

**ANTARCTIC INFRASTRUCTURE & LOGISTICS DIVISION/
POLAR ENVIRONMENT, HEALTH & SAFETY OFFICE**

2009 NSF COMMITTEE OF VISITORS REPORT

SUMMARY

A Committee of Visitors (COV) was convened 26-28 October 2009 by the NSF Office of Polar Programs (OPP) Advisory Committee (OAC) to address the performance of the OPP Antarctic Infrastructure and Logistics Division (AIL) and the Polar Environment, Health, and Safety Office (PEHS) as per NSF standard practice. The review template was modified by OPP to improve relevance to AIL/PEHS. The COV was composed of nine scientists and support specialists with expertise in AIL/PEHS matters. The previous AIL COV met five years ago. Most of the documents examined covered the intervening period. To optimize interactions with the Antarctic Sciences Division (ANT) COV, which met at the same time, the proposal jacket portfolio, examined jointly, was selected from the past three years.

The COV's primary conclusion is that AIL/PEHS consistently met high standards in performance of its functions, with procedures in place that are genuinely useful to the overall science support process. It is evident that AIL gives careful consideration to annual program requirements, both for individual projects and for the overall program, with the intent of maximizing the amount of science that can be accomplished any given year. The effort required to evaluate the needs, match to resources, complete the required documentation, and communicate with all affected parties is monumental, and the AIL/PEHS staff is to be commended for their thorough and timely completion of this task. Areas for improvements are mostly modest.

The COV observed, however, that little detail was provided about the OPP ships and marine science support on the primary logistics documents, showing up principally as ship schedules. The COV is therefore concerned that marine science support is not given the same level of attention as other areas of the AIL/PEHS purview. Is the level of overall logistics oversight needed for a quality marine sciences program in place? The COV notes, however, that this is not a criticism of the present OPP AIL staff, who are doing their jobs well and responsibly.

Jackets examined appeared to be exemplary in terms of providing documentation of the logistics requests and reviews, containing extensive documentation of logistics considerations. Additional useful information was aggregated in the Annual Allocated Resource Summaries compiled by AIL to identify the resources available to new projects each year, and the Annual Proposal Reviews compiled by RPSC planners to inform program officers of the resource implications of each year's proposals. When logistics needs for support of highly meritorious proposals seemed difficult to support, informal three-way discussion between PIs, planners and Program Officers provided for flexibility, exploration of alternatives and re-scoping. The COV found no evidence of proposals highly-rated for science being declined solely for logistics reasons.

PEHS environmental impact reviews are well-documented, and all programs reviewed were able to be fielded once their impacts were identified, reviewed and addressed. PEHS identified requisite permits for access to sensitive areas. The COV found no instances of excessive delays or overt delays introduced by the environmental impact review process itself.

In all available cases, safety reviews were conducted. The COV was impressed to see safety considerations identified in the Ops Reviews by AIL research support managers. In some cases

these were communicated to PIs. PEHS appears fully responsive as evidenced by identifying specific liens on risk as well as safety training and equipment training that would be required prior to remote field project work. All available safety reviews were finished in a timely manner.

The COV noted that the U.S. National Science Foundation's Advisory Committee for Geosciences recommended "embracing a culture that recognizes that transformational research involves an element of risk". While risk of scientific failure is mostly a science concern, it enters into logistics at times, for example taking a ship into a region where its risk of becoming ice-bound is significant in order to gain access at a scientifically important time of year. Safety risks are managed very well within AIL/PEHS and clearly must continue to be managed at the maximum possible level. But if at some point in the future there develops too great an aversion to a different type of risk - risk of scientific failure - this potentially could hobble some of the most logistically challenging yet scientifically rewarding projects. This concern is based on conversations with staff as well as written PI remarks. The COV perceives that risk aversion, if taken too far, may manifest as a philosophy or mind-set that may not embrace NSF's thrust toward supporting high risk / high reward science as boldly as suggested by the Geosciences Advisory Committee.

Alternative energy strategies have been carefully analyzed, and, along with energy savings, are on a good trajectory for the future. There have been impressive energy savings at South Pole and McMurdo Stations, and proof-of-concept wind generators are being installed for power supply to Scott Base and McMurdo. AIL has also introduced "smart grid" monitoring at South Pole station which can identify equipment failures and assist in re-distributing power across the station in an emergency, should this ever be needed. AIL is also looking at ways to increase alternative energy and decrease fuel use at field camps. Overall, there is a clear realization that conserving energy and monitoring usage will save money and decrease risks to the program.

Significant progress has been made in IT infrastructure at McMurdo and South Pole stations. South Pole now has the capability of transmitting at a rate of 200 GB per day. Unfortunately the TDRS F1 satellite recently became unavailable to the Antarctic Program; negotiations are now underway to use a commercial satellite. 7.2 kbps internet for large field camps is now available.

In 2005, an OAC Subcommittee reported recommendations on achieving effective long term resupply capabilities for the USAP. Since then AIL has taken steps to address nearly every recommendation, although heavy icebreaker support remains a fragile issue largely outside USAP control. The Swedish icebreaker ODEN has been chartered for six austral summers to carry out icebreaking into McMurdo (backed-up by U.S. Coast Guard icebreakers). This is serving present USAP needs well. Studies have been carried out that indicate the feasibility of constructing a runway capable of handling wheeled aircraft at South Pole Station to allow direct supply from outside of Antarctica and more efficient resupply from McMurdo. AIL continued its highly successful development of a ground traverse capability to provide alternative resupply of South Pole, to support remote field site research and to assist in McMurdo resupply. The COV commends AIL for developing such novel and innovative strategies, which have the potential to expand existing science programs and open new scientific opportunities.

This COV notes and heartily commends the improvement in coordination and collaboration between AIL and ANT apparent in the review documents and from the staff presentations. This has led to an overall improvement in the performance of OPP in the completion of its Antarctic obligations. ANT and AIL program officers are presently working together very well. OPP might consider structural changes to the administrative hierarchy to ensure that coordination and collaboration continues.

Based on the evidence provided, the COV perceives an increased interest in conducting research at locations outside the traditional core research locations of the Ross Sea, McMurdo Station area, South Pole, and the Palmer Peninsula area. The COV recommends that ANT and AIL engage in long-term planning to identify impending logistical and technical requirements for completion of the types of complex interdisciplinary projects that loom large on the science horizon. On the logistics side, the COV observes that NSF has made considerable advances in support for deep-field science. Additional possibilities might be engendered by occasionally providing extensive ship-based helicopter support, facilitating cooperative use of resources established by other nations, and temporary use of non-traditional commercial logistics support.

The COV suggests that continued NSF support for "Grand Challenge" or "Big Unknown" science workshops may help to draw in both established and young/new researchers into long-term, higher-risk, and/or logistically complex projects. NSF AIL should consider it sufficiently likely that a new logistically-challenging program will periodically arise and that funding for such yet-unknown projects should in essence be integrated into NSF AIL long-term planning, rather than being thought of as taking away from normal logistics support.

The COV is of the opinion that field research support is almost certainly running head-on into fiscal realities as we understand them today. Despite ample, highly rated science proposals requiring field logistics support, the escalating costs of running and maintaining continental and marine research may mean trouble ahead for USAP science. Science needs must be the deciding factor when choices of cuts are made as ANT and AIL balance their overall support.

The COV noted with gratitude that the OPP Director, ANT Director, AIL Deputy Director, and many Program Officers have spent considerable time in the international arena developing, maintaining, and/or formalizing agreements that have facilitated bilateral and multilateral scientific cooperation. At every level OPP personnel were involved in confirming and finalizing arrangements for logistics and partnerships.

The COV foresees a looming crisis in either 1) rebidding the current ice-capable research ship (LMG and NBP) contracts, or 2) acquisition of new ships, and is concerned about the potential impact of continuing uncertainty on advancements in polar marine sciences. It was not apparent to the COV from the materials provided that marine projects support is documented or supported via planning by AIL at the same level as are activities at McMurdo, South Pole, and Palmer Station. Details of marine project support planning were either completely or largely absent from the provided annual resource allocation summaries and annual science support proposal reviews. This is surprising considering the large numbers of science projects supported by the vessels, and thus brings into question the large scale focus on and priority of marine science.

PRINCIPAL RECOMMENDATIONS

The COV's principal recommendations regarding the AIL and PEHS divisions are few, because the COV found the structure of both divisions appropriate to their tasks and the performance of both divisions very good to outstanding for most areas, though rated less highly regarding marine science support, over the period of review. OPP might, however consider the following:

OPP should consider support for community workshops on the development of access capabilities to new remote field sites of great scientific interest.

OPP long-term logistics planning should allow for recurring logistical challenges, for example work in remote areas requiring services such as ice coring, ship-based helicopter operations, and helicopter support in remote or mountainous areas. The expectation of such programs should be built into the planning for resource allocation.

OPP should continue to proactively explore collaborations with international Antarctic program operators that may provide greater access to remote areas of the Southern Ocean and Antarctic margin and interior for US scientists.

OPP should consider improvements in coordination and reporting of marine projects support and integration with the rest of the OPP program, possibly via restructuring of staff responsibilities. There is also a need for OPP and the Office Advisory Committee to review and track progress towards safeguarding ship support for polar marine projects, and to evaluate the current organizational structure of the program and consider strategic options to better meet future requirements. For example, such an evaluation might examine the feasibility of redirection of project-specific science support funding into ANT in order that ANT may more closely manage its science support requirements.

OPP should examine its staffing with respect to overall responsibilities. Some funded positions remain open even in the face of massive workloads for the present staff, for example the Antarctic Research Integration and Support position for long-range planning within the science side of OPP. Marine projects support staffing is another area of COV concern, especially given the challenges of upcoming ship replacement / contract renewal, and COV observations that that marine projects support is not documented or supported via planning by AIL at the same level as are activities at McMurdo, South Pole, and Palmer Station.

RECENT AIL LOGISTICS DEVELOPMENTS

AIL has faced the dual challenges of supporting major science programs while carrying out major infrastructure projects. These challenges were accentuated by external developments including the 2008-09 budget crisis and the spike in fuel costs.

Major activities on the science front included the WAIS (West Antarctic Ice Sheet) Divide drilling project and the deep drill development ANDRILL (Antarctic Drilling) in the McMurdo area. International Polar Year (2007-2009) included extended season activities and very significant field programs (AGAP - the Antarctic Gamburtsev Province project; PoleNet – Polar Observing Network; LARISSA – Larsen Ice Shelf System Antarctica; and Traverse – Development and Implementation of Surface Traverse Capabilities in Antarctica). Other major projects supported were CReSIS (Center for Remote Sensing of Ice Sheets, including field development; SPT – the South Pole Telescope; IceCube – construction and operation of a high energy neutrino telescope at the South Pole; and science on board the Swedish icebreaker ODEN (currently under charter to NSF for six field seasons).

Infrastructure developments included completion of the South Pole Station Modernization Project (accepted in 2008, with full completion expected in March 2010); modernization of South Pole power management and optimization, including smart grid procedures; upgrade of the McMurdo power plant; and chartering of the Swedish icebreaker Oden for icebreaking into

McMurdo and as a science platform.

Highlights in logistical improvements realized during the review period were new support concepts for remote field site support including use of airdrops for the Antarctica's Gamburtsev Province Project (AGAP) and integration of large and small aircraft operations at remote sites to achieve synergies in support capability; proving of innovative extended season and deep field operations and techniques through the IPY supported projects; and extension of LC-130 deep field capabilities. Significant investment was made in IT and communications, including McMurdo bandwidth upgrades; Palmer Station satellite communications and information security (e.g., safeguards against hacking). Finally, AIL introduced a resource "bucket" approach (aggregating logistics resources at the three Antarctic stations) as an additional planning and management tool.

QUESTIONS PROVIDED BY NSF FOR CONSIDERATION BY THE 2009 AIL/PEHS COV

PART A. Management of the program under review.

A.1. Did AIL accurately estimate the resources required to support research proposals?

AIL in-house procedures to estimate the resources required to support research proposals are functioning very well and are proving useful to the overall science support process. In particular, the COV was impressed by the Operations Reviews carried out by OPP staff. These documents accurately describe logistics, time-lines, and responsibilities for each project, and are not burdened with unneeded (e.g., widely-understood) information. AIL managers and staff demonstrate commendable ability to sort through complex projects and identify essential needs. The OPP Operations Review documents clearly describe what types of support will be provided by the USAP, what kinds of support cannot be provided by the USAP, and what support must be procured by the PI through grant funds. The effort required to evaluate the needs, juggle the resources, complete the required documentation, and communicate with all affected parties is monumental, and the AIL/PEHS staff is to be commended for the thorough and timely completion of this task.

The COV observed that logistical support for ship-based projects was not documented as thoroughly as that for continent-based projects. It was recorded primarily in ship schedules and was not described in detail in other logistical planning documents (e.g., Annual Proposal Reviews [APR] and Annual Allocated Resource Summaries [AARS]). This was surprising to the COV in that the jackets indicated that some marine projects were more logistically complex than some continental projects, and that in terms of overall logistics demands and complexity, ship/marine projects rivaled those of Palmer Station projects, the logistics of which were well documented in the APRs and AARSs. The COV did not discuss with OPP staff any differences in land-based versus marine-based projects which would provide a rationale for this. Based on the apparent discrepancy in documented logistical planning, the sense of the COV is that OPP procedures for assessing and planning the logistical requirements of land-based projects may be working better than those for marine projects. [See also section C.1.]

AIL utilizes pre-award Operational Requirements Worksheets (ORW) which are required to be completed by the PI team for each proposal for early planning information related to logistics. The COV noted that the ORWs in their current form have provoked a degree of PI frustration, perhaps because all forms of science support are lumped together, without the focus provided by subsequent documents such as the OPP/AIL-generated Operations Reviews. Recent

OPP/AIL consideration of a shorter-form version of the ORW (known colloquially as ORW-lite) may be a step in the right direction. The shortened version would capture key logistic components whether they involve marine or continent-based operations. Streamlining of the ORW may also serve to lower the "polar operations" barrier for new investigators. The COV notes, however, that if the overall process is modified (e.g., use of a revised ORW), the desired result should continue to be OPP Operations Reviews which are as complete and useful as those examined by the COV.

The COV notes that AIL gives due and appropriate consideration to the requested resources as stated in the ORWs. AIL combines examination of individual proposal logistics needs with careful consideration of broader annual program requirements, with the intent of maximizing the amount of science that can be accomplished any given year while maintaining needed reserves for contingency. In this light, the COV discussed the merits of future tailoring of the ORWs to capture "desired" resource needs versus "essential" resource needs. Such a distinction would highlight the core support required to meet fundamental project goals. On one hand, there is concern that if there were a distinction between "desired" and "essential", then the default might tend towards servicing only minimum requirements as opposed to a broader set of support needs which might act to widen success or help enable serendipitous findings and discovery. On the other hand, the COV recognized that there are successful support programs which have been able to incorporate a "essential versus desired" approach while continuing to strive to meet the "desired" requirements. The managers of such programs demonstrate good will toward working to achieve full science support, thus over time making fears of "minimum-only" science support almost non-existent. The COV further noted that if program officers have such "desired versus essential" information at the early assessment and planning phase, it will facilitate USAP planning for the best feasible annual program without undue risk of accidentally curtailing crucial support for some of the science projects. Thus, if "desired versus essential" logistics information is acquired, it should be a tool that is shared by ANT and AIL working together during the planning phase in order to understand where trade space exists. For a science community not accustomed to making a distinction between what is "desired" versus what is "essential," this will require some getting used to and initially, may create some mistrust. But it can be made to work, and with ever-diminishing resources over time, this may be a more attractive option as opposed to the alternative risks of not getting funded / approved, or receiving imposed project support alterations that severely impact the science program. The COV notes further that for some projects centered in poorly known "frontier" areas, PI's may have insufficient information to distinguish between logistical requirements that are essential and those that are desired. The ORW should be sufficiently flexible to allow for explanation of important unknowns and for explanation of priorities.

Recommendation: *AIL is encouraged to work with ANT on continued streamlining of the Operational Requirement Worksheets - "ORW lite" - and on modifications to the ORWs to better learn from PIs, at proposal time, their desired versus essential logistics support requirements. This will assist the USAP to better match overall annual USAP science activities to program-available logistics while maximizing scientific success and discovery for individual projects.*

The COV found that on the individual project basis, as projects move forward, AIL does a commendable job on continuing the logistics review, identification and provision for appropriate resources to carry out the work, and post-field-work assessment. Two sets of documents examined by the COV demonstrate that appropriate attention is also being paid by the overall program (NSF plus contractors) in assessing the logistics interrelationships of each year's projects: (1) Annual Proposal Reviews are being carried out by the contractor from the ORW

forms submitted with each proposal, shortly after proposals are originally submitted, and (2) Annual Allocated Resource Summaries are being carried out by the contractor after review, for the projects most likely to be supported (presumably - but not demonstratively - including information from program officers). These two annual documents also provide a look-ahead to known out-year logistic requirements. They have evolved over the 5-year period examined by the COV to be easy-to-understand, information-rich presentations of the whole of the logistics requirements for ANT, particularly those of continent-based projects. Hopefully the needs of marine-based projects will be more fully integrated in the future. (See also section C.1.1.)

POLAR ICE

POLAR ICE is the web-based system for managing PI requests for logistics needed to undertake fieldwork in Antarctica. The 2004 COV for the Polar Research Support Section (now named AIL/PEHS) recommendation 3.6 was for OPP to “Implement a major re-evaluation and improve POLAR ICE, with emphasis on usability.” The July 2005 response from PRSS:

“OPP has tasked RPSC to begin the development of Version 3 of POLAR ICE. Version 3 development effort will address the shortfalls identified with Version 2 as noted by users and the COV. RPSC identified the following through user surveys and include: elimination of the itinerary planning requirement from most science projects; reexamining the work-flow logic to eliminate any unnecessary screens when there is no relevant data entry; evaluating the systems performance by identifying upgrades needed to ensure performance; evaluating the performance of POLAR ICE from the typical user’s perspective via low speed access (e.g., 56 kb/s dial-up modem) to better assess user experience for further streamlining; and evaluating the feasibility of incorporating inter-annual SIP-to-SIP copy for Version 3, and if not possible, continuing to offer a custom manual process for grantees who request such support. A critical factor for success for Version 3 will be the participation of grantees as reviewers and testers of the changes in the Version 3. Greater effort will be expended by RPSC during Version 3 development to increase user participation for input.”

The 2009 AIL/PEHS COV included this full text because this issue has not yet been satisfactorily resolved. ORW-to-SIP and SIP-to-SIP copies are possible, but there are still numerous complaints about the non-user-friendly aspects of the POLAR ICE interface. The current shortcomings of POLAR ICE include:

The completion process for both the ORW and the SIP is cumbersome (e.g., too many forms, too much “clicking”, very little option to upload data from spreadsheets).

The ORW requires too much detailed information at the proposal stage of a project. (The proposed ORW-lite modification mentioned in the AIL briefing to the COV may largely solve this issue.)

Some pages require a “dummy” entry and then an explanatory note in order to move on to the next section (e.g., “Dummy line was inserted in table in order to Validate Polar Ice.”)

Several sections of POLAR ICE are outdated, for example:

The Icebreaker Support section is specific for Coast Guard vessels which are no longer available.

The Service section indicates that analytical research support is available, but if the PI

selects this service they will be told in the Operations Review that the Analytical Lab at Crary is under the auspices of the Dry Valley LTER and they will need to make their own arrangements for processing of samples. (The COV notes from its discussion that some users, for example the Biology Course, have been frustrated by this issue for several years, and so suggests that OPP, perhaps with OAC advice, examine this issue.)

The Service section of POLAR ICE indicates that UV data services are available, but NSF has canceled the UV Monitoring Program and data are not available.

The Laboratory section does not include all available equipment and lists equipment no longer available.

Another issue highlighted by the 2004 COV is the difficulty of estimating the support costs for a field project, specifically the sometimes large cost discrepancies that occur over the time between ORW submission with the proposal and the subsequent cost total of post-award SIP requests by the PI. The 2009 COV observed that this problem has been somewhat addressed from the NSF point of view in that the NSF Operations Reviews indicate the dollar allocation for each project and clearly state that the cost estimate is a "not to exceed" value. Because the ORW entries can be used to populate SIP fields, differences between the two requests ideally should be minimal. But PIs can (and often do) revise the draft SIP and increase the total project cost to amounts well above those generated from the original ORW request. From the PI point of view, post-proposal logistics and resource estimates need to be updated because it can be very difficult to accurately estimate full project costs in the early stages of a program. This can also be the case for programs for which there is less cost knowledge at hand or for which the PIs are less experienced. Therefore it is logical that early costs estimates for project-specific resource needs may change, sometimes significantly. The COV found no direct evidence, however, that fiscal issues related to cost increases between proposal and field time seriously impeded the progress of proposed work.

Recommendation: *A revision of POLAR ICE is necessary to improve usability, and to update resources and support activities that are actually available.*

Improving usability would include less clicking, and options to bypass sections where no resources or support are required. There could perhaps be a cost estimate built into each request area so that the PI can see an accumulating total cost of resources requested (e.g., six hours of helicopter time = \$x, 3 cases of test tubes = \$y). (This would be similar to a shopping cart at a commercial website.)

A.2. Are the results of the logistics reviews documented adequately in the proposal jackets?

The COV found that the proposal jackets contained extensive documentation of logistics considerations. In fact, the jackets examined appeared to be exemplary in terms of providing documentation of the logistics requests and reviews. Furthermore, though the question posed to the COV focuses on "jackets", the COV notes that significant additional useful logistics information is aggregated in the Annual Allocated Resource Summaries compiled by AIL to identify the resources available to new projects each year, and also in the Annual Proposal Reviews compiled by RPSC planners to inform program officers of the resource implications of each year's proposals.

The COV commented that the Annual Allocated Resource Summaries contain valuable

information which may potentially be of use to PI planning and long term community knowledge. These summaries also appear to contain little proprietary data. The COV suggests that, at an appropriate time in the process, versions of these, vetted to eliminate protected information, be made available to current and prospective USAP researchers.

Recommendation: *Make information from Annual Allocated Resource Summaries report available to current and prospective USAP researchers in some appropriate form.*

A.3. *When logistics needs for support of highly meritorious proposals were initially assessed to be unrealistic to support, were adequate efforts made to find alternative means of support?*

The Annual Proposal Reviews provide evidence that the research needs of each project are being considered carefully by AIL. This is documented in: (i) The "resource bucket" evaluations which compare total requests for each critical resource (such as helicopter hours or LC-130 missions) to its availability. Only critical "make-or-break" resources are being examined in this way - for example Twin Otter hours or South Pole beds, which are in short supply, not camping equipment or other minor resources, inventories of which can be expanded easily if required. (ii) At a greater level of detail, RPSC planners are providing AIL with "stop-light" reviews of each proposal, in which critical resource requirements are identified and carefully documented. Planners can obtain permission to contact PIs to discuss details of proposed logistics and alternative arrangements (and evidently have been doing so). This informal three-way discussion between PIs, planners and Program Officers provides for flexibility, exploring alternatives and re-scoping that cannot easily be built in to the ORW.

The COV found the "bucket-level" resource evaluations especially useful (except in the case of ship-based programs where the bucket-level resource review does not appear to be used in the same way) for identifying demand and forecasting which resources may limit the program in future years. Some of this information seems to make its way to the community through advice from program officers, addresses to town hall meetings, and so forth, but these are comparatively informal channels. The committee considered whether it would be good to broadcast something like the "bucket" projections of resource availability to the scientific community to guide PIs in writing logistically feasible proposals. The benefit would be to allow PIs to better match their requests to available resources. The downside is that this could become strategic planning by default, by discouraging PIs from proposing adventurous science with demanding resource requirements. For example a proposal for work in the Amundsen Sea was generally well reviewed and described as "high-risk/high-return", but posed ambitious demands on logistics such as deployment of helicopters from an icebreaker. Logistics challenges may have played an ancillary role in this proposal being declined. The point here is that, arguably, a proposal addressing an important issue with strong justification might not have been written if the PIs felt compelled to tailor their scientific work to only the resources available. A fallback solution that would better inform the community (regarding available logistics and resources) may be for AIL to facilitate and engage in community-led strategic planning for AIL logistics capabilities. The scientific community should play a lead role in developing 5-10 year time scale AIL strategic plans, especially insofar as new and substantial logistical resources may be required to support the most transformative, high priority science.

Aside from evidence found in the documentation the COV was asked to review, the COV noted from personal experience that AIL has provided considerable assistance with project planning to include options for leveraging of resources and suggestions on how the project can better plan key milestone events so as to more seamlessly dovetail into the broader Antarctic program

support requirements. This less formal, verbal exchange has been extremely valuable to the project level as it provides for exchange of more information in a timely manner. AIL logistics documentation is clearly essential and provides a traceable record, but AIL program officers should continue to keep in mind the benefits of talking and emailing directly with investigators, working towards solutions as issues arise. The COV also noted that use of direct contacts as routine business would help to allay any community concerns if AIL begins to make increasing distinction between "desired" and "essential" logistics requirements.

A.4. To what extent was AIL able to deliver the committed logistics support to funded projects?

This question was addressable via the Outbriefs the COV examined (a total of 13). (The COV notes that it would have been useful to review a much larger number of Outbriefs. Perhaps the OAC will consider at some point a review of all Outbriefs.) The COV found that for every funded project, committed logistics support was provided by AIL. In a few specific cases the Outbriefs showed that contractor personnel were not uniformly helpful, and sometimes (but very rarely) scientific efforts and/or results were reduced due to equipment failure or malfunction. Improved identification and monitoring of availability of backup capabilities for mission-critical equipment may be useful.

Common threads of PI-contractor problems reported via the Outbriefs were lost documents, late or unsatisfactory travel arrangements, tracking and other problems with shipping (the leading complaint in terms of potential impact on research), issues with medical clearances, and negative comments about form bloat and difficulties with on-line forms such as the ORW and SIP. The OAC may wish to consider means to provide additional incentive to contractors to provide improvements in their performance in these areas.

Focusing here on only the negative comments in Outbriefs, these also often indicated problems with information technology. The COV noted with approval AIL Deputy Division Director Brian Stone's comments that the solicitation for the new Antarctic contractor requests that bidders provide software as well as expertise, rather than as in the past relying on existing systems. Although he mentioned specifically only materials and inventory software, the COV also hopes that shipping / logistics software, in particular, can be acquired that will reduce or eliminate the problems identified in this area. Comments on information technology are provided in C.1 below.

A.5. Did PEHS conduct appropriate environmental impact reviews?

The Antarctic Conservation Act (ACA), *inter alia*, implements for the United States the environmental impact assessment (EIA) provisions (Annex I) of the Protocol on Environmental Protection to the Antarctic Treaty. These provisions essentially apply to U.S. Government activities in Antarctica the assessment procedures set forth in the National Environmental Policy Act.

Consistent with the ACA, the USAP has established procedures for assessing the potential environmental impacts of program activities in Antarctica based on whether such impacts are assessed to be minor or transitory in nature, more than minor or transitory, or less than minor or transitory. The Office of Polar Environment, Health and Safety (PEHS) is responsible for carrying out the EIA obligations for the USAP.

Assessments of the impacts of science proposals are initially documented through the Record of Environmental Review (ROER). If, based on the ROER, PEHS judges the impacts of the proposal to be less than minor or transitory no further steps are required. If they are judged to be minor or transitory, an Initial Environmental Evaluation is required (example: SPT, the ten meter telescope project at South Pole Station). If they are judged to be more than minor or transitory, a Comprehensive Environmental Evaluation is required [examples: Project IceCube (construction and operation of a high energy neutrino telescope at the South Pole) and Traverse (development and implementation of surface traverse capability in Antarctica)].

In the view of the COV, PEHS has applied the EIA procedures to both science proposals and to infrastructure projects in timely and effective fashion, implementing both the requirements of U.S. domestic law as well as U.S. obligations under the Antarctic Treaty.

PEHS environmental impact reviews are appropriate and well-documented, and all programs reviewed were able to be fielded once their impacts were identified, reviewed and addressed.

Related Environmental Issues

PEHS is responsible for ensuring that the USAP implementation of other requirements of the Protocol on Environmental Protection to the Antarctic Treaty including its Annex II on the Conservation of Antarctic Flora and Fauna and Annex III on Waste Disposal and Management, as well as participating in consideration of these issues internationally through the Treaty system. In fact, involvement in environmental and related issues within or related to the Treaty system seems to be an increasingly important aspect of the Office activities.

Recent examples of important environmental initiatives undertaken by PEHS include the “Don’t Pack a Pest” awareness campaign to increase understanding of the threat to Antarctica posed by introduction of non-native species and of steps to avoid such introduction. Another was the research project that identified cumulative impacts of walking in the unique environment of the Dry Valleys.

A.6. Were the environmental impact reviews conducted in a timely manner?

Although the time interval for the process from proposal submission to the point of authorizing signature varied somewhat, the COV found no instances of excessive delays or overt delays introduced by the environmental impact review process itself.

A.7. Did PEHS conduct appropriate safety reviews?

PEHS has developed safety review procedures for assessing the safety and health risks of all funded projects involving work on USAP vessels or in Antarctica. The objective of the safety reviews is to determine whether a project, as proposed, can be carried out within an acceptable level of risk and, if not, to determine what controls can reduce the risk to acceptable levels.

PEHS completes for each proposed project a form - revised in 2008 - that first documents its assessed risks (significant hazards, potential consequences, risk determination and residual risk after implementation of controls); second, identifies required controls; and third, sets forth the resulting finding (acceptable level of risk, acceptable level of risk with specified control measures, unacceptable level of risk). A finding of unacceptable level of risk is in fact a

recommendation that the project should not proceed without significant modification and reassessment.

In all cases available to the COV, safety reviews were conducted. The COV was also impressed to see safety considerations identified in the Ops Reviews by AIL research support managers. In some, but not all, cases these were communicated to PIs in their Research Support Plans.

PEHS appears fully responsive as evidenced by identifying specific liens on risk as well as safety training and equipment training that would be required prior to remote field project work.

The Office prides itself on its record of being able to identify or develop precautions and control measures such that, to date, it has not had to make a finding of unacceptable risk.

Recent examples of important health and safety initiatives undertaken by PEHS include development of a new protocol for high altitude acclimatization for researchers undertaking high altitude field work in Antarctica and support of an international workshop on improving the safety and productivity of cold water scientific diving.

A.8. Were the safety reviews conducted in a timely manner?

The COV noted that all safety reviews available to the COV were finished in a timely manner.

A.9. Has PEHS been effective in meeting the requirements of the scientific community for protected and specially managed areas?

It was noted in the documentation that PEHS identified requisite permits for access to sensitive areas. PEHS has worked closely with projects to help formulation planning and rules for operation that seek to protect sensitive areas.

The Protocol on Environmental Protection to the Antarctic Treaty provides for the designation of areas in Antarctica in which human activities need to be or strictly limited and/or managed: specifically Antarctic Specially Protected Areas (ASPAs) and Antarctic Specially Managed Areas (ASMA). ASPAs are areas of outstanding environmental or ecological importance in which human activity is limited to compelling scientific research only, with human entry prohibited except in accordance with a research permit. ASMA's provide for management of human activities to protect areas of special scientific significance, avoid environmental degradation and generally prevent conflicts in use.

PEHS oversees the implementation of ASPA and ASMA requirements for the United States and takes the lead in consideration of these issues under the Antarctic Treaty. PEHS has been instrumental in establishing the U.S. as a leader on area protection and management within the Antarctic Treaty system. As a result of PEHS leadership, Antarctic Specially Managed Areas have been designated, under the Treaty, for McMurdo and the Dry Valleys (ASMA 2 (2004)), for Amundsen Scott South Pole Station (ASMA 5 (2007)) and for Southwest Anvers Island and Palmer Basin (ASMA 7 (2008)). In addition, PEHS has been a key player in the efforts to develop a system of marine protected areas jointly under the Antarctic Treaty and the Convention on the Conservation of Antarctic Marine Living Resources.

A.10. Is AIL making effective use of alternative energy technologies?

Overall, the COV found that there is a clear realization that conserving energy and monitoring usage will save money and decrease risks to the program. The COV concluded that alternative energy strategies have been carefully analyzed within AIL, and are on a good trajectory for the future.

AIL has taken significant steps to address USAP energy requirements, including alternative energy technologies. The significance and urgency of the issue was heightened by the dramatic spike in fuel prices beginning in 2008.

Generally, energy conservation has been elevated as a factor in consideration of project acceptance criteria and green building and engineering techniques in infrastructure planning.

Work neared completion on the upgrading of the McMurdo power plant to provide for necessary redundancy in the power and water supplies for the station, as well as to achieve greater fuel efficiency. Completion of the project is anticipated for January 2010. In addition, steps are being implemented to reduce water consumption, for waste heat recovery, to improve detection of and reduce heat losses in piping and other heating systems and to apply smart grid technologies.

Wind and solar energy sources are increasingly being used in small field camp operations and AIL is working with New Zealand on a pilot wind turbine generator project, with long-range prospects of making significant contributions to McMurdo's energy needs.

Concerted attention to upgrading the electrical and heat generation systems at South Pole Station, along with application of waste heat recapture and smart grid technologies, have resulted in significant energy savings.

AIL Deputy Division Director Brian Stone described many impressive energy savings at South Pole and McMurdo stations. Wind generators are being installed for power supply to Scott Base and McMurdo. This effort is at the proof-of-concept stage. If all goes well the wind generation scheme will be able to power Scott Base and distribute surplus power to McMurdo. Together with the reported increase in fuel storage capacity at McMurdo, this will also help to provide insurance if there is a repeat of the situation in which icebergs or heavy sea ice threatens to block re-supply to McMurdo, or some other event disrupts fuel re-supply.

AIL has introduced a system of smart grid monitoring at South Pole station which can identify equipment failures and assist in re-distributing power across the station in an emergency, should this ever be needed. Conversion to a smart grid at McMurdo is under study. AIL is also looking at ways to increase alternative energy and decrease fuel use at field camps.

AIL provided invaluable assistance with design of alternative technologies for heating of the new LDB payload preparation buildings at Williams Field. The alternative approach incorporated distributed heated glycol circulation built into floor radiators that were served via a central distribution off of a single plant supporting several buildings; thus, realizing an energy savings versus use of traditional kerosene heater methods.

A.11. Is AIL making progress in resolving resupply challenges?

The COV found that AIL is making excellent progress in resolving those resupply challenges which are within OPP control, following closely and expanding upon the advice of the 2005 Subcommittee of the OPP external Advisory Committee (OAC) which was formed to make recommendations on achieving effective long term resupply capabilities for the U.S. Antarctic Program.

In the period since the issuance of the report of the Subcommittee, AIL has taken steps to address the fragility of icebreaker support for the U.S. Antarctic Program pending completion of high level studies on overall U.S. Government icebreaking capability and action thereon. The Swedish icebreaker ODEN has been chartered for six austral summers to carry out icebreaking into McMurdo (backed-up by U.S. Coast Guard icebreakers).

Studies have been carried out that indicate it is feasible to construct a runway capable of handling wheeled aircraft at South Pole Station to allow direct supply from outside of Antarctica and more efficient resupply from McMurdo. Another facility being investigated is a blue ice runway on the polar plateau.

AIL has continued to pursue development of a ground traverse capability to provide alternative resupply of South Pole, to support remote field site research, and to assist in McMurdo resupply. The concept has been proved in science project support as well as in resupply logistics. A traverse to South Pole in the 2008-09 season offset approximately 37 LC-130 flights.

Finally, cooperative exchanges have been initiated with Australia and trials with New Zealand involving provision of airlift capability to McMurdo for the U.S. Program.

The COV noted that studies by many groups identify the continuing requirement for heavy icebreaker support for the annual McMurdo break-in and resupply. The arrangement with Sweden for use of Oden is a commendable example of utilization of international resources, and does supply a small amount of much appreciated annual science support from Oden (if the break-in itself uses the expected number of icebreaker days). The agreement in its current form is, however, unlikely to enable longer periods of heavy icebreaker support for special ANT deep-ice marine missions. With the future of US Coast Guard or other US-controlled heavy icebreakers as yet undetermined, the USAP requirements for heavy icebreakers are not being addressed for the long term. Again, though, it should be emphasized that the COV found that the current arrangement is functioning well in terms of meeting basic USAP needs for the present.

Regarding science support enabled by AIL's implementation of the resupply subcommittee's recommendations, the successful traverse to South Pole is a significant milestone in South Pole resupply concerns as well as freeing up over 50 flights for other uses. Also on the horizon are the possibility of direct flights to Pole (bypassing McMurdo), as a means of staging and supplying field activities in East Antarctica such as the AGAP camp. The COV commends AIL for developing such novel and innovative strategies, which have the potential to expand existing science programs and open up new scientific opportunities in parts of Antarctica where OPP has been challenged to work in the past.

Recommendation: *AIL should continue to explore alternatives to existing supply chains, especially traverse destinations in West and East Antarctica where long distances, site altitudes, and/or weather conditions make it difficult to operate aircraft effectively.*

A.12. *Have issues raised by the last COV been adequately addressed?*

OPP has addressed all or nearly all of the issues raised by the 2004 COV. Most answers to this question can be found via the answers to other questions. The following contains additional answers and recommendations.

Recommendation: *The 2009 COV concurs with the 2004 COV that OPP must "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)."*

The 2004 COV recommended that OPP organize a series of workshops on "grand challenges" in Antarctic Science. As far as the COV is aware, this has not happened at the Division level, but some research communities have organized meetings that served this function.

The previous COV noted with concern that some proposals rated highly for their intellectual merit were not supported because of logistical considerations. To investigate the extent of this problem the 2009 AIL COV read the review analysis of proposals that were declined. The number of projects in the different Antarctic science programs that were evaluated by the AIL COV is provided in the following Table:

Antarctic program	AOE	AAA	AISS	AES	AOAS
Number of declined proposals examined	9	7	4	9	3

The 2009 COV's review analyses indicated that in almost all cases the proposals that were not funded were declined on the basis of the science, not because of lack of logistical resources.

One large collaborative project presented difficult logistical and technical challenges that would have been difficult for AIL to meet. There were questions raised by reviewers regarding scientific merit, and so the proposal was declined on scientific grounds. The issue remains that a proposal dealing with similar science issues and challenging logistics requirements is likely in the future. It was such large, cutting-edge, innovative projects that the 2004 COV identified as those most likely to be abandoned due to insufficient logistical capabilities; it is these projects that also are arguably the most important to fund if the USAP is to strengthen its leadership in Antarctic science.

The 2009 AIL COV thus shares the concern expressed by the 2004 AIL COV that, whereas the logistical needs of the individual and small proposals are met, the resources required for major initiatives are either insufficient or are difficult to provide without significant impact on the entire scientific program. Although the objectives of future proposals are unknowable, it is highly likely that some proposals will increasingly involve imaging, penetrating, and sampling multiple combinations of water, ice, rock, and sediment in the most inaccessible parts of the continent. This underlies the COV's recommendation, expressed in this report, that ANT and AIL engage in long-term planning to identify impending logistical and technical requirements for completion of the types of complex interdisciplinary projects that loom large on the science horizon. Consideration should also be given to the question of the boundary between "technology development" and "logistical support", and how each will be supported.

PART B. Questions Considered Jointly by the Antarctic Sciences and Antarctic Infrastructure & Logistics/Polar Environment, Health & Safety COVs

B.1. *Are processes in place to ensure alignment of USAP support infrastructure to emerging scientific community requirements within a reasonable timeframe? Have Antarctic Sciences and AIL/PEHS responded to those emerging requirements within a reasonable timeframe?*

The AIL/PEHS COV found that OPP is doing well in terms of ensuring alignment of USAP support infrastructure to emerging scientific community requirements within a reasonable timeframe, and further noted that ANT and AIL/PEHS have responded to emerging requirements within a reasonable time frame. That said, there was considerable COV discussion regarding this issue, which the COV will relate in the remainder of the reply to these questions.

Unlike other divisions at NSF, OPP is responsible for several major aspects the US Antarctic Program (USAP). These responsibilities include 1) maintaining a US presence in the Antarctic region through the operation of year-round research stations, 2) coordinating research activities at permanent stations, seasonal field camps and through ship operations around the continent, 3) funding research across a wide range of scientific disciplines, and 4) coordinating research activities from a number of other federal agencies, among others. And unlike other many national Antarctic programs, it is not NSF policy to set a research agenda for polar science, but rather to allow research areas to be determined by proposal submission from the science community. Therefore, long-range planning for future research is not in the direct purview of NSF, but needs to be initiated by the science community (with NSF encouragement and support) through workshops and meetings to identify the “grand challenges” (e.g., the report on Frontiers in Polar Biology).

There remains an essential need for OPP to have a long-term strategic plan for the logistics infrastructure that is required for research to be conducted under the auspices of the USAP. One element of such a plan would be for each major asset (e.g., station, ship, seasonal field camp) to have a life cycle management plan such that maintenance and replacement can be scheduled in a reasonable time frame and not become an emergency response to impending or sudden failure. For stations and ships this will be a complex process of examining and evaluating individual components, but would prevent loss of field time and allow for accurate planning and acquisition of funds. It is not clear from the documents provided or the briefings to the COV the degree to which this process is already a formalized activity as opposed to being accomplished via ad hoc observations. A similar strategy should be in place on a smaller scale for science support instrumentation (e.g., equipment in the Crary Lab, instrumentation onboard ships).

Recommendation: *AIL should have a life cycle management plan for the major assets of the USAP (e.g., stations, ships, perennial field camps, major instrumentation). Aspects of such a plan might be shared with user groups and the OPP Advisory Committee.*

There is currently no process or staff person in place to do long-range planning. The AIL/PEHS COV was impressed with the amount of effort expended by the AIL and ANT staff on coordinating and juggling logistics needed to maximize the scientific activities that are supported while minimizing conflicts. Their tasks are completed expeditiously and effectively. Given the work entailed in these crucial operations, additional staff may be necessary to address other important but less immediately pressing issues. For example, the addition of an Antarctic

Research Integration and Support position would facilitate longer term planning and coordination of science and logistics activities than is presently possible.

Recommendation: *Fill the Antarctic Research Integration and Support position for long-range planning, within the science side of OPP.*

There is a strong tie between strategic science planning and infrastructure. As was the case for the previous AIL COV, the 2009 COV grappled with issues relating to the most complex, long-term projects and the attendant strategic planning.

The AIL COV suggests, jointly with the ANT COV, that ANT and AIL continue efforts to bring together scientific interest and logistics capabilities to carry out research in scientifically valuable but difficult to reach locales. On the logistics side, the COV observes that NSF has made considerable advances in support for deep-field science, for example with establishment of traverse capability, increased availability of LC-130 missions for deep-field support, and so forth. Other possibilities might be engendered by at least occasionally providing extensive ship-based helicopter support, facilitating cooperative use of resources established by other nations, and temporary use of non-traditional commercial logistics support. The mechanism used by other nations - announcement of a logistics opportunity some years in advance, inviting proposals to utilize it - may not be strictly appropriate to NSF. But COV analysis of some of the more logistically complex proposals shows the value of long-term scientific planning to put together such programs. This suggests that continued NSF support for "Grand Challenge" or "Big Unknown" science workshops may help to draw in both established and young/new researchers into long-term, higher-risk, and/or logistically complex projects. On simply the logistics side, NSF AIL should consider it sufficiently likely that a new logistically-challenging program will periodically arise that funding for such yet-unknown projects should in essence be integrated into NSF AIL long-term planning, rather than being thought of as taking away from normal logistics support. The community may find valuable a workshop on the development of access capabilities to new remote field sites of great scientific interest.

Recommendation: *That NSF plan for longer term cycling of "logistical challenges" that would include remote areas requiring services such as ice coring, ship-based helicopter operations and helicopter support in remote or mountainous areas. The locations and scientific rationales for the areas selected would vary, but the necessity for expensive logistical operations of different styles on a rotating basis should be built into the planning for resource allocation. The community may find valuable a workshop on the development of access capabilities to new remote field sites of great scientific interest.*

Currently the push to fund complicated deep-field operations emerges from community activism, which grows through workshops, town hall meetings, and eventually wide-scale proposal pressure. This is a good way for the grass-roots scientific community to influence program direction, but it is likely to be daunting for young investigators and those outside the Antarctic community to mobilize such activity. The need to go through the process of assembling a nucleus of people, workshops, etc., may to some extent be a disincentive to new/young investigators. If the site/logistics information could be managed, this might help enable grassroots efforts.

The COV noted during discussion that AIL could capture (via a 'wiki'?) information about past and current visits to deep-field sites, to help enable repeat visits to new remote sites and re-visits to important sites visited long ago. Perhaps the Outbriefs could be used to provide information about sites (such as significant weather conditions, aircraft operations, accessibility

of nearby sites of scientific interest, and so forth), not just contractor performance as is mostly the case at present. Information from Outbriefs and old, pre-electronic-era documents could be captured relatively inexpensively by summer undergraduate interns.

Recommendation: *That OPP support each summer one or more undergraduate interns charged with retrieving literature, data, and logistical information about remote sites of possible interest and posting the information on an appropriate website.*

B.2. *Have Antarctic Sciences and AIL been effective in developing appropriate partnerships to provide logistics and infrastructure support*

- *With other federal agencies?*
- *With other national Antarctic programs?*

NSF and NASA have partnered to provide cost sharing for logistics and infrastructure. NSF has been responsive to broader agency needs and has made available alternative approaches and options that are of mutual benefit to both agencies. This has been a long-standing partnership over several years that has resulted in achieving monumental cutting-edge science for the earth science, astrophysics, astronomy and space science communities.

AIL Deputy Division Director Brian Stone provided the COV with a detailed list of interagency support agreements and memoranda of understanding related to logistics and/or support of specific science projects. These include agreements with US Department of Defense, US Air Force, US Army Cold Regions Research and Engineering Laboratory, Department of State, NOAA, and USGS (all U.S. agencies), and with scientific agencies or national representatives of France, Norway, New Zealand, Germany, Italy, Great Britain, Argentina, Australia, China, and Ukraine.

Although many international scientific projects begin with contacts between individual investigators (the prototypical paradigm for NSF-supported science), we note with gratitude that the OPP Director, ANT Director, AIL Deputy Director, and many Program Officers have spent considerable time in the international arena developing, maintaining, and/or formalizing agreements that have facilitated bilateral and multilateral scientific cooperation. Several of the funded projects that the COV examined had international collaborators or had field teams that were slated to visit stations of other national programs in order to access sampling sites. The Operations Review document and e-jacket diary notes indicated that these OPP representatives were all involved in confirming and finalizing arrangements for these projects to ensure smooth logistics and success with the field season. Such partnerships may be of increasing importance in the future.

Recommendation: *That NSF continue to proactively explore collaborations with international Antarctic program operators that may provide greater access to remote areas of the Southern Ocean and Antarctic margin for US scientists.*

B.3. *Was the review of logistics requirements and subsequent allocation of logistics resources conducted expeditiously?*

The AIL/PEHS COPV found that AIL is performing well in this regard. Although the Operational Request Worksheets (ORW) are at times cumbersome, their required inclusion with proposals is essential to initiating review of logistics requirements and allocation of resources. Review of the

jackets showed that for proposals calling for on-Continent research, the Contractor thoroughly (and apparently promptly) reviewed the ORWs and noted problems, issues, and incompatibilities captured in the Annual Proposal Reviews. OPP AIL Research Support Managers used the ORWs, communications with the PIs, and the Annual Proposal Reviews to create succinct, highly useful Ops Reviews. As noted in A.1, the AIL Research Support Managers showed ability to sort through complex projects and identify the essential needs. The Ops Review document clearly describes what types of support will be provided by the USAP, what kinds of support cannot be provided by the USAP, and what support must be procured by the PI through grant funds. In most cases the Ops Reviews were completed within a reasonable time frame relative to the granting of the award. Any delays in the timing of the Ops Review relative to the start of the field season appeared to be related to delays in the approval of the proposal.

PART C. OTHER TOPICS

C.1. *Please comment on any program areas in need of improvement or gaps (if any).*

Marine Science Support

Based on the jacket evidence and other information provided to the COV, the COV considers marine projects support to be an area of special concern. It was not apparent from the materials provided that marine projects support is documented or supported via planning by AIL at the same level as are activities at McMurdo, South Pole, and Palmer Station. For example, the details of marine project support planning were either completely or largely absent from the provided annual resource allocation summaries and annual science support proposal reviews. This is surprising considering the large numbers of science projects supported by the OPP ships. For example, the number of grantees/projects being served places the vessel-based program at a level intermediate between Palmer Station and McMurdo. The allocations of shipboard resources and vessel operational days/areas are as complex as those for many continental projects with potentially as many logistics issues which would be expected to be tracked in the above-referenced documents. The COV was unable to identify a specific OPP staff member assigned to oversee marine science support and ship operations. The needs of the marine programs thus appear to be somewhat off the radar screen at OPP AIL.

Recommendation: *ANT/AIL are encouraged to include substantially more information about marine science support in the Annual Proposal Reviews and Annual Allocated Resource Summaries.*

Recommendation: *That coordination and reporting of marine projects support and integration with the rest of the OPP program be improved, perhaps via restructuring of staff responsibilities at NSF. The COV singled out the possible need for a person at OPP more closely identified with marine science logistics in order to improve coordination and reporting of marine projects support and integration with other OPP programs.*

Although there was only minor evidence that specific projects in the jackets the COV reviewed were declined or impeded by ship or ship-based resource availability issues, the COV notes that a number of projects were deferred due to ship issues and that potential proposal submitters have been actively discouraged from proposal submission by OPP program managers because of the current lack of available ship time in key research areas.

Additionally, the COV foresees a looming crisis in either 1) rebidding the current LMG and NBP contracts, or 2) acquisition of new ships. Significant efforts, involving large numbers of scientists and planners, have already been directed towards the planning of both LMG and NBP replacement ships, with specification-based conceptual designs or draft RFP's developed through multi-step engagement with the science community. Neither of the two processes has yielded a direct pathway to either a rebid for the use of an existing ship or the acquisition or construction of a new ship.

Recommendation: *That the Office Advisory Committee review the current status of OPP ship rebid/procurement in the context of planning at the 10 to 20 year timescale. An agile "action team" might be formed, including several science community leaders and NSF staff to track progress towards the safeguarding of marine projects support.*

The COV noted the establishment of solid science programs in collaboration with the Swedish Antarctic community on the icebreaker ODEN. A variety of new ships with Antarctic research missions have been introduced by other nations. These offer additional opportunities for collaborative US science support.

Recommendation: *That NSF proactively explore collaborations with international Antarctic program operators that may provide greater access to remote areas of the Southern Ocean and Antarctic margin for US scientists.*

Infrastructure and Logistics in Support of New Research Sites

Based on the evidence provided, the COV perceives an increased interest in conducting research at locations outside the traditional core research locations of the Ross Sea, McMurdo Station area, South Pole, and the Palmer Peninsula area. This trend is to be expected as research questions are extended to include less-studied areas of Antarctica and the Southern Ocean and are also driven by place-based discoveries, for the example the fact that the Pine Island Glacier is the fastest-changing ice stream on the continent. Access to these new and remote locations is important to the US and international science communities yet the logistical challenges are substantial. The COV suggests that planning for and implementing capabilities to access to these areas will require long lead time, on the order of 5 years or longer. While NSF should lead the organizing of these visioning and planning activities, the justifications and specific needs can and should come from the science community.

Recommendation: *OPP should consider support for community workshops on the development of access capabilities to new remote field sites of great scientific interest.*

Recommendation: *That NSF plan for "logistical challenges" that would include remote areas requiring services such as ice coring, ship-based helicopter operations and helicopter support in remote mountainous areas. The locations and scientific rationales for the areas selected would vary, but the necessity for expensive logistical operations of different styles, perhaps on a rotating basis, should be built into the planning for resource allocation.*

OPP program structure relevant to the delivery of infrastructure and logistics support

This COV notes and enthusiastically approves the greater coordination and collaboration between AIL and ANT that is apparent in the review documents and from the staff presentations. In our view, this greater flexibility in how the two divisions jointly support science has led to an overall improvement in the performance of OPP in the completion of its Antarctic obligations. The COV discussed further integration of the two divisions as a possible means of additional enhancement of performance. The COV anticipates that significant challenges to OPP performance may be imposed by rapidly escalating resource and logistics costs coupled with increasingly variable annual budgets. The requirement for agility in responding to an increasingly complex set of individual and group proposal submissions in this environment suggests to the COV that NSF may wish to consider further improvements in coordination of the science-support functions of AIL with ANT.

Recommendation: *That OPP and the Office Advisory Committee evaluate the current organizational structure of the program and consider strategic options to better meet future requirements. For example, such an evaluation might examine the feasibility of redirection of project-specific science support funding into ANT in order that ANT may more closely manage its science support requirements.*

IT support at McMurdo, South Pole, and Palmer Station

Significant progress has been made in IT infrastructure at McMurdo and South Pole. In 2003, McMurdo operated with a 24 hour T1 connection (1.5mbps) to CONUS and today, McMurdo has a 24 hour 10Mbps link to CONUS. At South Pole, a new 4.5 meter earth station has the capability of transmitting at a rate of 200 GB per day. Commissioning tests reached an Antarctic data transmission record of 239.7 GB on January 27, 2009. Unfortunately, on October 21, 2009, the TDRS F1 satellite became unavailable to the Antarctic Program and negotiations are now underway to use a commercial satellite, SKYNET-4c, which would yield almost the same data rates as TDRS F1, although it will be above the horizon for only 4.2 hours/day, increasing to 6.2 hours/day by January 2013.

IT support for large field camps is now available. A portable Iridium phone cluster provides connectivity to the internet at 7.2 kbps 24 hours/day. Larger clusters are possible by adding modular units to the package, resulting in higher data rates.

C.2. Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

The South Pole Station upgrade was an enormous undertaking for OPP. The COV takes note that during the planning and construction of the new South Pole Station, two major projects (Ice Cube and the South Pole Telescope) were also starting up, yet the impact of the station construction and infrastructure to ongoing South Pole science operations was minimized. Although some science projects were unable to get into the field because of the tremendous amount of cargo necessary to be moved to South Pole, the COV commends OPP on its planning and operations in balancing the many conflicting needs in this complicated task. As part of this effort it was recognized that AIL must pursue additional means of supplying the South Pole Station with cargo. The overland traverse has proved to be an economical solution to resupply not only the pole, but other field locations.

OPP has demonstrated ongoing support over many years for the NASA Long Duration Balloon

(LDB) program. This has been an effective partnership that has resulted in accomplishment of monumental science for NSF and NASA. OPP has worked with NASA to achieve an effective partnership for cost sharing and utilization of resources to achieve world-class science. The balloon science community recognizes the vital importance of the opportunities provided in Antarctica that cannot be achieved elsewhere. OPP has done an outstanding job in stepping up to the many challenges posed by NASA's balloon program.

C.3. Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

The COV noted that it is somewhat paradoxical that NSF funds can be provided for workshops, where scientists can assemble to discuss short- and long-range scientific issues, while there are - at least in some cases - insufficient funds for career Program Officers to go to even a few scientific meetings each year to carry out vital community interaction. It is often at such meetings that the ideas and logistics challenges of future science first appear. Although present policy places somewhat fewer restrictions on travel for so-called rotators, it is equally or more important that the career Program Officers continually take the pulse of their science communities.

Recommendation: *Travel budgets for (career) Program Officers should be increased to levels sufficient to allow them to attend a reasonable number of scientific meetings and interact with the community outside of the Washington, DC area. This budget should include travel to appropriate international meetings (e.g., SCAR).*

C.4. Please provide comments on any other issues the COV feels are relevant.

1. The COV briefly discussed, without coming to any specific conclusion or advice, a question for longer term planning: How should resources - especially in tight budget environments - be apportioned between exploratory, campaign-type projects and long-term monitoring functions? Both extremes, as well as the many gradations between them, are important scientifically. The COV suggests that the OPP Advisory Committee may wish to examine this issue.

2. The COV also discussed at greater length, but also without conclusion or specific advice, the issue of scientific risk (as opposed to hazard risk) as related to logistics.

The COV noted that the U.S. National Science Foundation's Advisory Committee for Geosciences recommended "embracing a culture that recognizes that transformational research involves an element of risk". While risk of scientific failure is mostly a science concern, it enters into logistics at times, for example taking a ship into a region where its risk of becoming ice-bound is significant in order to gain access at a scientifically important time of year. Safety risks are managed very well within AIL/PEHS. But if at some point in the future there develops too great an aversion to a different type of risk - risk of scientific failure - this potentially could hobble some of the most logistically challenging yet scientifically rewarding projects. This concern is based on conversations with staff as well as written PI remarks. The COV perceives that risk aversion, if taken too far, may manifest as a philosophy or mind-set that may not embrace NSF's thrust toward supporting high risk / high reward science as boldly as suggested by the Geosciences Advisory Committee.

The question devolves partly upon whether or not the broader Antarctic science community is responding appropriately. A casual remark during discussion referred to the notion that OPP was engaged in "business as usual" science. The COV noted that when expectations of delivering innovations and transformations are ramped up, one should accept that the risk of scientific failure will also rise. This spills over into logistics support. An example from the past is the hovercraft experience. In the end, the use of the hovercraft to support science was unsuccessful, for a variety of issues, but the community of users appreciated that the attempt was made. The surface heavy cargo traverse to South Pole carried risks as well, in terms of geopolitics, safety, and overall viability, but OPP developed it and the science community is pleased they did. When the NBP became partially icebound in Marguerite Bay several years ago, that was the result of a logistics support risk taken with a negative consequence, yet the ship-using science community realizes that kind of risk enables access to remote sectors of the margin at interesting times of the year.

OPP needs to (and does) fully manage the easily-managed risks in delivering the science. OPP needs to (and does) track and manage life safety risks at the maximum possible level. And OPP needs to (and appears to) think hard about reducing risks in any new and innovative ventures. But at the same time, OPP should not be unduly averse to failure. PIs can be encouraged to attempt significantly new, different, and challenging projects. And we should avoid focusing so much logistic support on one specific project - in an attempt to beat down the risk of failure from 10% to 1% - that we are not able to support other worthy ventures.

Every project has some degree of question on science risk. The COV calls attention to the continuing need for risk management in order to better facilitate the call for transformative science. In terms of a general long-term recommendation, the COV notes that AIL might work to develop a culture where people continue to work to understand the science risks, and know how and when to reduce them, but are also not so risk averse that new and innovative approaches are difficult to bring to fruition. It is OK to fail (but not too often). Science on the front edge should not be (unreasonably) hampered.

3. The COV discussed an issue peripheral to its Charge: support for ever-more-expensive logistics when or if overall science funding does not increase to match.

The COV lauds NSF's continued progress in bringing closer the daily workings of the science and logistics aspects of the USAP. At the individual project level - the level most easily reviewed by the COV - this appears to be at near-ideal levels, at least in terms of results. Presentations to the COV by NSF Program Officers demonstrated the strains that can result from untoward events. For examples, fuel price volatility and funding shortfalls required ANT to commit program funds to activities formerly supported by AIL. This required cuts in overall science supported by ANT. Although it was not possible for the COV to evaluate the process in detail, the COV is of the opinion that in the end, science needs must be the deciding factor when choices of cuts are made as ANT and AIL balance their overall support.

Every indication from the jackets is that the demand for Antarctic-region field research on the continent and from ships is increasing. Ever more advanced (and more expensive) facilities are required, and the need for USAP-provided technical support remains strong and is continuing to grow. On top of this are the unknowns of fuel prices - fuel costs are a major component of the USAP budget - and long-term levels of Federal support for USAP activities in an era of what many fear to be ever-increasing budget constraints. Certainly field logistics costs for a given level of effort have risen faster than the overall inflation rate, and coming "big science" will place heavy demands on USAP logistics. A collision course has thus been set: science planning is

almost certainly running head-on into fiscal realities as we understand them today. Simply put, if continued, a lack of growth in the USAP budget, along with escalating costs of running and maintaining its field research and other USAP Continental and marine support, mean trouble ahead for USAP science.

One typical past response has been to defer projects into out years, partly with the hope that future budgets would provide some relief. But if budgets do not increase and operation costs remain high and continue to climb the total USAP field support must eventually decline, creating a long downhill slide of total USAP research support available to US investigators.

Because the field scheduling and support process already attempts to maximize efficiency, to achieve further cost saving implies that scheduling and planning may need to cover longer time lines than the present "one year ahead", and the community may need to become increasingly flexible about when field work for funded projects is scheduled, especially if those projects require specialized equipment or involve work in especially remote or difficult to reach areas.

4. The COV also briefly discussed OPP's relationship with its contractors, as related to the costs of science support.

Although OPP's relationship with its Antarctic Support contractors and service providers was excluded from COV examination, some aspects of project support and PI-contractor relationships were clear from documents in the jackets, chiefly the Outbrief reports. First, it must be noted that most field teams reported a high to very high degree of satisfaction with their contractor-provided support. PI complaints about allocation of resources were consistently related to issues with the contractor in Denver; on-ice support was usually considered to be excellent. The COV noted in passing that however commendable this may be, high field team satisfaction is an expected result from a contractor reimbursement system where profit is based upon customer satisfaction.

C.5. NSF would appreciate your comments on how to improve the COV review process, format and report template.

OPP did a very good job preparing for the COV. It was much appreciated, for example, that presentations (typically via PowerPoint files) and other documents were provided to the COV in advance of the meeting. Interactions with OPP staff at the meeting were ample and very helpful, and focused on discussions rather than reiterating the advance materials. It was also helpful that OPP provided the COV a chart showing where each document type is to be found (CD, jacket, etc.). The COV suggests a few minor improvements:

The COV examined several multi-institutional collaborative proposals. In these, it was not always easy to ascertain which specific proposal was the lead proposal.

Future AIL COVs would benefit from dates of creation (and editing) being attached to more of the documents in the jackets. For example the dates on the Ops Reviews examined did not seem to be related to the time the Ops Review was mostly likely carried out. For some other documents (e.g., ROER) the dates of creation and approval were clear. This is mentioned because the overall timeline of the AIL/PEHS information-decision-implementation stream is subject to COV review, and thus this small addition would facilitate that task.

Future AIL COVs would benefit from access to more field season Outbriefs, because the Outbriefs are the best source of information regarding the success of AIL in providing science support and constitute the best currently available method of capturing P.I. views of the logistical support that was provided to them. The 2009 COV had access to only 14 Outbriefs because the AIL/PEHS COV met in conjunction with the ANT COV, and so both COVs examined the same suite of proposal jackets. Future AIL/PEHS COVs might look somewhat further back in time (perhaps 5-6 years) so as to capture more Outbriefs.

Recommendation: *OPP should consider providing jackets which cover a longer period of time, perhaps 5-6 years, for AIL COV review in order to capture a greater number of completed projects for review of logistics support.*

The COV is grateful to OPP Director Karl Erb, AIL Deputy Division Director Brian Stone, ANT Director Scott Borg, Acting PEHS Head Michael Van Woert, and numerous of their staff in providing excellent support, substantive and frank discussions, and much appreciated insight to the COV.

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