants from Denmark because of their collaborations on the Greenland ice sheet. Ms. Jessie Crain said there were no representatives from BAS, though there were individuals who have worked with BAS. Dr. Nettles added that there was discussion of those models and hopefully that will be in the workshop report. Ms. Renée Crain said the goal was not to set a hard and fast rule or develop a singular policy but a chance to talk through the pros and cons of different approaches and when one might be more appropriate.

Dr. Nettles said there are questions on the table about working with university risk management offices and the challenges there and expressed her hope that the AC can come back to that.

Ms. Renée Crain said it was important to also highlight the use of technology and other resources like imagery to aid risk management and capacity areas.

### Sub-Committee Update

Dr. Hayden

Dr. Hayden, co-chair of the Subcommittee on Diversity and Inclusion, began with the subcommittee's charge:

- Characterize the current state of diversity of the NSF sponsored polar research community
- Examine efforts by NSF and others to enhance diversity and inclusion
- 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.

To that end, the subcommittee organized a number of supporting efforts:

- OPP works with the sub-committee to arrange and host a series of learning activities regarding a number of past and present NSF sponsored efforts aimed at increasing diversity and inclusion.

The subcommittee members are:

- Dr. Linda Hayden, Elizabeth City State University
- Dr. Gretchen Hofmann (Co-Chair), University of California Santa Barbara
- Dr. Ginny Catania, University of Texas at Austin
- Dr. Aron Crowell, Smithsonian Institution's Arctic Studies Center
- Mr. Steve Iselin, Iselin Consulting Enterprise, LLC
- Dr. Ginny Catania, University of Texas at Austin
- Dr. Ryan Emanuel, North Carolina State University
- Dr. Amanda Kelly, University of Alaska Fairbanks

- Dr. Vera Kuklina, George Washington University
- Dr. Herb Schroeder, Alaska Native Science & Engineering Program
- Dr. Anne-Marie Nuñez, The Ohio State University
- Dr. Eric Steig, University of Washington
- Dr. Anne Todgham, University of California Davis
- Dr. Marta Torres, Oregon State University

Dr. Hayden said the subcommittee met with Dr. Marinelli, who suggested a focus on recommendations. Next, she discussed the learning activities she noted earlier, emphasizing those held since the last AC-OPP meeting:

- Learning Activity 7: Culture & Community
- Learning Activity 8: Indigenous Knowledge & Co-Production of Knowledge
- Learning Activity 9: Ensuring equity in incorporating Indigenous Knowledge into research: Best practices from Alaska

She added that these activities included considerable expertise from outside the community.

Dr. Crowell continued the presentation to discuss the final report structure:

- Broad diversity, equity and inclusion (DEI) challenges in STEM education, university and graduate training, OPP grant applications and awards, participation in research, fieldwork experiences.
- What we hope to accomplish: review, recognition, innovation
- Situational analysis of DEI in the polar disciplines (e.g., social, biological, earth, and physical sciences); each has particular issues and opportunities for NSF engagement.
- Role of MSIs, HBCUs, Indigenous, and professional organizations in bringing students into polar fields
- What we can learn from existing DEI initiatives at OPP and other directorates: goals, strategies, outcomes, feedback from participants, measures of success
- Consider Arctic, Antarctic, and wider NSF programs such as INCLUDES, JEDI, Research Experiences for Undergraduates (REU), graduate fellowships, Geoscience Opportunities for Leadership in Diversity - Expanding the Network (GOLD-EN), Geopaths, Arctic Community Engagement and others
- Recommend ways to expand or revise existing programs
- Suggest new directions, ideas, and programs based on perceived issues and opportunities
- Recommend timely and immediate actions as well as long-term strategies

Dr. Hayden resumed the presentation to discuss some ideas the subcommittee has generated:

- Overall, work to address culture in the field (e.g., feeling safe)
- Expanding funding opportunities to include a Broadening Impact Solicitation
- Intentional inclusive recruitment of future OPP participants, emphasizing entry points
- Developing partnerships (e.g., with MSIs and Minority Professional Organizations)
- Enhanced field training opportunities
- Intentional work to create community, something that might differ for the Arctic and the Antarctic

- Resources for PIs and the OPP community. Preexisting platform for PIs (especially new PIs)
- Improvements in tracking and reporting (BI)
- Establishment of an OPP Diversity office
- Connections to/Respect for people in Arctic and including other knowledge systems
- Highlighting BI models/examples that are successful (e.g., GEO)

The subcommittee has changed its schedule and will now meet Mondays at 4:00 pm. Eastern Standard Time on a weekly basis. Dr. Hayden also highlighted the National Technical Association, which she said is probably the oldest minority professional organization that assists HBCUs and the geosciences. She also discussed the Museum of African American Technology's Science Village and a virtual cruise to Antarctica from November 26 to December 14.

#### Discussion

Dr. Hayden responded to a question about retention by saying it is important to articulate a pathway for students, so they know the next step and prepare for that. The entry points are like a watershed, they enter at some point and settle for a while where they can be nurtured and contribute and then maybe move on to the next place where they can continue to grow and be nurtured and contribute. There should be an emphasis on retention and continued mentoring and fostering their development.

Dr. Nettles asked about building those nurturing points in the most effective way. Faculty tend to tell their undergraduates to do graduate work at a different institution. But it takes a long time for some students to get comfortable with where they are and feel safe and build the relationships they need to succeed. She asked about modifying standard advice and practices to be more supportive and inclusive, particularly for students from a background that hasn't had the same kind of assumptions and support built in that you have if you've gone on a standard pathway and look like most people already practicing science.

Dr. Hayden stressed letting them know from the beginning that this is a career path for them, not just a summer internship where they can earn a few dollars, that it is a steppingstone to something bigger. Most of the students are looking for a career path where they can apply their talents. She said it is important to approach it as a first step and show them the next step, after that internship, and make them feel part of a welcoming community.

Dr. Steig said the NSF graduate fellowship is three years, but some people take longer to get used to things. He asked why it can't be five years, to help retention, and said he would try and insert such language in the recommendations. There are also other similar things to help retain people in graduate school and retain faculty. He asked how many years after a minority faculty member gets tenure do they suddenly get considered by NSF to no longer be early career and no longer get the attention they were getting just a year earlier.

Dr. Crowell emphasized how slow progress has been and how there's a long way to go. But there is the opportunity at OPP to make a difference, going back to undergraduate levels or before to get students engaged in polar research. He supported Dr. Steig's suggestions and agreed with Dr.

Hayden this this is a career path where you can be successful, and it is the way OPP can make more of a difference.

Dr. Marinelli emphasized the retention problem and said there is also an entrainment problem. Some of that relates to not getting exposure to fields in your formative years that are fundamentally outside of what a K-12 education would offer. The degree to which we get exposed to that has a lot to do with where we grew up, socioeconomic backgrounds, and so on. Part of the charge is to create an environment where entry is easier. There is a mentality at times of putting up bars for people to jump over to get to the next stage. There's a cultural transformation science itself needs to undergo to be more inclusive.

Dr. Nettles added that some universities are looking at the way course requirements are formulated because particular courses seen as gatekeeper courses tend to keep people out rather than bringing them in. There is work showing that if you just let people in, you don't see a difference in performance based on who got through those gatekeeper courses. It also starts earlier. In some systems, geosciences in K-12 are seen as remedial science. She asked whether the committee has thought about the way students are admitted. It is important to have a cohort instead of one person from an underrepresented group. She asked where to find the discussion about possibilities for structural change. Admissions models that are merit based do not always mean more than matching with preconceived notions of what makes a good scientist. Colleges and especially graduate schools admit students on a one-by-one basis, much like faculty hiring, which leads towards people being risk averse. You're looking for a particular image that you think may give you the best student and it doesn't always stack up with who's going to be the good scientist.

Dr. Hayden said she knows programs where she recruited students from high schools or pre-college programs and brought them in together. But usually that comes after having a relationship with the director of the program who can advise on a student's potential or interests and maturity level. It is important to cultivate their interest once they're in the university system because with a lot of minority groups, a lot of it is about the relationship and being able to support one another and being able to pull on the strengths of one another so they don't feel isolated and can work through what's coming at them. Those relationships are very important.

Ms. Walker said subcommittee discussions sometimes involve the different roles and responsibilities for different entities and, at the institutional level, such and such might need to occur. The subcommittee has done a good job of asking what aspects of NSF programs can help facilitate that. The recommendations that come through are things OPP can take as action items.

Dr. Mack remarked on the juxtaposition of enhanced field training opportunities and intentional work to create communities. Some of the best work that creates intentional communities among a cohort of students that can persist when students are at a diverse array of graduate institutions is field training or a field course. There are many opportunities, particularly in Arctic and Antarctic research, to create a field course to bring together diverse cohorts of students that would have an element focusing on community building and taking learning from educational psychology. That would serve several purposes at the same time. Dr. Nettles said kindergarten



classes spend the first six weeks learning how to be in school and it is not done in such an intentional way with regard to building up a field team or coming to graduate school.

Dr. Steig said the Juneau Icefield Research Program (JIRP) is on the cusp of possibly having significant funding from the State Department and possibly other government entities. There is an opportunity for NSF to make this a training ground long term. Separately, he noted a particular challenge at the University of Washington (UW), where there's a perception the university is not welcoming and inclusive. This is not about UW, it's about Seattle. The notion is that if you're from the southeast in particular, Seattle may as well be Anchorage. It's very far away and there's an incorrect assumption about the diversity of Seattle; it is diverse, although segregated. In a recent analysis of applicants to faculty positions, 90 percent of the Black applicants answering the survey at least said they wouldn't have applied, if they didn't have a pre-existing relationship with the university. That must be true of undergrad recruiting as well.

Dr. Hayden said that JIRP was particularly helpful in orienting students to field work, though it was very expensive. It included issues of clothing, shoes, etc., but was very much worthwhile. She said a program in Norway also assisted with field training for students. Identifying more of those opportunities for building student capacity is something that needs to be looked at.

Dr. Kuklina said another way to build relationships are with [RCN](#) programs, which are helpful, especially for early career Arctic scientists. But it requires a lot of coordination and those building careers who want tenure track positions have other priorities. She asked how to increase RCN programs and still make them appealing to researchers.

Dr. Loose said his graduate program recently joined the American Geophysical Union (AGU) Bridge Program, which is like a matchmaking service that helps connect with potential student applicants who have expressed an interest in geosciences. He asked if NSF or OPP is positioned to empower a similar matchmaking service through institutions they fund, like MSIs. He suggested specifically looking at how that kind of network can help overcome geographic differences within the U.S., connecting different parts of the country. Dr. Hayden said the subcommittee felt it was important to have that resource, where you can get that service to find institutions or programs aligned with your particular research and it is something the subcommittee is looking at.

Dr. Marinelli recalled how, as a graduate student, she'd go back and forth between the Northwest and the southeast and the different communities she matriculated in where it was differently diverse, and a reminder of the very different parts of the country, in their character and their own diversity. Not every institution is going to be able to diversify in the same way. Your opportunity space is going to differ according to where you are and the relationships you build. Some of those relationships are placed based and, in particular, tribal colleges and communities are very focused on the land that is important to their culture. Any kind of partnership would have to reflect that value. Partnerships are important and sustained relationships are a way to build community. NSF might be able to seed some of those relationships to get them to flourish. But there must be an understanding on the part of the universities that seek these partnerships as to the culture of the partner university, what you both hope to get out of it, to make sure the efforts are aligned and that you're trying to move in the same direction.

Dr. Nettles said the subcommittee is aiming to provide draft recommendations at the spring meeting and a final report at the fall meeting and the AC looks forward to continuing the discussion in the spring. She encouraged AC members who have not been able to participate in the learning opportunities to contact the subcommittee, which will provide access to recordings.

### Wrap-up: Identify Topics for Next Meeting

Dr. Nettles; Dr. Marinelli

Dr. Nettles noted that AC membership will begin rotating again, after a delay and extended terms due to COVID-19. She thanked members who will be rotating off:

- Dr. Thomas Weingartner
- Dr. Amanda Lynch
- Mr. Ray Arnaudo
- Dr. Michael DeGrandpre
- Dr. Mark Flanner
- Dr. Abigail Vieregg

Next, she and other members identified an initial set of topics for follow-up at the spring 2022 AC meeting:

- Pursuing relationships with ACCI
- Meeting with the DEI subcommittee
- Further discussion of COVID-19 impacts
- Results from a study underway of differential impacts
- Further discussion of security and international relations issues
- Infrastructure upgrades and support for future large science projects at the South Pole
- Updated information on TIP

Dr. Heimbach reported that ACCI is excited to be working with AC-OPP and is viewing it as a prototype to work through issues on how the OAC can contribute to progress in other directorates. ACCI has decided on a working group for volunteers, and he asked whether one should pick topics right away or if the working group will go into the details and decide on specific topics or whether to branch out in different directions. Discussing issues of connectivity between polar regions and North America is perhaps a different topic than working through data accessibility, standardization, workflows and reproducibility. He said his hunch is that a subgroup or working group might initially discuss this and look for different directions.

Dr. Nettles asked to clarify that ACCI has decided there should be a working group and four people have volunteered. She added that some discussion to identify the next steps and topics and how to move forward would be appropriate. That is a model where members of ACs engage in an initial discussion and then potentially decide whether to recommend that a subcommittee should form. Typically, it is not necessary that all such work be done exclusively by members of the of the ACs. She asked if the thought is that an initial discussion would happen between members of the ACs, and then figure out the next steps.

Dr. Heimbach responded that the ACCI discussion was not that detailed. There was enthusiasm to talk broadly about data, but the discussion stayed there. The question is whether one should carve that out right away or allow for an extra step of discussion before embarking on specific action items for a subcommittee. In addition, if more than 50 percent of the committee cannot be AC members, and one of the AC members can lead that, the other ACs can just be one AC member. He said his concern is first discussing what aspects such a working group or subcommittee should take on before launching it. Dr. Nettles agreed on having the extra discussion step. She said for that it might be okay to use 50 percent. In general, there is a benefit from bringing in additional members to the subcommittees from outside the AC.

Dr. Marinelli said that was appropriate. Orienting a discussion around the pilot problems, the committee might be able to help formulate some of questions and get at the heart of where the interactions could be.

Dr. Nettles asked about identifying volunteers now from AC-OPP to engage with those four people, or pursuing that as an offline activity. Dr. Marinelli said she was not sure of the AC rules. There is one other possible AC subcommittee activity, so bringing in other people to help with this question would be useful and will not be hard because a lot of people want to engage in this topic.

Dr. Nettles said the AC will follow up with Dr. Heimbach and next week figure out what model will work, given the various constraints. She asked him to assure ACCI of AC-OPP's enthusiasm and that it will engage with this, within AC-OPP's constraints, and will figure out the mode for moving forward.

Dr. Loose suggested another update on NNA's response to the Kawerak, Inc. letter and facilitating a greater voice for the Alaskan Native organizations that signed the letter, such as participating in panel reviews. Dr. Nettles said it was a good suggestion and referred members to the release of the [plan from NSF](#) to enhance tribal consultation in response to a presidential memorandum on tribal consultation and strengthening nation-to-nation relationships. She said there is a desire to have sustained engagement there, especially with OPP's special role in the conduct of research and associated Arctic principles. ([Dear Colleague Letter](#): Update on NSF's Efforts to Improve the Inclusion of Local and Indigenous Voices in Arctic Research.)

Dr. Kuklina said sometimes there is a lack of understanding of what kinds of resources are available in infrastructure terms for those who work with indigenous communities, and she expressed her hope for somehow bridging different knowledge systems re trust relations and data usability and suggested future discussion about better connecting indigenous and scientific knowledge systems.

Mr. Arnaudo brought up possible overfishing of krill in Antarctica, He also discussed the possibility that the U.S. Fish and Wildlife Service Wildlife Service's will put emperor penguins on the threatened or endangered list. He said Russia is chairing the Arctic Council, which is something to keep an eye on. Also, there is an Arctic Council proposal to have each country contribute to a scientific expedition, which hasn't been done successfully before. Dr. Marinelli agreed with Mr. Arnaudo said that the degree of cooperation has decreased.

In closing, Dr. Marinelli added that by the next meeting there will be a better sense of what has shaken out from the aspirations of the administration and the budget reality, and the different emphases being pushed within the administration. There will be a different landscape to talk about, come March or April.

Dr. Nettles thanked Ms. Walker and the technical support team and everyone on the committee. Dr. Marinelli also thanked members for their participation.

The meeting was adjourned.