

A large iceberg floats in a deep blue ocean under a clear sky. The sun is positioned directly behind the iceberg's peak, creating a bright lens flare effect. The iceberg's tip is visible above the water, while its massive, jagged base extends deep into the water, illustrating the concept of the 'tip of the iceberg'.

NSF RESPONSE

MORE AND BETTER SCIENCE IN
ANTARCTICA
THROUGH INCREASED
LOGISTICAL EFFECTIVENESS

Report of the
U.S. Antarctic Program
Blue Ribbon Panel

CONTENTS

Letter from Dr. Subra Suresh, Director, National Science Foundation, to Mr. Norman R. Augustine, Chair, U.S. Antarctic Program Blue Ribbon Panel.....	i
Letter from Dr. Dan E. Arvizu, Chairman, National Science Board, to Dr. Subra Suresh, Director, National Science Foundation	iii
The 2011-12 United States Antarctic Program Two-Part Review	vi
A. Background.....	1
B. Summary Response.....	2
Appendix A Statement of Task for the U.S. Antarctic Program: Future Science Opportunities in the Antarctic and Southern Ocean Committee	10
Appendix B Charge to the Blue Ribbon Panel	14
Appendix C Charter for the USAP Blue Ribbon Panel Report Tiger Team	17

— NATIONAL SCIENCE FOUNDATION —
SUMMARY RESPONSE TO THE REPORT OF THE
U.S. ANTARCTIC PROGRAM
BLUE RIBBON PANEL

MARCH 2013



NATIONAL SCIENCE FOUNDATION

4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230



OFFICE OF THE
DIRECTOR

March 19, 2013

Mr. Norman R. Augustine
Chair, U.S. Antarctic Program Blue Ribbon Panel

Dear Mr. Augustine,

On behalf of the National Science Foundation, I thank you for leading the United States Antarctic Program (USAP) Blue Ribbon Panel (BRP) and for the significant time and effort that you and your Panel devoted to prepare your report released in July 2012. I am grateful to the BRP for your thoughtful examination of U.S. logistical capabilities that are likely to be needed in Antarctica and in the Southern Ocean in the decades to come.

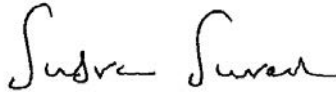
The release of the BRP report, *"More and Better Science in Antarctica Through Increased Logistical Effectiveness"*, co-commissioned by the Office of Science and Technology Policy (OSTP) and the National Science Foundation (NSF), could not have been more timely. In our Presidentially-mandated role as the manager of the USAP on behalf of all of the U.S. government, NSF must be a vigilant steward of world-class, innovative science as well as science support in Antarctica and the Southern Ocean. Your findings made it very clear that a number of near-term and long-term improvements are needed to ensure continuation of a robust and sustainable USAP into the future.

Upon delivery of your report on July 23, 2012, I charged a group of senior leaders at NSF (referred to as the "Tiger Team") to develop a point-by-point and summary response to the numerous report recommendations. The National Science Board (NSB) reviewed these NSF responses at their December 2012 and February 2013 meetings, and strongly endorsed them (see the letter from the NSB Chair attached to this report). The Tiger Team exercise is now formally complete.

I am pleased to enclose the NSF Summary Response to your report, organized according to your ten overarching recommendations. You will note that we agreed with the majority of your recommendations, and that substantial progress has already been made on many fronts in implementing these recommendations. While others will require further study before final decisions on the recommendations are made, we now have in place the means for disciplined, multi-year tracking and planning for additional improvements. We look forward to implementing, over the next several years, safe, modern, energy-efficient and cost-effective science facilities and support systems for research in Antarctica.

I am confident that the changes we have put in place will enable us to sustain and strengthen our world-leading U.S. Antarctic Program. This is due in no small measure to your invaluable contributions for which I express my profound gratitude to you and to your distinguished BRP members.

Sincerely,

A handwritten signature in black ink, appearing to read "Subra Suresh". The signature is fluid and cursive, with the first name "Subra" and last name "Suresh" clearly distinguishable.

Subra Suresh
Director



March 14, 2013

Dr. Subra Suresh, Director
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Suresh:

In its policy development and oversight roles for the National Science Foundation (Foundation), the National Science Board (Board) has a longstanding interest in the vitality of the United States Antarctic Program (USAP). The Foundation's responsibilities in Antarctica go far beyond its traditional mission of supporting ground-breaking research, touching on everything from foreign relations, to national security, to undertaking logistics challenges more commonly associated with forward deployed military units.

The challenges of conducting and supporting research in Antarctica are many, not the least of which are budgetary challenges that have prevailed in recent years. They have put significant stress on U.S. research endeavors in the Southern Ocean and Antarctica, prompting the Foundation, in conjunction with the White House, to undertake an end-to-end review of research priorities and activities as well as a review of existing Antarctic infrastructure and logistics. The Board applauded the decision to undertake these reviews as they serve as important steps in ensuring that the U.S. Antarctic science stays at the forefront of discovery and innovation while the USAP infrastructure and logistics remain effective, affordable and sustainable.

The Board read with great interest and has now evaluated the external report summarizing the infrastructure and logistics review (*More and Better Science in Antarctica Through Increased Logistical Effectiveness*), known as the Blue Ribbon Panel report, and was recently briefed by the Foundation on its response and approach to recommendations contained in the report. The external report contains ten overarching recommendations ranging from recapitalization of facilities to increasing international cooperation to governance and policy considerations. The Board, through its Committee on Program and Plans (CPP), has carefully monitored the progress of both the review and NSF's response and as a whole is pleased to see that in many cases, the Foundation already has taken significant steps toward implement suggested recommendations and is in the process of developing a longer-range implementation strategy to respond accordingly.

National Science Foundation

4201 Wilson Boulevard • Arlington, Virginia 22230 • (703) 292-7000 • www.nsf.gov/nsb • email: nationalsciencebrd@nsf.gov

This activity highlights the ongoing need to look for efficiencies in the program and the Board will continue to pursue those efforts in the coming years. In the short-term, the Board looks forward to ongoing discussions with the Foundation regarding efforts to implement report recommendations. It also encourages the Foundation to continue to explore creative approaches to meeting present as well as future USAP infrastructure needs and, where consistent with and enhancing the Foundation's mission, consider working with third parties to leverage Foundation resources.

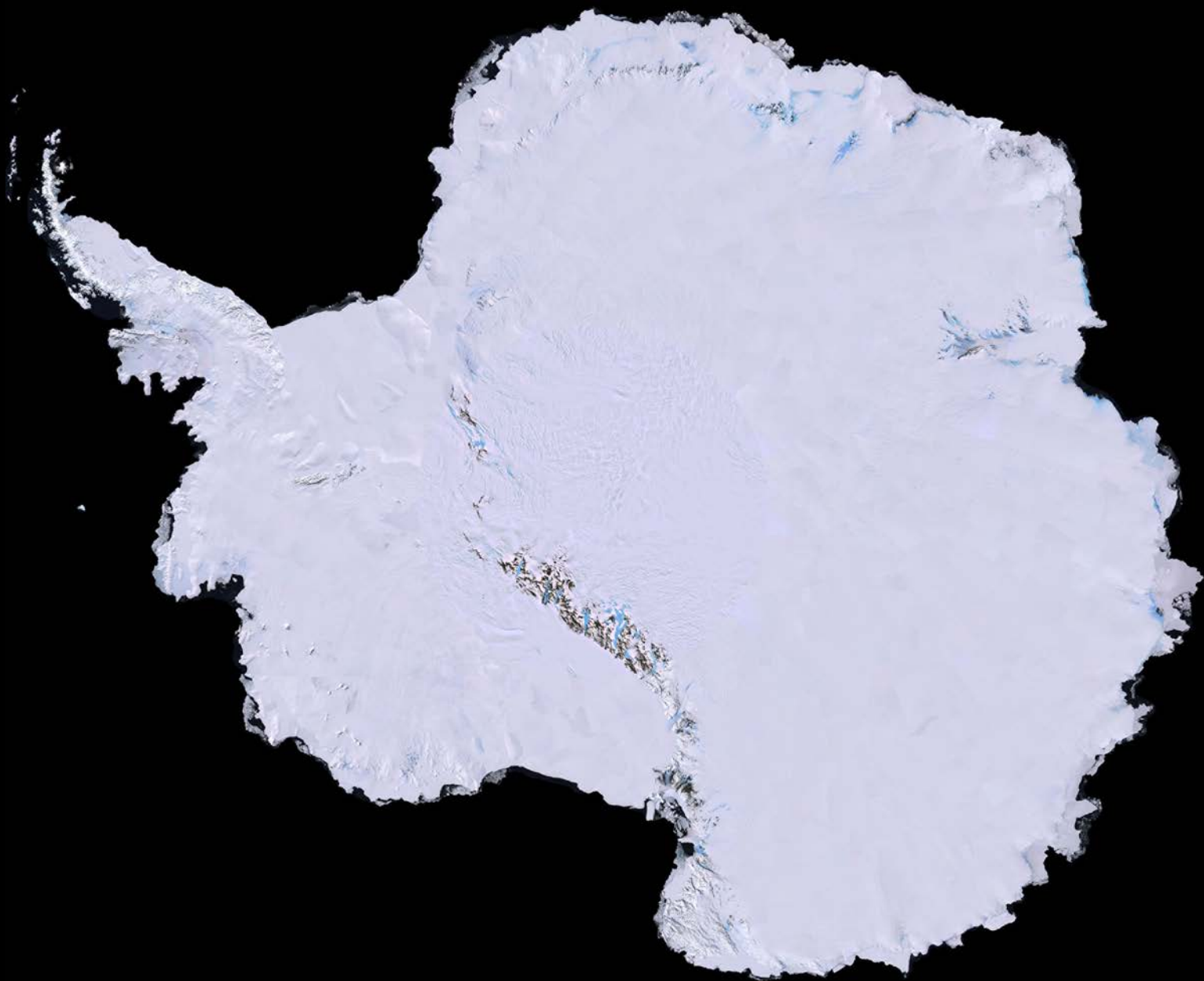
Finally, the Blue Ribbon panel report, and the Foundation's response to it, represent an important first step toward ensuring an ongoing active and influential U.S. presence in Antarctica. The Board strongly endorses the Foundation's response to the logistics and infrastructure review.

Sincerely,

A handwritten signature in black ink, appearing to read "Dan E. Arvizu". The signature is fluid and cursive, with the first name "Dan" being the most prominent.

Dan E. Arvizu
Chairman

cc: Dr. Kelly K. Falkner, Director
Division of Polar Programs,
Geosciences Directorate



Landsat Image Mosaic of Antarctica. Representatives of the National Science Foundation, the U. S. Geological Survey, the National Aeronautics and Space Administration and the British Antarctic Survey worked cooperatively to produce the Landsat Image Mosaic of Antarctica, a map that combines more than 1,100 hand-selected Landsat satellite scenes digitally compiled to create a single, seamless, cloud-free image. *Credit: U.S. Geological Survey*

THE 2011-12 UNITED STATES ANTARCTIC PROGRAM TWO-PART REVIEW

As affirmed by Presidential Memorandum 6646 (1982), the National Science Foundation (NSF) is designated as the single point manager responsible for budgeting for and managing the United States Antarctic Program (USAP) on behalf of the Nation. Through the USAP, NSF provides funding for research in Antarctica and the Southern Ocean and also provides the associated logistics support.

In 2010, the NSF Office of Polar Programs (OPP), in coordination with the Office of Science and Technology Policy (OSTP), initiated a two-part review of the USAP.

NRC STUDY

In the first phase of the review, NSF sponsored the National Research Council (NRC) to convene a Committee of Experts to identify the major science questions that will drive research in Antarctica and the Southern Ocean in the coming decades. The Committee's full *Statement of Task* and the full list of members are provided in Appendix A.

The Committee on "Future Science Opportunities in Antarctica and the Southern Ocean" was formally convened in January 2011. Several of the committee members visited Antarctica. The Committee held three meetings in various geographic locations in order to enable the widest possible input to its study. The Committee also distributed a community survey to more than 1,000 Antarctic and Southern Ocean researchers and the broader Polar science community and received over 200 responses. Input was received from representatives of other Federal agencies with interests in Antarctica, including National Oceanic & Atmospheric Administration (NOAA); National Aeronautics & Space Administration (NASA); U.S. Geological Survey (USGS); and U.S. Coast Guard (USCG). In addition, the Committee reviewed background articles and reports.

The final report, entitled *Future Science Opportunities in Antarctica and the Southern Ocean*, was released in September 2011.¹

BRP STUDY

In October 2011, Dr. John P. Holdren, Director of OSTP and Dr. Subra Suresh, Director of NSF, co-commissioned a Blue Ribbon Panel (BRP) of external experts to conduct the second phase of the USAP review. This phase was designed to examine U.S. logistical capabilities likely to be needed in Antarctica and the Southern Ocean to support the science drivers identified by the NRC Committee, and to seek ways to enhance logistical efficiency to support world-class science. Building on the findings of the NRC Committee, the BRP was charged with conducting an independent review of the current USAP to identify and characterize a range of options for supporting and implementing the required national scientific endeavors, international collaborations, and strong U.S. presence in Antarctica. The Panel's full *Charge* and membership are included in Appendix B.

The BRP met in the Washington, D.C., area for a total of six days. Some members traveled to McMurdo, Palmer, and South Pole Stations. They visited various USAP logistics centers, including Christchurch, New Zealand; Punta Arenas, Chile; the Antarctic Support Contract headquarters in Centennial, Colorado, cargo facilities in Port Hueneme, California, and the 109th New York Air National Guard in Schenectady, New York. The Panel's members also went aboard the U.S. Antarctic Research and Supply Vessel *Laurence M. Gould* and the Research Vessel Icebreaker *Nathaniel B. Palmer*, and witnessed the offloading of the chartered supply ship *Green Wave* on the U.S. West Coast at Port Hueneme, California. Members visited Chilean and New Zealand stations in Antarctica and met with the New Zealand airport and port authorities and the managers of New Zealand's Antarctic program in Christchurch, New Zealand. The BRP also established an electronic mailbox to receive comments and suggestions from the USAP community.

The BRP Report, entitled *More and Better Science in Antarctica through Increased Logistical Effectiveness*, was formally delivered by the Committee to OSTP and NSF on July 23, 2012.²

1 Copies are available from the National Academies Press, 500 Fifth Street, NW, Washington, D.C. 20001; (800) 624-6242; www.nap.edu.

2 Copies of the report are available through: http://www.nsf.gov/od/opp/usap_special_review/usap_brp/rpt/index.jsp

DEVELOPING THE RESPONSE TO THE BRP REPORT

Immediately following delivery of the BRP report, NSF Director Subra Suresh charged a group of senior leaders from throughout NSF to guide development of the response to the report's recommendations. The *Charter* for this group, known as the "Tiger Team", and the full membership of the Tiger Team are included as Appendix C.

The Tiger Team began by developing and populating a matrix to record responses to each of the BRP's 84 recommended actions. They determined that NSF agreed with the majority of the recommendations and provided explicit reasoning for the few cases in which it could not agree or needed further analysis to develop a future course of action. The status of implementing activities to achieve improvements was also recorded in the matrix. In the face of rapid progress being made on many of the recommended improvements, it was determined that the matrix should serve as a living document and be updated regularly as a means for NSF management to track progress.

The Tiger Team drafted a summary document to capture major elements of the NSF response including a newly developed *Long-Range Investment Plan* and a budget that will take into account critical infrastructure renewal requirements at McMurdo and Palmer stations. The specific infrastructure improvements and replacements for both stations are to be guided by Master Plans that are currently being updated. The approach, activities and overall recommendations of the Tiger Team and key highlights of the ensuing improvements enacted to date were reviewed with the National Science Board (NSB) at their December 2012 meeting. The Tiger Team met with the NSB during the February 2013 meeting to review budget- and procurement-sensitive elements of the response. Following feedback from the NSB, the Tiger Team updated and refined the summary response contained herein for public release.³

³ The House Committee on Science, Space and Technology held a hearing on the BRP report on November 15, 2012. Witnesses included Mr. Norman R. Augustine, Chair, U.S. Antarctic Program Blue Ribbon Panel, Dr. Subra Suresh, Director, National Science Foundation, General Duncan J. McNabb, USAF (ret), Member, U.S. Antarctic Program Blue Ribbon Panel, and Dr. Warren Zapol, Chair, Committee on Future Science Opportunities in Antarctica and the Southern Ocean, National Research Council. Both a video recording and the full text for the hearing are available through: <http://science.house.gov/hearing/full-committee-hearing-us-antarctic-program-achieving-fiscal-and-logistical-efficiency-while>

NSF and its Division of Polar Programs in the Geosciences Directorate look forward to executing and managing the numerous improvements recommended by the BRP that will most certainly place the USAP on a robust trajectory to sustain and strengthen world class U.S. Antarctic research in the coming decades.⁴

⁴ In January 2013, the Office of Polar Programs within the Office of the Director was officially merged into the Geosciences Directorate as the Division of Polar Programs. No changes in personnel or budget were associated with this realignment. The authorities for executing NSF's responsibility for single point management of the USAP remain as they were before the realignment.

A. BACKGROUND

The U.S. maintains a world-class science program in Antarctica to advance the frontiers of knowledge and in so doing maintain its active and influential role in the Antarctic Treaty System, which has now been in force for over 50 years. High-level reviews of the U. S. Antarctic Program (USAP) have been conducted approximately every 10 to 15 years since 1970, when by presidential mandate NSF was designated as the single point manager of the USAP on behalf of the United States. These program-wide overviews supplement ongoing internal and external studies of various aspects of the USAP. The last review, delivered in 1997, resulted in the 2008 commissioning of a modernized South Pole Station. The most recent two-part review of the USAP was initiated in 2010 to ensure that the nation continues to pursue the best trajectory for conducting science and diplomacy in Antarctica over the next twenty years—a trajectory that is environmentally sound, safe, innovative, affordable, sustainable, and consistent with the Antarctic Treaty.

A National Research Council (NRC) committee completed the first phase by examining likely science drivers for the coming decades in Antarctica and the Southern Ocean. Its report, *Future Science Opportunities in Antarctica and the Southern Ocean*, was delivered in December 2011. The NRC envisioned that future science activity in the Antarctic region would entail substantial organizational changes, broader geographic spread, and increased international involvement and growth in the quantity and duration of measurements. Implementation and maintenance of more science observations and coordinated observing systems will introduce new demands on data storage, communications capacity, transportation reach, and autonomous operations.

The NRC report findings and other studies informed the second part of the review whereby a Blue Ribbon Panel (BRP) was charged with conducting an independent assessment of the USAP logistics support system. The Panel was asked to identify and characterize a range of options for supporting and implementing the required national scientific endeavors, international collaborations, and strong U.S. presence in Antarctica.

The BRP report, *More and Better Science in Antarctica through Increased Logistical Effectiveness*, was formally released on July 23, 2012. The BRP concluded that ushering in a new age of Antarctic science simply by expanding traditional methods of logistical support would be prohibitively costly. Instead, they recommended numerous ways to more efficiently and cost-effectively support research while maintaining high standards of safety and increasing the flexibility to support evolving science foci in the future.

The BRP report contained 10 overarching recommendations covering the following topics:

- Antarctic Stations
- Polar Ocean Fleet
- Logistics and Transportation
- McMurdo and Palmer Facilities
- USAP Capital Budget
- Science Support Costs
- Communications
- Energy Efficiency
- International Cooperation
- Antarctic Policy

The recommendations were further categorized into 84 implementing and ancillary actions organized according to the following categories:

- Research Facilities and Equipment
- People
- Technology
- Transportation
- Supply Chain
- Energy and Utilities
- Communications and Information Technology
- Human Care
- Environmental Stewardship
- International Considerations
- Governance

B. SUMMARY RESPONSE

This document provides summary information on major actions the National Science Foundation (NSF) has taken and plans to take in response to the BRP report. It is organized according to the 10 overarching topics noted above.

ANTARCTIC STATIONS

The BRP recommended that NSF continue the use of McMurdo, South Pole, and Palmer stations as the primary U.S. science and logistics hubs on the continent, and noted in particular that there is no reasonable alternative to McMurdo.

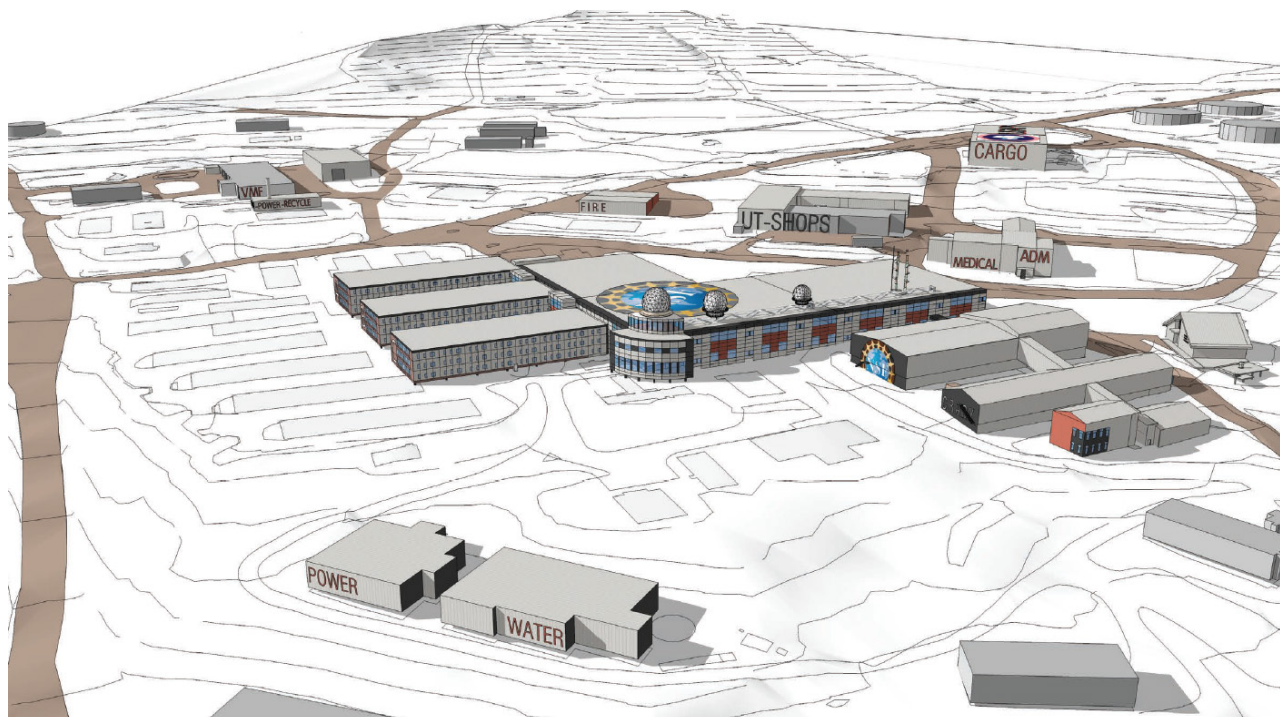
NSF concurs with the BRP's recommendation and notes that it is consistent with current U.S. policy. Presidential Memorandum 6646 (1982) requires that the USAP "be maintained at a level providing an active and influential presence in Antarctica designed to support the range of U.S. Antarctic interests," including year-round occupation of the South Pole and two coastal stations.

McMurdo presents the combination of logistical characteristics best suited for supporting resupply

operations by sea, air and land, and is particularly opportune for supporting resupply of the U.S. station at the geographic South Pole. Furthermore, McMurdo offers ready access to the Dry Valleys, Mt. Erebus, the southern most penguin colonies, the Ross Ice Shelf, and other nearby areas of keen scientific interest. South Pole Station offers uniquely advantageous observing conditions important for astrophysics, geospace science, atmospheric, and seismic studies. South Pole also serves as an excellent high altitude logistics and refueling point for deep field operations in the Antarctic interior. Palmer Station, on the Antarctic Peninsula, provides essential access to marine ecosystems and organisms and ice shelf systems in what is one of the most rapidly warming regions on the planet.

POLAR OCEAN FLEET

Following a survey of the USAP's polar ocean fleet, the BRP concluded that action should be taken to restore the fleet to support science, with appropriate research icebreaking capability, as well as logistics and national security, via appropriate operational icebreaking capability, in both polar regions over the long-term.



Artist's rendering of the long-term plan for McMurdo Station. The McMurdo Long-Range Plan, currently in the concept stage, incorporates operational efficiencies by consolidating functions, reducing personnel requirements, and improving energy usage. Improvements are also planned for support to local science and science conducted at sites served by McMurdo, such as the Dry Valleys, temporary camps located throughout the Continent, and the South Pole Station. Another goal of the Plan is to ensure that McMurdo is flexible and agile to support future science. Credit: U.S. Antarctic Program/National Science Foundation

With respect to icebreakers, NSF is participating in an interagency effort, led by the U.S. Coast Guard (USCG), to assess government-wide requirements for icebreaking. USCG will consider this information as it proceeds with design and construction of a new polar class icebreaker (initial funding requested in the 2013 President's Budget for USCG). NSF is also actively engaged with USCG in monitoring progress on the reactivation of the USCG Cutter *Polar Star* (WAGB-10). It currently appears that this vessel will be available for the 2013/14 break-in to McMurdo Station and possibly for the subsequent 7-10 years.

NSF is pursuing options for meeting future science activities that require a Polar Research Vessel (PRV). A University-National Oceanographic Laboratory System (UNOLS) led community-based refresh of the mission needs requirements for a PRV was delivered in February 2012. A lease/buy analysis is currently underway to inform the Foundation's decision regarding possible acquisition of a research icebreaker.

NSF agrees with the BRP that it would be beneficial to identify additional opportunities to leverage resources with our international partners. Further leveraging could be promoted through the research community, the Council of Managers of National Antarctic Programs (COMNAP, an international organization of National Antarctic Program operators), and program-to-program exchanges. Significant potential for collaborative logistics and research may exist in the Antarctic Peninsula region where NSF and other nations have, or would like to pursue, active programs. For example, consideration is already being given to shared use of vessels and development of an air link. NSF is currently reviewing opportunities and developing a roadmap for potential science and operational collaborations in this region. Once completed in 2013, the roadmap will serve as the basis for formal discussion with our international partners.

LOGISTICS AND TRANSPORTATION

The BRP recommendations associated with transportation underscore the importance of having a range of logistics options available for supporting research in the field.

NSF has worked to diversify these options through extensive research and development of overland traverse capabilities, and also by integrating new fixed- and rotary-wing aircraft in support of the USAP over the last fifteen years.

South Pole Traverse. NSF will incorporate robotics technology, a project with a very high return on investment, in the overland traverse platform. This technology will reduce the cost of resupplying South Pole Station while improving the efficiency of the operation. The goal is to double the number of traverses to South Pole from two to four by FY 2016, achieving an estimated net annual savings of \$2.0 million dollars. To achieve this aggressive goal, NSF is working with other Federal agencies and industry to integrate commercial off-the-shelf products into the traverse fleet.

Funding for implementation will be included in a future budget request. Once funded it will take



Long-distance, over-snow, heavy-haul traverse trains provide an efficient alternative to airlift for moving cargo, fuel, and science equipment to remote sites. Credit: The Whillans Ice Stream Subglacial Access Research Drilling Project



The Yeti robot (pictured in the foreground) was used successfully last season to remotely locate sub-surface areas with buried structures or voids so that the overlying snow could be made safe for surface activities. Credit: James Lever, U.S. Army's Cold Regions Research and Engineering Laboratory

approximately two years to procure and implement. NSF plans to continue the practice of piloting system improvements in Greenland during the boreal summer and then implementing these improvements in Antarctica during the following austral summer.

An ancillary benefit of further developing the traverse platform is the opportunity it affords for future research. As previously demonstrated, science enabled by traverse can take many forms. For example, paleoclimate studies were undertaken as part of the traverse-supported International Trans-Antarctic Science Expedition (ITASE) before and during the International Polar Year. The exploration via clean drilling of a subglacial lake under the Whillans Ice Stream during the 2012-13 season also capitalized on traverse support.

LC-130 Fleet Reduction and South Pole Hard Surface Runway. NSF is engaged with its Department of Defense (DoD) partners to explore the feasibility of implementing other recommendations made by the Panel. Two primary topics under discussion are the recommendations to reduce the operational LC-130 fleet from ten to six aircraft, and to construct a compacted snow runway at South Pole Station to allow wheeled aircraft operations. While NSF believes that construction of such a runway is technically feasible, there are many operational issues associated with landing wheeled aircraft at the South Pole (such as infrastructure and equipment for fire and emergency response, refueling, and cargo handling) that must be understood in order to conduct a cost-benefit analysis. Such an analysis would also need to take into account cost savings and efficiencies gained as a result of reducing the population at South Pole Station and increasing the traverse capabilities. A further complicating factor for USAP air support is the seasonal warming that has been impacting wheeled operations at McMurdo's Pegasus Runway. For the past three seasons, local temperature conditions have limited wheeled aircraft operations during the mid-December to late-January timeframe. In December 2012, the runway became completely unusable for wheeled aircraft due to melting exacerbated by volcanic dust blown from Black Island; portions of the snow road from Pegasus to McMurdo were also made impassable to all but tracked vehicles. During this period of time, only

LC-130 aircraft enabled access between New Zealand and locations within Antarctica. These recent developments are causing NSF to review whether further consolidation at the Pegasus site and increased reliance on wheeled aircraft are advisable.

MCMURDO AND PALMER FACILITIES

The BRP recommended that aging facilities be upgraded according to master plans in order to reduce operating costs and increase efficiency for science support.

NSF is currently in the process of updating the master plans for both McMurdo and Palmer stations. For McMurdo, the Master Plan is in the final stages of development. The Master Plan addresses most of the large-scale investments recommended by the Panel for operational efficiency and safety. For example, it seeks to minimize the need to handle materials multiple times, to improve energy efficiency and to consolidate functions to reduce personnel requirements. Activities are being sequenced in discrete phases to ensure continuity of operations as upgrades proceed. A Palmer Station Systems Study was released in 2010. This study considered some of the health and usability issues that were raised by the BRP. In accordance with the BRP's recommendation, an in-depth study of the fire suppression systems at all USAP operating locations will be undertaken in FY 2014. In the near-term, NSF has continued to take steps to ensure that fire protection systems are fully operational in critical facilities in Antarctica such as berthing and food preparation areas. NSF will consider the results of these studies and update its long-range investment plan, discussed below, for priority investments.



The USAP recently upgraded the emergency response equipment at McMurdo Station. Credit: George Blaisdell, National Science Foundation

Specific to boating operations at Palmer Station, NSF has taken actions to improve the safety and efficiency of boating operations at Palmer Station. NSF is working on assessments in preparation for replacing the pier and mitigating a hazardous underwater rock ledge that currently limits the size of vessels that can directly access the station. An improved pier is expected to take two years to complete once funding has been identified. In the meantime, a temporary fender system is being employed to keep docked ships away from the underwater obstruction. Safety concerns related to small boat embarkation/disembarkation have been resolved through installation of a floating dock at Palmer Station. The Antarctic Support Contractor is working with vendors to finalize requirements for RIBs (rigid-hull inflatable boats) that are expected to be delivered and operational in FY 2014 to safely extend science operations farther from the station than is currently possible. A boat ramp to facilitate safe launch and recovery of all small craft has been designed and is scheduled to be constructed and operational in this same timeframe.



A new floating dock and ramp system at Palmer Station provides improved safety and efficiency for conducting small boating operations in support of marine research. Credit: Rebecca Shoop and Bob Farrell, Antarctic Support Contract

USAP CAPITAL BUDGET

In order to improve and maintain USAP facilities and infrastructure, the BRP recommended that NSF establish a capital plan and budget for the Program.

NSF agrees that planning tools are needed to guide its longer-term approach to improvements and maintenance within the constraints of the federal budgeting process.

NSF has developed a Long-Range Investment Plan (LRIP) and associated budget, using myriad inputs including needs identified by the user communities consisting of support contract employees, DoD partners, NSF-funded researchers, and other agencies relying on USAP support in Antarctica. The LRIP is also informed by other long-range planning activities in which NSF regularly engages, such as the updates for Palmer and McMurdo stations that are currently underway. These updates entail a complete review of current requirements, an assessment of current facilities and equipment to meet requirements, and recommendations for corrective action and improvements.

As needs are identified, project proposals will be generated and prioritized against factors such as mission criticality, alignment to vision, program interface, cost/benefit, risk assessment, and readiness (among others). A project will be added to the LRIP in accord with the determination of its priority. NSF will adopt a portfolio management approach to lifecycle management, which will be built into the LRIP over time to sequence major investments such as vehicle fleet replacement and major maintenance. The LRIP captures planned and in-process capital investments in terms of budget outlays and cash inflows. Budget Outlays are categorized according to Capital Investments and Life Cycle Support. Cash Inflows become available as projects are completed, through appropriations, and from returns on investments already made. The LRIP is constructed to provide a high-level view of outlays and inflows over a rolling five-year period.

The LRIP process represents a further step in improving the USAP's budget structure, but for this system to be effective, significant management attention—and discipline—will need to be paid to avoid encroachment on these funds by competing priorities within the overall infrastructure and logistics budget. Stakeholders within Polar Programs have agreed that the LRIP budget is appropriately and adequately sized and have pledged to respect the designation of these funds for investments.

Due to the inclusion of procurement- and budget-sensitive elements, distribution of the LRIP is limited to a management group with direct responsibility for implementation and oversight of the USAP.



The USAP recently introduced more versatile dump trucks at McMurdo Station. These multi-purpose, commercial trucks have beds that can be converted for varied uses such as for towing, cargo movement, and hauling bulk materials. This reduces the types and numbers of vehicles required and capitalizes on the savings to be gained from standardization. Credit: Martin Reed, Antarctic Support Contract

SCIENCE SUPPORT COSTS

The BRP recommended that NSF further strengthen the process by which the fully burdened cost and technological readiness of research instrumentation and observing systems, as well as overall projects, are considered in the review and selection of science projects.

NSF agrees that increased cost awareness could be beneficial. This recommendation reinforces NSF actions over the last several years to bring greater cost awareness to proposal reviewers via discussions of operational support, and to principal investigators during the award negotiation process. The actions are evolving as NSF and the Antarctic Support Contractor improve the robustness of cost information. NSF engaged the services of the expert who supported the BRP to complete development of the cost model that will identify discrete elements of cost and make it easier to predict the impacts on cost of various actions. Once completed, the cost model will be a useful tool for developing messaging related to costs for the USAP community. This cost model, along with continual improvement of science project planning activities, will also be useful for developing budget plans for the evolving science program and for ensuring that NSF can

protect commitments that are made. It will aid in understanding the impacts of funding fluctuations in the USAP budget as well. In short, it will assist NSF in making well-informed and balanced decisions about USAP operations.

NSF will expand pre-deployment testing and evaluation activities now used for larger and more complex projects. For example, both the deep ice core drill and the CReSIS (Center for Remote Sensing of Ice Sheets) radar technologies were tested extensively in Greenland before being deployed in Antarctica. NSF has also strengthened requirements for field instrumentation proposals to achieve two principal objectives that tie directly to recommendations of the NRC and BRP reports. First, proposal solicitation language now requires that instrumentation be developed with holistic considerations of simplicity and reliability of deployment, service, and operational support in addition to achieving the scientific requirements for particular observations. This is intended to minimize the operational footprint and thus contain costs associated with deployment, servicing, and retrieval of scientific instrumentation. Second, solicitation language requires instrument development proposals to explicitly describe and employ project management best practices, such as defining milestones for development and testing, establishing criteria for evaluating whether or not milestones are met, and conducting readiness reviews prior to deployment. These changes



An image from the Whillans Ice Stream Subglacial Access Research Drilling project (WISSARD) borehole camera. In January 2013, scientists and drillers with this interdisciplinary project announced that they had successfully used a first-of-its-kind, biologically-clean hot-water drill to directly obtain samples from the waters and sediments of subglacial Lake Whillans. Credit: The Whillans Ice Stream Subglacial Access Research Drilling Project

are already in effect for the current competition (proposals are due in April 2013).

Finally, NSF recently established the Antarctic Research and Logistics Integration Program Manager position with responsibilities that include funding for scientific instrumentation development and ensuring that appropriate instrument development plans are in place prior to an award. This program manager will engage across all of NSF to identify reviewers of the appropriate expertise for such instrument development proposals.

To achieve improved methods for observations as recommended by the NRC and BRP reports, the Antarctic Science programs will be investing \$4 million per year beginning in FY 2014 in new or improved instrumentation to accomplish science while reducing the human footprint. The proposal solicitation language described above guides competition for these funds. These actions have been announced in discussions with the community and at town halls at venues such as the American Geophysical Union meeting. NSF will also use workshop venues, such as the Polar Technology Conference series (<http://polartechnologyconference.org>), to foster science community progress in this direction.

COMMUNICATIONS

The BRP recommended that NSF modernize communication capabilities in Antarctica and the Southern Ocean to enable increased science output and reduce operational footprint.

NSF appreciates the value of communications for science and operations and works to balance needs and desires through evaluation of requirements, cost/benefit analyses, and implementation of alternatives. NSF currently has the capability to provide high-bandwidth communications to all Antarctic field sites, although not continuously at all sites. Data-intensive activities such as the IceCube Neutrino Observatory and the South Pole Telescope employ filtering and compression techniques developed in partnership with other parts of NSF in order to ensure that critical data are provided on a



Tracking and Data Relay Satellite. Credit: NASA.

near real-time basis. In addition, NSF maintains a program for actively pursuing all available options for improving high-bandwidth communications. This program includes participation by other agencies such as NASA and DoD. In preparation for the BRP review, NSF funded an “analysis of alternatives” for Antarctic communications that reviewed requirements as well as the cost and feasibility of a range of communications solutions. There appear to be cost-effective solutions that make use of satellites retired from other uses to meet NSF needs for the foreseeable future.

ENERGY EFFICIENCY

The BRP recommended that NSF increase energy efficiency and implement renewable energy technologies to reduce operational costs.

NSF agrees that maximizing the use of alternative and renewable energies at all operating locations is a necessary goal given the rising cost of fuel. Significant strides have been made in this area, driving down annual fuel consumption through reductions in personnel and the overall operational tempo. For example, during the 2012-13 season, the population at South Pole Station was reduced from 250 to 168 personnel, resulting in a 30 percent reduction in fuel usage at the station. Additional study to determine the optimal use of these resources will be needed. The study will necessarily draw on the long-range planning activity that is currently underway for McMurdo and the Palmer Station Systems Study. Projects to implement improvements will be included in the LRIP.

In the short-term, NSF and Antarctica New Zealand (AntNZ) continue to work cooperatively



NSF and AntNZ partnered to introduce wind energy for their adjoining stations. Under optimal wind conditions, the turbines produce approximately one megawatt of power, which is sufficient to power all of Scott Base and approximately 30 percent of McMurdo's current power needs during the peak summer months. Actual fuel savings over the two-year test period were in excess of 300,000 gallons. Plans are currently under way to further optimize operation of the wind turbines. Credit: Mike Casey, Antarctic Support Contract

to determine the feasibility and advisability of expanding the use of wind turbines in McMurdo. In addition, significant returns to both the USAP and AntNZ are thought to be achievable by optimizing operation of the current system. At no cost to NSF, the New Zealand program supplied engineering and technical personnel to review and optimize the existing power production and distribution systems on Ross Island. The overall goal is to modernize the infrastructure and reduce overall power demand so that the majority of power can be provided from the existing one-megawatt wind turbine system.



NSF partners with the Department of Energy to identify opportunities to expand the USAP's use of alternative and renewable energy, such as the electric vehicles that are now in use at McMurdo Station. Credit: Peter Rejcek, Antarctic Support Contract

NSF has an ongoing partnership with the Department of Energy for exploring the use of alternative and renewable energy for its Antarctic (and Arctic) operations. The Antarctic Support Contractor has a division that focuses on waste-to-energy programs and will be researching the viability of converting the USAP's waste stream to building heat and estimating the investments that would be needed. With this information, NSF will compare the risks, costs, and benefits of alternatives relative to the current method of transporting material off-continent. The analysis is targeted for completion in 2013.

INTERNATIONAL COOPERATION

The BRP recommended that NSF pursue additional opportunities for international cooperation in shared logistics support as well as scientific endeavors.

As previously noted, NSF is actively pursuing additional opportunities to leverage resources with our international partners. For example, pursuant to more general agreements to cooperate, annual implementation plans that benefit the USAP are developed with international partners. Such arrangements are discussed year-round through recurring face-to-face meetings, frequent e-mail and telephone contact, and through the annual meetings of COMNAP and SCAR (Scientific Committee on Antarctic Research, an advisory body to the Antarctic Treaty). NSF engages with other national programs through international organizations such as COMNAP to look for opportunities to standardize equipment and take advantage of volume pricing. NSF is also looking to expand arrangements in the Ross Sea region as well as in the Antarctic Peninsula. Countries including Australia, Italy, France, South Korea, and New Zealand have active logistics programs and bases in the Ross Sea region and represent cost-sharing opportunities for the USAP, while several countries offer opportunities in the Peninsula area. NSF will continue to work with our international partners to ensure active and open data sharing that is a hallmark of the Antarctic Treaty and facilitates more efficient science.

ANTARCTIC POLICY

The BRP, citing current realities as well as findings identified in the NRC and BRP reports, recommended that existing documents and implementing mechanisms governing Antarctic Policy be reviewed and revised as appropriate.

Presidential Memorandum 6646 and Presidential Decision Directive/NSC-26 provide NSF with the appropriate level of authority and guidance. The Department of State has indicated there is no need to revisit these policy statements at the current time. NSF stands ready to support their effort if they choose to initiate such an action.

APPENDIX A

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The U.S. Antarctic Program: Future Science Opportunities in the Antarctic and Southern Ocean

Statement of Task

Under the auspices of the National Research Council (NRC), the Committee on Future Science Opportunities in the Antarctic and Southern Ocean will identify and summarize the changes to important science conducted on Antarctica and the surrounding Southern Ocean that will demand attention over the next two decades. The committee will assess the anticipated types and scope of future U.S. scientific endeavors and international scientific collaborations over a ~20-year period in Antarctica and the Southern Ocean. Membership should include leading polar scientists that span a wide range of expertise who actively participated in Antarctic research in recent years, and scientists with broad experience in global and international research. The committee should identify and summarize likely future science requirements of the U.S. research community, including the needs of the federal mission agencies that depend on U.S. Antarctic Program (USAP) infrastructure and logistics. At present, those agencies are NASA, NOAA, USGS, DOE, EPA, the Smithsonian Institution and the Department of State, which relies on infrastructure support from the Program for official inspections of foreign facilities in Antarctica. The committee should:

- build upon the work of other organizations (e.g., ICSU, SCAR, etc.), draw upon recent scientific achievements in Antarctica and the Southern Ocean including those reported during the 2007-2009 IPY, and utilize previous workshops and reports (e.g., those from the NSF and NRC that pertain to future research directions in Antarctica);
- identify changes to anticipated types and scope of scientific programs for the U.S. in Antarctica and the Southern Ocean over the next two decades;
- examine appropriate opportunities for international Antarctic scientific collaborations based on recent U.S. experiences from the International Polar Year and other anticipated activities;
- report any new emerging technologies should they be found while reviewing the scientific achievements that enhance the U.S. ability to realize important future opportunities or the application of new technologies that enable the collection of scientific data in more effective or efficient ways; and
- comment on the broad logistical capabilities and technologies that, from a science delivery perspective, would need to be improved or require major changes to enable the anticipated types and scope of future U.S. scientific programs, with the intent of informing the concurrent FACA Blue Ribbon Panel that will examine and have a central focus on logistical operations in Antarctica.

In carrying out its work, the committee is expected to draw on existing reports, results of national and international workshops, strategic plans of involved federal agencies, recommendations of

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

professional scientific societies and other organizations, and any other sources it might find useful. The committee is not expected to set priorities among scientific research areas, nor is the committee to discuss budgetary issues. The primary goals are to identify important future research directions in Antarctic and to inform the companion review looking at logistical planning and operations. Together these two studies are intended to help ensure that logistical operations are capable of supporting important forefront scientific research in Antarctica over the coming decades.

The Committee on “Future Science Opportunities in Antarctica and the Southern Ocean” members included:

Warren M. Zapol, (Chair), Harvard Medical School and Massachusetts General Hospital, Boston, Massachusetts

Robin E. Bell, Lamont Doherty Earth Observatory, Palisades, New York

David H. Bromwich, Ohio State University, Columbus, Ohio

Thomas F. Budinger, University of California, Berkeley, California

John E. Carlstrom, University of Chicago, Chicago, Illinois

Rita R. Colwell, University of Maryland, College Park, Maryland

Sarah B. Das, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts

Hugh W. Ducklow, Marine Biological Laboratory, Woods Hole, Massachusetts

Peter Huybers, Harvard University, Cambridge, Massachusetts

John Leslie King, University of Michigan, Ann Arbor, Michigan

Ramon E. Lopez, University of Texas, Arlington, Texas

Olav Orheim, Research Council of Norway, Oslo, Norway

Stanley B. Prusiner, University of California, San Francisco, California

Marilyn Raphael, University of California, Los Angeles, California

Peter Schlosser, Columbia University, Palisades, New York

Lynne D. Talley, Scripps Institution of Oceanography, La Jolla, California

Diana H. Wall, Colorado State University, Fort Collins, Colorado

APPENDIX B



Office of Science and
Technology Policy



National Science
Foundation

November 3, 2011

MEMORANDUM TO THE MEMBERS OF THE ANTARCTIC BLUE RIBBON PANEL

FROM: John P. Holdren, Assistant to the President for Science and Technology and
Director, Office of Science and Technology Policy

Subra Suresh, Director, National Science Foundation

SUBJECT: Charge to the Blue Ribbon Panel

The Blue Ribbon Panel should assess the current U.S. Antarctic Program operations, logistics, and management and make recommendations on a long-term strategy to deliver an efficient and effective national research program for Antarctica and the Southern Ocean, informed by the recommendations of the National Research Council. To this end, the Panel should consider:

- the status and capabilities of the current U.S. Antarctic infrastructure;
- appropriate opportunities for international collaborations;
- the role of and future requirements for permanent stations, remote camps, mobile stations, ships, and aircraft support;
- the management and logistics support options required to support the projected scientific program; and,
- complementary R&D activities (e.g., satellite measurements, technology development, etc.) that would help make Antarctic activities even more productive and affordable over the long term.

The Panel is strongly encouraged to consider and recommend innovative operational and technological approaches to maximize the scientific impact of the U.S. program in a necessarily constrained budget environment.

MEMBERSHIP*

The 12-member USAP Blue Ribbon Panel included:

Mr. Norman R. Augustine (Chair)

Admiral Thad Allen

Dr. Hugh W. Ducklow**

Rear Admiral Craig E. Dorman

Mr. Bart Gordon***

R. Keith Harrison

Dr. Don Hartill

Dr. Gérard Jugie

Dr. Louis J. Lanzerotti

General Duncan J. McNabb

Mr. Robert E. Spearing

Dr. Diana Wall**

16

* Full biographies are included in the Blue Ribbon Panel Report at http://www.nsf.gov/od/opp/usap_special_review/usap_brp/rpt/antarctica_07232012.pdf.

**Drs. Ducklow and Wall served on the NRC study and so provided formal continuity between the studies.

***Mr. Gordon's membership on the Panel spanned from the Panel's creation (October 12, 2011) until May 11, 2012, when a change in his employment activities necessitated his withdrawal.

APPENDIX C

USAP BLUE RIBBON PANEL REPORT TIGER

TEAM CHARTER

AUGUST 2012

Purpose:

Senior Management team chartered by the NSF Director to guide a comprehensive response to the 2012 U.S. Antarctic Program (USAP) Blue Ribbon Panel (BRP) Report “*More and Better Science in Antarctica through Increased Logistical Effectiveness*”

Membership:

Acting Head of the Office of Polar Programs (OPP): Kelly K. Falkner (lead for the team)

Assistant Director Biology Directorate:
John Wingfield

Assistant Director Engineering Directorate:
Tom Peterson

Assistant Director Computer & Information Science & Engineering: Farnam Jahanian

Head of Office of International Science & Engineering: David Stonner

Senior Advisor for Strategic Initiatives, Office of the Director: Dedric Carter

Division Director, Astronomical Sciences, Mathematical & Physical Sciences Directorate:
Jim Ulvestad

Acting Assistant Director Geosciences Directorate:
Marge Cavanaugh

Charge to the team:

Review the USAP BRP report and guide completion of an NSF written point-by-point response to its recommendations by December 2012.

The Tiger Team will convene during the September-December, 2012 timeframe. OPP will provide the Tiger Team, for its review, copies of the BRP and precursor National Research Council “*Future Science Opportunities in Antarctica and the Southern Ocean*” reports. OPP will provide the Tiger Team with a summary of the current status for each of the recommendations and will also review the process underway in OPP for drafting an integrated master plan to cover 5+ years of capital investment and savings measures. The Tiger Team will direct particular attention to approaches for implementing recommendations that would benefit from or be beneficial to enhanced cross-

Foundational and external engagement. The Team should also identify and provide the rationale for any recommendations that it advises that NSF should not implement. The Tiger Team will roll up point-by-point responses into a summary document tracking with the top ten issues as laid out in the executive summary.

The lead will be responsible for capturing in writing the team’s activities and guidance for its review by e-mail prior to delivery to the Director and Deputy Director. The lead will collaborate with team members to brief upper management regularly (\approx biweekly) during the working period.

The Team is working to an initial deadline of November 15 in order to prepare the director for possible questioning at the Nov 15 hearing and for a Nov 16 dry run of a December 4th or 5th presentation of the response to the National Science Board.

Activities Timetable

(As amended 26Sep12 & 11Mar13)

- Team members receive and read BRP report (\approx 2.5 hr, Sep 5).
- Preview OPP’s status summary of BRP recommendations (\approx 0.5 hr, Sep 21).
- Team members meet with OPP personnel to discuss recommendations and develop action items toward the comprehensive response to be delegated as appropriate (2 hrs, Sep 26).
- Team reviews and endorses via e-mail “already done” subset of recommendations (week Oct 1-5).
- Team reviews “recommendations not adopted” with justifications and meets to discuss. Team assigns thinking/writing subgroups to priority remaining recommendations. Examines suggested text and “policy” for acknowledging NSF USAP support in publications (1 hr, Oct 15).
- Team meets to discuss and collate response to all other recommendations. Captures priority actions to involve engagement of OPP with other units within and outside of agency (2 hrs, week of Oct 17-19).
- OPP creates draft roll up response document selecting examples that speak to top 10 areas of Executive Summary and extracts talking

- points for Director's congressional hearing testimony on November 15. Circulates for Team consideration (Oct 24-26).
- OPP drafts and Team meets with OPP staff to review the presentation content for NSB, BRP, OAC, congress, and public (1 hr week of Nov 1-2),
 - Team reviews OPP presentation of the comprehensive response to the NSB (1 hr, Nov 16).
 - NSB presentation delivered (Dec 4-5).
 - Team meets after NSB engagement to advise on any adjustments of strategy needed to finalize comprehensive response (1 hr, week of Dec 10-15).
 - Team and Director reviews response status update and response summary prior to NSB meeting (Feb 7-18).
 - NSB presentation delivered (Feb 20).
 - Team reviews the summary document changes via e-mail (Mar 4-8).
 - Division of Polar Programs incorporates input and finalizes response summary document for clearance, layout, printing and posting to web by Office of Legislative and Public Affairs (deadline Mar 19).
 - Team participates in final conference call to the BRP lead by Director Suresh (Mar 20).
 - Tiger Team stands down (Mar 20).

NSF 13-77



National Science Foundation

4201 Wilson Boulevard | Arlington | Virginia 22230