NATIONAL SCIENCE FOUNDATION
4201 Wilson Boulevard
Arlington, VA 22230

OFFICE OF POLAR PROGRAMS

MEMORANDUM

Date: May 25, 2005

To: Director, OPP

From: Budget and Planning Officer, OPP

Re: 2004 PRSS COV: Demographics and COI

Below is relevant information about the composition of the COV and procedures to resolve conflicts.

The COV had 10 members, with the following demographic constitution:

Gender: 7 Male, 3 Female
Geographic Distribution: 1 Northeast, 3 South, 1 Midwest, 4 West, 1 Canada
Underrepresented Minority Representation: none
Institutions: 8 Public, 0 Private, 2 non-academic
Carnegie Classification: 4 Doctoral/Research-Extensive[1], 3 Doctoral/Research Intensive[2]
Recent NSF Awardees: 7
Number With No NSF Support: 2

The introductory session included a conflicts briefing and review of confidentiality requirements. It is worth noting that this COV was reviewing the Polar Research Support Section so the review covered issues relevant to the responsibilities of the section rather than research proposals, awards, and declinations, which are not handled by PRSS. However, none of the COV members had financial interests in the topics being discussed.

Altie Metcalf

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[1] Institutions conferring a total of at least 50 doctorates per year across at least 15 fields.
[2] Institutions conferring a total of at least 10 doctorates per year across at least 3 fields, or 20 doctorates overall.

Polar Research Support Section
2004 Committee of Visitors

Executive Summary

The primary goals of the Polar Research Support Section (PRSS) of the National Science Foundation's Office of Polar Programs are "to plan for, provide, and manage logistical support that enables researchers supported by U.S. federal agencies to conduct forefront research effectively and safely in Antarctica and the surrounding Southern Ocean, to do so in an environmentally responsive manner, and to provide other technical input to NSF offices relevant to the management of contracting organizations." This requires providing quality facilities, ensuring effective and efficient use of resources, applying modern technology, integrating responsible environmental health and safety practices and maintaining system flexibility. It also requires meeting the primary duties of contract development and oversight (Raytheon Polar Science Services), annual and strategic planning, budgeting for science requirements and overseeing project management.

The Committee of Visitors (COV), an ad hoc committee of the Office of Polar Programs Advisory Committee, conducted its review over 3 days, 25-27 August 2004. We considered abundant support information, including past COV reports and PRSS responses, and heard presentations from PRSS personnel. We also had ample opportunity to question both PRSS and Science Section personnel. Our review was guided by a series of questions presented to us by the PRSS in consultation with our Chair (appended). These focused, but did not limit or constrain, our considerations. We believe that the time and information available allowed us to complete our task to the mutual satisfaction of the OPP and ourselves.

The COV considers the PRSS to be exemplary in its dedication to meeting its goals and serving Antarctic science as measured through metrics such as efficiency, productivity and addressing, in large part, goals as listed above. It was stated near the end of the review that Antarctic scientists often find it easier to conduct high-quality, cutting edge research in the Antarctic than they do in their own backyards. This perhaps says as much as anything about the ability of the PRSS to support high quality scientific research in the most remote and harshest environment on the planet.

The charge to the committee (see Appendix) did not task us with assessing PRSS oversight of the various contractors that underpin science support, but we would note in passing that PRSS has responsibility for this as well, and that it has developed several effective mechanisms tailored to specific needs. For example, technical oversight of the Ice Core Drilling Services (ICDS) contractor rests with a team of two Contracting Officer's Technical Representatives, one a PRSS Manager and one a Science Program Manager. This joint approach to management reflects the fact that ICDS develops equipment needed for specific cold-regions research activities and appears to serve both PRSS and the science programs effectively. Another type of management oversight of contractors is the South Pole Station Modernization (SPSM). This project dominated activities during the 2001-2003 period covered by our COV report. PRSS oversight is for the contractor, RPSC, rather than jointly with a science team. PRSS has assured that the

project is proceeding well within cost and time estimates. The two types of management oversight (ICDS and SPSM) illustrate the complexity of responsibilities and high quality results from PRSS. The Committee did not look in depth at the relationships between PRSS and the support organizations it manages, focusing its efforts instead on how well PRSS achieved its overarching goals as stated above.

As we considered each question in detail, we identified aspects of PRSS performance that could be improved or restructured. These concerns are noted in the following report. Each question is followed by suggested answers or solutions, and concludes with one or more recommendations. In this Executive Summary, we list only those Major Recommendations that we feel are deserving of immediate attention, and we expand on them in more detail in the text. The Major Recommendations are not prioritized and are instead numbered relating to their appearance in the report. While the other recommendations throughout the document are important, we think that these will be more easily addressed, or that they may require consideration before implementation. An Executive Summary of the Major Recommendations was presented and discussed with the PRSS and Director Erb in our concluding session.

An issue that flavored our discussions during all three days concerned PRSS's ability to anticipate new trends in Antarctic science and then to prepare to support them. The concern is not as much with science that is proposed and funded as with the potential for the development of a scientific culture where ideas and innovations (including novel, but risky projects) are not being funded or proposed because potential PIs doubt there will be satisfactory logistic support from OPP. This culture can extend to panelists and reviewers and beyond to scientists external to OPP, ultimately resulting in decreased vision and innovation, which becomes unhealthy for all global science. A related issue is proposals that are declined because of overwhelming or unusual logistic needs. How much science is never pursued because scientists believe the proposal effort is unwarranted in light of the likelihood of rejection based on logistic constraints or because NSF declines support based on logistic cost estimates or logistic conflicts? Answers to these questions are difficult, but are vital to maintaining leadership in Antarctic science. The COV suggests a proactive effort for identifying these types of future support needs. We suggest (Major Recommendation 1) that this question might be addressed by jointly improving communications among scientists, PRSS and Program managers, who together consider emerging issues at the frontiers of Antarctic science, and the support elements needed to address them.

Our review also identified a systemic problem that we state here for emphasis: the continuing, or growing, difficulty of estimating the real logistic costs of supporting science projects that are being proposed, or have been accepted, for funding and are moving into the implementation stage. This issue is manifested by significant discrepancies between the cost estimates based on the Operations Requirements Worksheet submitted by the PI and the costs later defined by the Support Information Package (SIP) and was noted by Program managers and acknowledged by PRSS. It was not clear to the COV how much of the problem in estimating and tracking costs through the life cycle of a project was due to Raytheon Polar Services, to funding uncertainties (e.g., fuel costs) or to structural elements of science implementation. This issue requires continuing study (Major Recommendation 3).

The major and most important issue, now and for the future, is the pending crisis in icebreaker operations that are the basis for ocean and land- based science (Major Recommendation 5). We again note for clarification that the numbering of recommendations is aligned with the report structure and is not a prioritized list of recommendations. Major Recommendation 5, if not addressed as highest priority, will have major consequences for the United States Antarctic Program.

Major Recommendations

1. ***Sponsor with the OPP Science section, a community-wide workshop, or series of workshops on Grand Challenges in Antarctic Science.*** *(See detail in text Recommendation 1.1).*

2. ***Work with OPP Science section to identify logistical requirements and constraints in order to optimize USAP participation in the International Polar Year (IPY) and to provide support for collaborative international efforts funded by other nations.*** *(See detail in text Recommendation 1.4*

3. ***Provide science program managers with a concrete estimate of funds available for project support, at the time of proposal evaluation***. *(See detail in text Recommendation 2.2).*

4. ***Identify and pursue supplemental funding for IT and IT security infrastructure***. *(See detail in text Recommendation 2.5).*

5. ***Continue to draw policy-level attention to the pending crisis of polar class icebreaker support to ensure the uninterrupted functioning of the United States Antarctic Program (USAP).*** *(See detail in text Recommendation 3.1).*

6. ***Continue, and expand the Area Users Committees***. *(See detail in text Recommendation 7.2).*

QUESTIONS ADDRESSED BY THE NSF OPP COMMITTEE OF VISITORS

1. Have the processes used by PRSS to establish its priorities been effective in capturing the long-term needs and priorities of the Antarctic research community?

The COV regards this question as fundamental in assessing the performance of the PRSS in supporting Antarctic science and thus, we allocated a considerable amount of time for discussion. Another way of stating this question is to ask if PRSS priorities for support and operations capabilities reflect the priorities of the scientific community and if scientific research is limited because of support and operational restrictions. In briefings from the PRSS and subsequent discussions, two separate dimensions to the question became evident. The first concerns the familiar, small-scale basic science traditionally encouraged and supported by the NSF. We find that priorities for such projects are effectively identified, and are well-supported by PRSS. A second, increasingly important class of scientific research includes larger-scale, longer-term, more expensive programs driven by environmental and societal needs (e.g., climate change) or very large programs addressing problems at the frontiers of science (e.g., ICECUBE). These aspects of Antarctic science are discussed in turn below. A final section examines opportunities presented by the International Polar Year.

<u>Individual and small group projects (e.g., cruises, LTER etc).</u>

Both the NSF in general and the OPP are still overwhelmingly focused on small-scale projects that arise through the normal proposal process instigated by individual investigators. In this scale of projects we include not just single-PI projects, but also collaborative research, individual oceanographic cruises and multicruise programs (e.g., JGOFS and GLOBEC) and other multidisciplinary programs (e.g., LTER) costing ≤ $1-10M/year. The existing planning and support structure within the USAP is geared to address this brand of science and does an outstanding job of supporting individual PIs and “small” programs in Antarctica.

The remote location and extreme climate of Antarctica present special challenges and barriers to scientific investigation, especially as advanced technologies ranging from broadband data communications, large-scale computing, and sophisticated analytical instrumentation to genomic, chip-based techniques become increasingly in demand. The PRSS and RPSC have performed heroically in maximizing scientific success and productivity of these programs, while ensuring the health and safety of the investigators and support personnel, as well as protecting the Antarctic environment (see also Questions 4-6). In this, we can conclude that the USAP is indeed science-driven. The USAP remains at the leading edge of international Antarctic science, and as concluded in the 2001 COV review, this indicates that the PRSS must be doing its job.

How are priorities of the scientific community for this kind of science identified and addressed by OPP and PRSS? These priorities are most commonly transmitted to OPP via the individual proposal process. Besides innovative, basic-science proposals from PIs, the OPP also depends on community workshops to generate reports that encourage new programs from specific segments and disciplines in the community (e.g., WAIS Cores, Winter Science in Antarctica, Subglacial Lake research). The large collection of workshop listings and associated reports included on the COV resource CD-ROM attests to the effectiveness of this grassroots mechanism for initiating new science programs within the familiar NSF funding structure. Thus, to the extent that individual PI plans and workshops reflect the near- and long-term priorities of the community, and to the extent that they result in viable proposals, these interests enter the funding process.

Identifying cutting edge science and proposals requesting unusual logistic support and ensuring they get proposed and accomplished.

A significant amount of science that PIs want to do may not be proposed, and is never pursued, because of the known or perceived inability of the OPP to support it technically and logistically. In this respect, one could conclude that cutting-edge scientific projects are limited by logistic capabilities; i.e., the USAP is driven by logistics rather than science *per se*. There are several different aspects to this problem. First, it appears that investigators currently active in the Antarctic are well aware of existing limitations and rarely submit proposals requesting support that will be difficult to provide, for fear of having the proposal declined on the basis of logistics. The separation between the Science and Support Sections within the Antarctic Program, limits an important mode of communication between the research community and PRSS. Second, existing limitations may prevent researchers from outside the Antarctic science community who are naïve of these limitations from receiving support, depriving the community of valuable opportunities for scientific infusion and exchange of ideas. Third, even for proposals considered for support, constraints within PRSS or logistic commitments made during the time lag between filing of the Operational Requirements Worksheet and the approval of the Research Science Plan, may result in scaling back or eliminating innovative new science and advanced research components with unusual logistic requirements. The separation of science funding and logistic planning functions in the USAP, the resulting uncertainties in the cost of complex projects, and decisions regarding "supportability" made by PRSS may eliminate more innovative, complex or challenging proposals, in particular those with the tight timelines and uncertainties in the estimation of associated costs at all levels.

Question 1 highlights the long-term needs and priorities of the scientific community. The COV asked if a Long-Range Plan exists for scientific research in the Antarctic. The answer is no. The OPP has not commissioned such advice because it does not want to be in the position of driving the science, preferring instead to encourage "bottom-up" inputs from the community at large. We believe that considering such a plan, particularly with regard to future logistic requirements, would benefit the scientific community and the PRSS. A joint workshop bringing together scientists with the OPP Science and Support sections would enable PRSS to learn about new ideas and Grand Challenges at the cutting edge of Antarctic science before they reach the proposal stage. Additionally, it would allow scientists to learn about existing support capabilities, and describe the challenges to move to the next level of Antarctic science. A good example is the series of Frontiers Workshops sponsored by OCE in the 1990s and the National Research Council's Space Studies Board Decadal Surveys in Solar System Exploration within the planetary sciences community (www.nap.edu/books/NI000529/html/).

Better understanding and projections of the actual costs of doing field and lab science in Antarctica remain as a significant barrier to improved planning and implementation. These shortcomings often result in underestimating costs as funded proposals are translated from the ORW to the SIP stage of implementation. At the proposal evaluation stage, science program managers need a reasonably accurate estimate of support costs to assure that novel, but perhaps expensive, science can be incorporated. In turn, PRSS and

RPSC personnel need to be more closely informed about the science being considered and proposed for the future by the community, in order to make better cost projections and to prepare for future logistic needs.

1.1 RECOMMENDATION: ***Sponsor with the OPP Science section, a community-wide workshop, or series of workshops on Grand Challenges in Antarctic Science.*** *The goals of the workshops are to identify and match emerging areas of inquiry with the support requirements necessary to enable the science. Participants should include those within and beyond the Antarctic community. The process used by PRSS for evaluating, assessing and implementing recommendations from workshops should be clear and available to the community.*

1.2 RECOMMENDATION: ***Become more efficient and accurate in providing timely support cost estimates and innovative in enabling more complex projects.***

As part of its strategic planning efforts, OPP and PRSS can enable new breakthroughs in science. To this end, OPP and PRSS need a mechanism to move from reacting to the infrastructure needs specified in current proposals to being more proactive in future support needs. The COV also suggests that PRSS additionally be outward looking in its infrastructure investments, so that it is positioned as part of its long-term strategy to consider opportunities for research at new locations "South of 60°." The COV believes there is a need to provide opportunities for researchers to go to new regions on the continent and ocean, but projects are now constrained to locations for which current logistic support or permanent infrastructure exists. While it is reasonable to place emphasis on the maintenance, modernization and incremental enhancement of existing infrastructure, now is the time to begin consideration of developing new infrastructure at new locations where researchers need to conduct research.

1.3 RECOMMENDATION: ***Based on input from the Science community, PRSS should take a comprehensive "South of 60°" look at other opportunities for infrastructure development to encourage the submittal of proposals that stretch the bounds set by current support limitations.***

The International Polar Year (IPY) proposed for 2007-08 commemorates the first IPY of 1882-83 and the 50th anniversary of the 1957-59 International Geophysical Year. A large array of programs and projects has been proposed at the international level, and planning within the USA (under the auspices of the three National Academies) is being advanced. Research in the Census of Marine Life is involved in IPY, and a circum-Antarctic cruise has been planned. While there is no current commitment for significant separate funding for new projects, much can be accomplished by appropriate planning and reallocation of OPP resources. The IPY represents a valuable opportunity to expand public understanding, appreciation and support for Antarctic research, and is a novel jump-starting mechanism for encouraging novel new science through new national and international collaborations.

1.4 **RECOMMENDATION:** ***Work with OPP Science section to identify logistical requirements and constraints in order to optimize USAP participation in the International Polar Year (IPY) and to provide support for collaborative international efforts funded by other nations.*** *Schedule ship time and allocate space at the continental base.*

2. Has the balance between PRSS funding for support of specific science needs and investment in general infrastructure been appropriate?

One considerable improvement in managing the PRSS budget during the past three years was the institution of: (a) the decision matrix for initial project prioritization / selection spreadsheet; and (b) Project Selection Scores spreadsheet, noting which PRSS projects have been funded in FY03 and FY04. However, it is unclear to the COV if the balance between PRSS funding for support of specific science needs and investment in general infrastructure has been appropriate. This is partly because the operations budget does not clearly distinguish between funds that are allocated to directly support science projects and those necessarily allocated to operations and maintenance of core facilities. Establishing separate budgets for these activities, even at an informal level, would enable PRSS to track the funds that support science and those that support general operations, ensuring that PRSS is better able to keep an appropriate balance. Additionally, the COV suggests that the direct science support budget be identified and established ahead of time (and made known to the PRSS Research Support Manager early on) to facilitate science planning and funding decisions.

2.1 **RECOMMENDATION:** ***Separate items in the PRSS budget that directly support science versus those that do not.*** *The ratio between these parts of the budget should be documented and justified.*

2.2 **RECOMMENDATION:** ***Provide science program managers with a concrete estimate of funds available for project support, at the time of proposal evaluation.*** *Determine the proportion of the PRSS budget that directly supports science beforehand to assure flexibility for funding innovative science. This requires an accelerated pace of project costing by PRSS and RPSC. The direct science support budget should become part of each budget cycle so that logistics costs can be identified in order to facilitate long-term projects.*

During the three-year period of review there have been increased infrastructure developments. For example, PRSS has developed telemedicine capabilities that led to a clearer understanding of communication bandwidth requirements; the Pegasus runway was enhanced; the seven LC-130s currently in operation have been refurbished; and PRSS has initiated a mechanized South Pole traverse capability. All of these infrastructure and support initiatives demonstrate that PRSS is being strategic in its efforts to better support quality science in the Antarctic.

A challenge facing OPP PRSS is to invest in IT and business management while balancing and ensuring the quality of science. IT requirements vary among users. The COV suggests conducting a data assessment that would serve as a baseline to inform IT management in support of science. At a time when IT infrastructure has not been growing and expectations are rising, PRSS has identified the need for major systems replacement. This is because the present legacy systems are no longer being maintained adequately and yet these systems are still being used. PRSS must inevitably be prepared to support bandwidth management. Moreover, there is a need to have systems that better support financial management within PRSS. The target expenditure is large, and the effort requires a good bit of BPR (Business Process Reengineering). An ERP (Enterprise Resource Planning) system is also required.

2.3 RECOMMENDATION: ***Make multi-year plans for IT acquisition and upgrades, and plan investment accordingly rather than pursuing an incremental "patch and upgrade" approach*.**

During the past three years, PRSS faced formidable challenges, ranging from limited IT funding and lack of technical understanding on the part of client scientists. On May 3, 2003, the NSF South Pole station's network was compromised by a hacker who stole scientific information and attempted to ransom it. On May 12, 2003, the director of OPP issued a memo directing all systems connected to the South Pole station network to identify and correct all known vulnerabilities. Over 100 vulnerabilities were subsequently identified and are being addressed. The May 2003 incident resulted in a demand for "immediate security" and scientists' awareness and acceptance of new and increased security. The NSF and RPSS recently instituted an information security awareness program to ensure that grantees are aware of and able to follow NSF information security policies and best practices. In instituting best practices for security, OPP and PRSS have made significant progress in spite of the aforementioned challenges.

Communication connections and bandwidth vary greatly at the NSF's three Antarctic science stations. Bandwidth management will require increased attention during the coming years. There is an aging IT infrastructure at the McMurdo station; and the network at all three stations as well as that of the science vessels requires overhauling. For example, the Crary Lab network currently suffers from congestion; Palmer station needs network upgrades; and the science vessels lack the same 24/7-communication capability currently available on tourist ships operating in the same regions.

McMurdo Station has a single T1 that is currently managed with time division multiplexing. The IP networking sub-channel is about 968 kb/s, and there is about 334 kb/s locked up for conventional PSTN telephony (compressed speech). This link is oversubscribed for inbound IP and outbound telephony traffic, and PRSS is currently conducting systems studies to determine the best approach to increase bandwidth. Money and time to work the solutions are the predominant challenges. In short, McMurdo needs more bandwidth and the network needs to be examined and scientists consulted concerning future field opportunities and concomitant IT requirements.

In 2002, PRSS modernized the Palmer station satellite communications with a state-of-the-market C-Band satellite earth station for commercial fixed satellite service. The link is all IP, and running at 384 kb/s. It provides VoIP phone service, general Internet, and on-demand tele-medical video teleconferencing (the VTC preempts all other bandwidth applications). The earth station is designed to operate up to a T1. When Palmer grows, PRSS will need to buy more satellite bandwidth.

Total coverage at the South Pole station has dropped to 10-11 hours. OPP lost access to the LES-9 satellite that was used to move email at the beginning of the viewing window day. The added time of day coverage that LES-9 provided that did not overlap the next satellite in view (MARISAT-2) is approximately 2 hours.

2.4 RECOMMENDATION: ***Invest in upgrading and modernizing the IT infrastructure at each of the three NSF Antarctic Science Stations.***

Identifying and pursuing supplemental funding will aid PRSS in addressing IT infrastructure upgrades and modernization. The balance appears to be acceptable for now, but everything is clearly stressed and a leap in IT demands is anticipated in the coming years. Because money is tight, PRSS is having to micromanage budgets for small projects. For example, IT security is currently tracked as a project on the PRSS Project Prioritization/Selection spreadsheet rather than as a sustaining activity. This is of concern because it suggests that money that could support science is being invested in short-term IT support. PRSS needs more money for IT infrastructure upgrades and modernization, and should develop a convincing strategy documenting the investment and how it affects the quality of science. Finally, pursuing external supplemental funding and leveraging potential partners (e.g. NASA, USAF, NOAA, etc.) will better position PRSS to make bold science support infrastructure investments for the future.

2.5 RECOMMENDATION: ***Identify and pursue supplemental funding to ensure increased funding for IT and IT security infrastructure.*** *Budget IT funding annually as a sustained operational expense rather than as line item projects.*

3. Once science projects have been recommended for funding, does PRSS plan and implement them effectively so that the research goals are achieved?

PRSS has shown dedication and full commitment towards achieving the research goals of the United States Antarctic Program. It works from the ORW through to SIP via the POLARICE data portal, with environmental concerns raised and addressed at each step. The data are checked against the original proposal to ensure that the logistic requirements are accurate and adequately addressed. PRSS also identifies alternate approaches to research support, and then evaluates these in discussion with the program managers and PIs. PRSS recognizes the inherent uncertainties associated with some types of Antarctic research, particularly weather-dependent operations, and has shown necessary flexibility and willingness to help PIs adjust their science activities to these conditions.

Evaluation of logistic services is provided through discussions during the season, out briefs at the end of the field operations, and via direct communications between the PIs and program managers. These comments feed back directly into the annual evaluation of the contractor, but can also lead to immediate adjustments during the field season. The Raytheon planning group offers an important approach towards providing logistics expertise and advice, and a mechanism for effectively planning next season's activities.

Logistic planning requires considerable background knowledge and experience in Antarctic operations. NSF-OPP has a team with an enormous depth of experience in Antarctic science as well as in logistics to aid this process. Due attention should be given to maintaining and developing equivalent (or even enhancing) expertise in the event of key individual retirements or departures. As a result of the above, PRSS and their contractors provide USAP science teams with outstanding support in one of the world's most challenging environments. However, we tender recommendations as outlined below to improve planning and implementation of the science programs.

<u>Icebreaker support</u>

Icebreaker operations are critical to U. S. Antarctic research because of the essential logistical support they provide to land-based as well as ocean science activities. The COV has been informed that only one polar class icebreaker is currently available for Antarctic support. Loss of service from this single vessel before the delivery of fuel to McMurdo would trigger a crisis, likely causing an immediate halt to a significant portion of science funded by the USAP.

During the 2001-2003 period the Polar-class icebreakers experienced challenges due to ice conditions and vessel maintenance. The difficult ice conditions have abated but will likely recur and the USCG icebreaker fleet is not prepared to meet them. The ships are within 2-3 years of their design lifetimes and there is no plan for replacing or refurbishing them. Without the ice-breaking capability provided by these ships, McMurdo Station and the new South Pole Station cannot be re-supplied and could not continue to operate at more than a fraction of their current levels. This could also severely impact other international programs.

In addition to the operational concerns and challenges, the NSF is being asked to fund a steeply increasing fraction of the USCG vessel costs, including ship maintenance costs. The COV learned that NSF and the Coast Guard senior leadership are working with the Office of Science and Technology Policy to initiate policy level discussions within the government to address this pending crisis.

3.1 RECOMMENDATION: ***Continue to draw policy-level attention to the pending crisis of polar class icebreaker support to ensure the uninterrupted functioning of the United States Antarctic Program (USAP).*** *At the same* *time, all alternatives to mitigate the potential impacts of impaired ability to supply fuel to McMurdo Station should be explored.*

The latter action may include: (1) Extending the fuel storage capacity at McMurdo to last over two full seasons, (2) Developing a strategy to reduce fuel consumption (conservation efforts, alternative energy supply options, etc.) in case resupply may not be possible during a given summer season, and (3) Exploring other supply options, including different offloading locations and strategies. Efforts by PRSS to continually improve ice runway operation extend runway lifetime and develop more efficient transfer of personnel and cargo coming into McMurdo by air may help address the larger-scale supply problems.

3.2 RECOMMENDATION: ***Explore different options for fuel supply to McMurdo Station.*** *Considering PRSS' potentially limited resources, an ad-hoc panel consisting of scientists, engineers and other experts may aid in exploring and developing potential solutions.*

Project cost estimation

PRSS has been very effective in deploying small experiments at the three stations (McMurdo, Palmer, and South Pole) and field camps. Working with RPSC they have developed a sophisticated system that deals effectively with the requirements of most projects. However, larger projects or those with new or specialized needs can be delayed because they are not sufficiently well understood in terms of support costs and field requirements until well after they have been proposed or even funded.

3.3 RECOMMENDATION: ***Develop a mechanism that delivers an accurate and timely workup of the full costs of supporting a project, including the logistics and field-support cost.*** *Given the June submission date for proposals, having a 90% estimate of the total cost and support for the project shortly after the proposal is recommended for funding would provide the timely feedback now needed. It is expected that such a comprehensive workup, however, would not be scheduled until after the project had been approved or at least short-listed.*

Deep field LC130 air support

LC130 deep field operation capabilities, specifically open field landings, have been reduced in recent years, and this has affected the ability of field parties to achieve their science objectives. There appears to be a need for additional training of air crews, for example in recognition of ice features, snow mechanics and landing on unprepared ice surfaces. A core cadre of highly experienced pilots should be developed and maintained for deep field operations.

3.4 RECOMMENDATION: ***Consult with the Air National Guard to better define the capabilities of the LC130 for open field landings, including developing a protocol for this type of operation.*** *If it becomes apparent that* *the Air National Guard is not well- suited to provide open field landing air support, PRSS should explore other options.*

Air Support Flexibility

Intracontinental LC-130 flights cannot be scheduled on Sundays, which eliminates a significant fraction (14%) of the limited flying time available in a given field season. This scheduling constraint may simply reflect a longstanding tradition that can be changed, or it may be the result of personnel, maintenance and other operational issues that should be addressed.

3.5 RECOMMENDATION: ***Explore whether Sunday flights can occur in cases where weather, aircraft maintenance or other issues have caused delays in the implementation of science programs.***

POLARICE

The POLARICE data acquisition system has already evolved considerably but requires ongoing major improvement. Researchers find it to be slow, rigid in its data entry requirements, time-consuming and not always compatible with specific requirements; e.g., the itinerary system is not appropriate to ship-based operations, it will not accept spreadsheet entry of consumable lists, etc.

3.6 RECOMMENDATION: ***Implement a major re-evaluation and improve POLARICE, with emphasis on usability.***

4. Does PRSS plan for and implement science support and operations with appropriate regard for environmental issues (or without creating adverse environmental impacts).

During the past three years, the U. S. Antarctic Program has been a leader in environmental stewardship and implementation of environmental protocols in Antarctica. A pioneering and detailed environmental management plan, the Antarctic Specially Managed Area (ASMA) was designed and implemented for the environmentally sensitive McMurdo Dry Valleys area and will serve as a model for the conservation and protection of other environmentally sensitive regions in Antarctica and elsewhere. The early adoption of an 'Environmental Code of Conduct' formulated at a series of workshops initiated and funded by OPP provided immediate awareness for increased environmental protection for the Dry Valley region. The USAP spearheaded collaborative international activities to promote the long-term environmental health of Antarctica. Detailed "comprehensive environmental evaluations" were prepared for two major projects during the past three years. Grantees presently must document and justify any potential environmental impacts produced by their projects and an extensive recycling program exists for the Antarctic stations and field camps. All of these actions have resulted in an overall increase in the level of environmental awareness across the international Antarctic community. NSF currently has the opportunity to influence environmental regulation of tourism activities in Antarctica, and the committee suggests that NSF OPP continue to play an international leadership role in this arena.

The COV notes that the NSF and USAP deserve increased national and international recognition for their exemplary efforts in the area of environmental stewardship, particularly in view of the planned increase in research activities by many nations for IPY in 2007- 2008.

4.1 RECOMMENDATION: ***Increase publicity for USAP environmental excellence.*** *NSF can increase national and international public visibility of the USAP's Antarctic environmental policies and successes through their Office of Legislative and Public Affairs, perhaps in conjunction with IPY press releases.*

Despite these successes, there have been a series of environmental problems that have arisen during the past three years. The level of coordinated response to these problems has not always been satisfactory, and the protocol for responding to environmental disasters has been changed to be more flexible and appropriate for the Antarctic environment.

4.2 RECOMMENDATION: ***Maintain environmental vigilance and take leadership in improving environmental protocols.***

Despite an impressive environmental policy, the USAP continues to remain heavily reliant on fossil fuel consumption and internal combustion engines, which are associated with fuel spills and exhaust emissions. One mechanism for alleviating at least some of these problems is to place a greater emphasis on alternative/renewable energy sources and energy conservation. Although some progress has been made in this area during the past three years, alternative energy sources are still not widely used at field camps or at stations. Progress has been made towards energy efficient buildings in stations, but many energy inefficient buildings remain, and even some of the energy efficient buildings seem to have energy balance problems.

4.3 RECOMMENDATION: ***Improve energy conservation.*** *PRSS should increase efforts to develop and make use of alternative energy sources wherever possible and practical in stations and field camps. A greater focus on energy conservation and use of low emission fuels at stations and in consideration of new vehicle purchases is also recommended.*

5. Do established training procedures adequately prepare grantees for work in Antarctica?

During the past three years, the overall quality of training provided to USAP participants has been extensive and of high quality. USAP researchers are well prepared for working in the Antarctic environment and are familiar with field equipment and with the environmental stewardship required for working in the sensitive Antarctic environment. The downside of this extensive training is that scientists are spending a large amount of on-ice time attending training classes. Even a researcher who has been through the basic snowcraft school may spend two full days in training classes, and twice as much time may be required for an inexperienced person.

The COV recognizes that some aspects of training require face-to-face, hands-on instruction, but believes a substantial amount of training could be accomplished using Web-based classroom technology, such as "Blackboard," that would allow researchers to have the option to complete some aspects of training on their own schedules before their arrival at McMurdo. Progress has been made in this area, (such as the in-progress development of the on-line altitude class available on the RPSC website), but currently no training can actually be accomplished prior to deployment.

5.1 RECOMMENDATION: ***Reduce researcher time spent in on-ice training.*** *The PRSS, in conjunction with RPSC, should determine the aspects of training that can be transferred to a Web-based medium, and implement these changes in a timely manner.*

6. Does PRSS plan for and implement science support with due regard for quality of life issues?

PRSS efforts to ensure that quality of life issues are adequately addressed in science support have been exemplary over the past several years and appear to be successful in all major relevant areas. Due regard appears to be placed on the importance of such issues at the research stations and aboard the vessels. By aggressively instituting satellite communication at field camps and remote sites, quality of life has been improved at these locations as well.

In regards to health issues and quality of life, measures taken to reduce spreading of viral and bacterial infections ("McMurdo crud") were successful. Annual reviews of procedures and policy by a medical commission also appear to be appropriate, in particular in addressing potential concerns (e.g., risk of meningitis or SARS outbreaks etc.).

The attacks of September 11, 2001 brought to reality what were previously unfathomable threats. An action of note, as part of the post 9-11 assessment of preparedness by PRSS, the DRAFT Comprehensive Emergency Management Plan for McMurdo Station incorporates a paragraph addressing potential threats from terrorism/biological weapons. This example is illustrative of the breadth of planning on the part of PRSS, and the comprehensive nature and overall regard for serious quality of life issues.

One quality-of-life issue that has not yet been adequately addressed is that of the quality of housing. While the COV recognizes that limitations exist with regard to housing options in locations such as McMurdo, with a high transient population and a wide range of personnel and scientists deployed, there still appear to be areas where significant improvement is possible.

6.1 RECOMMENDATION: ***Improve quality-of-life aspects in the area of housing, focusing on more amenable conditions in dorms and more flexibility in accommodating room assignment requests.***

7. Are the communication links between the science support organizations and grantees effective in raising and addressing outstanding science support, operations, and infrastructure issues?

The PRSS had a broad range of feedback mechanisms including user committee recommendations, almost 50 workshops, working group recommendations, Science Advisory Boards, project Out briefs, which are tracked and assessed, individual communications and personal interactions with the OPP. With this range of input, there come significant challenges in addressing the needs of multiple disciplines and the diverse needs of individual researchers. PRSS uses these feedback mechanisms to identify and set priorities.

PRSS recognizes that logistical planning by the PIs requires considerable background knowledge and expertise, and the need to help researchers, especially new researchers, formulate their ORWs and SIPs. The New Proposers workshop is a positive step in providing pertinent information to researchers with little background in the complex logistical process required to operate in Antarctica. The ongoing development of the Raytheon planning group is also an important aid for new researchers. However, an added resource that could be introduced into the program for new researchers would be a formalized mentoring program. PRSS could match a new researcher with a willing, experienced researcher who could provide advice for preparing a sensible logistical field plan. This would allow more accurate planning and costing by PRSS.

7.1 RECOMMENDATION: ***Establish a new researcher-mentoring program.*** *The PRSS, in conjunction with program managers and RPSC, should initiate a program to match a new researcher with an experienced researcher mentor.*

Area User Committees

The Area Users' Committees are a very important forum of communication between scientists and support personnel. Beyond out-briefs, they are the only formalized means of information flow between the end users, NSF and RPSC. Recent moves toward making the committee meetings more efficient (less time spent on presentations and more on dialog) are welcomed. Emergence of issues and needs that stretch across and beyond the three principal Antarctic bases (e.g., IT security, data communications) indicate that coordination and integration among the three groups is necessary.

The User Committees provide an effective and timely way of getting information and recommendations back to both the NSF and the RPSC. The three standing committees are the Palmer, McMurdo, and South Pole Committees. These committees generally meet once a year either at the NSF or in Denver. Both sites have advantages, and disadvantages. When at the NSF, the committees have direct access to and discussions with the NSF principals; while meeting at Denver provides similar access to the RPSC personnel who will implement the actual policy. By developing the principle theme for any meeting and identifying the NSF and RPSC personnel who need to be involved, the location could also be determined, e.g. NSF or Denver. When meetings are at RPSC then it would be extremely useful to have senior NSF representatives from both science and operations present. If the meeting had a specific important theme, such as IT, it would be useful to have those involved in this subject at NSF at the meeting. It would increase the effectiveness of meetings to have prior discussions or phone-conferences between the various User Committee Chairs and relevant committee experts in order to better coordinate and refine common requests from the various groups. IT issues illustrate the importance of this joint committee action.

Finally, it should be pointed out that User Committee recommendations to RPSC and NSF should provide a careful balance between strategic and tactical views. Recommendations should address long-term strategic issues, but can also provide "crisp" specifics of a tactical nature. And to be effective, the list of specifics should be prioritized.

7.2 RECOMMENDATION: ***Continue and expand the Area Users Committees.*** *Their importance to the PRSS is reaffirmed with some suggested modifications. Meetings can be made more efficient by distributing Minutes shortly after the meeting, then following up at midyear with a summary of actions taken. Intergroup coordination can be improved by an annual meeting (or video conference) with the three Chairs, PRSS and RPSC representatives.*

8. Have the issues raised by the 2001 COV been adequately addressed?

PRSS's response to the 2001 COV report addresses the major recommendations of the committee, but does not break them out into the subsections of the COV report. It appears that the responses are largely complete and satisfactory, but the level of detail varies. Also, the responses were written soon after the last COV and not updated prior to this COV to indicate further progress on addressing recommendations. Comparing the detail provided in the recommendations with information provided to this COV (2004) indicates that further action is warranted on some items. Our evaluation of the PRSS's response to the recommendations of the last COV is as follows, keyed to the section numbers in the COV report from 2001.

Major Recommendation 1. While PRSS has implemented screening processes to cut down on the number of proposals reviewed, the funding stream still seems to bog down at times, especially in proposals that seek support for projects that are not routine. This is primarily manifested as a lag in obtaining a final budget estimate from Raytheon and from high estimates. Specifically:

2.1.1a. It appears that the field logistics planning process could be improved further, especially the steps from SIP to RSP. Making this process more efficient would help USAP by enabling more accurate estimates of funds available to both PRSS and to the Antarctic Science Section in a given FY. This ties to item 2.3.3, and it is unclear whether or not the feedback is being efficiently incorporated into the process.

2.1.1.1. New user workshops have been established and are a success, although review of the 2004 workshop indicated that too much time was spent on explaining FASTLANE, detracting from communication of OPP-specific information.

2.1.1.2. Done.

2.1.1.3. The worksheet that Raytheon has developed for project planning is a very good planning tool and addresses a significant need. It appears that the information from SIPs is being considered in renewals, but in an informal manner. It might be useful (RE: 2.1.1a) to develop a more structured mechanism for this.

Major Recommendation 2. OPP has exceeded expectations in meeting this recommendation and put the USAP at the forefront of efforts in this area. The success of OPP's efforts in this area should be lauded; they are serving as a model and as leaders for the international community of both science agencies and the tourism companies. However, new challenges will arise, such as increasing tourism, so the USAP needs to maintain its efforts in this area.

Major Recommendation 3. Progress has been made in this area as detailed in PRSS's response to the last COV. There are still issues to be addressed, particularly in long range planning (>10 year horizon) and in the impending crisis in icebreaker and possibly air support. These have been addressed in the text above.

Major Recommendation 4. OPP's response to this recommendation has been adequate; we accept the explanation that constraints on this aspect of budgeting are beyond their control and that it is not a critical problem.

Major Recommendation 5. USAP has made progress on this recommendation; however, we encourage USAP to continue to explore alternatives for air support and to develop air support (and other long-range logistics) collaborations with other countries to the mutual benefit of both parties.

Major Recommendation 6. PRSS has met this recommendation. A somewhat more detailed response to the last COV report would help; the terse response given (as discussed in the introduction to this section), does not adequately address some of the issues raised. Also, the response should be updated just prior to the next COV so that they will know what WAS accomplished instead of what IS EXPECTED TO BE accomplished.