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NSF Office of Polar Programs activities conducted in response to the 2015 NAS report: "A Strategic Vision for NSF Investments in Antarctic and Southern Ocean Research"

The National Academies of Sciences, Engineering, and Medicine (NAS) released a report in August 2015 entitled "A Strategic Vision for NSF Investments in Antarctic and Southern Ocean Research" that offers recommendations for USAP research priorities. The report made two major recommendations: 1) that NSF maintain strong investigator-driven core research programs, and 2) that NSF support three strategic, larger scale, priority research initiatives.

This NAS report was built on the foundation provided by two earlier reports. One was a 2011 NRC report entitled "Future Science Opportunities in Antarctica and the Southern Ocean". That study identified major questions driving scientific research in Antarctica and the Southern Ocean over the next two decades, without prioritizing or considering budget limitations. The second was a report of the US Antarctic Program Blue Ribbon Panel, entitled "More and Better Science in Antarctica Through Increased Logistical Effectiveness" focusing on opportunities to improve the logistical support and facilities in support of future Antarctic and Southern Ocean science.

OPP recognized that given relatively constant funding levels it would not be possible to scientifically or logistically support all of the research goals identified in the "Future Science Opportunities..." report. The 2015 report was requested by OPP to obtain community input regarding prioritization of research initiatives for the next decade. The NSF greatly appreciates the effort and insight provided by the Antarctic research community in developing this report. This document describes actions undertaken by the NSF Office of Polar Programs (OPP) in response to that report.

NSF Actions: In response to the 2015 NAS report, OPP modified the Antarctic Research Program Solicitation ([NSF Solicitation 16-541](#)) to highlight the recommendations in the report and encouraged research proposals in response to the three strategic priorities.

In addition, specific activities relating to the strategic themes include:

1) How fast and by how much will sea level rise? *The Changing Ice Initiative*

OPP released a solicitation for joint NSF/NERC research on ice-mass loss in West Antarctica, focusing on the Thwaites Glacier region ([NSF Solicitation 17-505](#)). This will support a 5-year research program of up to \$25M, addressing the future of one of the most sensitive regions of the Antarctic ice sheet and its impact on sea level rise. Science funding is provided through the NERC Joint Strategic Research mechanism and NSF funding is through PLR's core Antarctic science programs. Logistics and field support will be coordinated by the OPP Antarctic Infrastructure and Logistics Section and by the British Antarctic Survey. This solicitation has a deadline of March 1, 2017.

2) How do Antarctic biota evolve and adapt to the changing environment? *Decoding the genomic and transcriptomic bases of biological adaptation and response across Antarctic organisms and ecosystems*

OPP has several research projects ongoing and under consideration that are strategically aligned with this priority. These projects target community structure and genomic capacities of soil and microbial communities in ice-free areas of the Transantarctic Mountains, and adaptive capacities of Antarctic fishes due to regulation of protein production by microRNAs. Additional projects are currently under consideration.

OPP is supporting community workshops and anticipates supporting one or more community Research Coordination Networks (RCN) in this research area. A recent EAGER awardee successfully tested the first use of portable genomic sequencing instrumentation in the field in Antarctica. This theme is strongly aligned with the goals for the NSF-wide “Big Ideas” effort on “Understanding the Rules of Life: Predicting Phenotype”. OPP staff is involved in the development of this future activity.

3) How did the Universe begin and what are the underlying physical laws that govern its evolution and ultimate fate? *A next generation cosmic microwave background program*

NSF (AST, PHY, and OPP) has funded several ongoing and planned major upgrades to the Cosmic Microwave Background (CMB) instrumentation at South Pole. These are: 1) 2016/17 SPT-3G receiver upgrade (16,000 detectors, 3 frequencies, allowing full CMB delensing), 2) 2016/17 BICEP Array 3G upgrade (35,000 detectors, 5 frequencies focusing on B-mode polarization, and 3) 2018/19 CMB telescope upgrade to 50,000 detectors.

A Cosmic Microwave Background Stage 4 Concept Definition Task force (CMB-S4 CDT) has been established as a subcommittee of the Astronomy and Astrophysics Advisory Committee (AAAC). The group was formed in response to a request from NSF (AST, PHY, and OPP) and DOE (High Energy Physics, HEP). The CDT will develop a concept for a CMB-S4 experiment and provide a roadmap for community development of the next phase of CMB research. The CDT will consider the global landscape of CMB experiments (including ground, balloons, and space) and will convene 5-6 community workshops beginning in February 2017 at the SLAC National Accelerator Laboratory. The CDT will deliver to the AAAC a report on the Science and Measurement Requirements by June 2017 and a final report by October 2017.

The Cosmic Microwave Background theme is also aligned with the NSF-wide “Big Ideas” effort on “Windows on the Universe: The Era of Multi-messenger Astrophysics”. OPP staff is involved in the development of this future activity.