Polar Environment, Health and Safety
GPRA Highlights, FY 2008

Don't Pack a Pest When Traveling to Antarctica

Highlight ID: 15478, Version: AC/GPA

The United States Antarctic Program (USAP) has implemented an awareness program aimed at reducing the risk of introduction of non-native species to Antarctica. The "Don't Pack a Pest" awareness campaign features an informational brochure with how-to preventative steps for individuals and a campaign logo sticker to serve as a reminder. All USAP participants, including scientists and personnel, have been briefed on the campaign and materials have been distributed to research stations and vessels.

Non-native species are those species that are not naturally found in an area and have been introduced either intentionally or unintentionally. Such species could potentially enter Antarctica via clothing, equipment, or personal gear. The brochure reminds USAP participants to clean gear before leaving for Antarctica, clean gear between site visits, and report the presence of any non-native species if found.

Party nations to the Antarctic Treaty are currently concerned about the potentially harmful impacts of non-native species on the continent. The "Don't Pack a Pest" campaign is one of several steps the USAP and other national programs have initiated to prevent such harm.
In the future, the USAP will institute further education programs for protection of the pristine Antarctic environment while continuing to support cutting-edge scientific research on the continent.

NSF Office of Polar Programs, Office of Polar Environment, Health and Safety (OPP/OPESH)

Primary Strategic Outcome Goal:

- Public Understanding of Science and Lifelong Learning

Secondary Strategic Outcome Goals:

How does this highlight address the strategic outcome goal(s) as described in the NSF Strategic Plan 2006-2011?
The Don't Pack a Pest awareness campaign is an important element of the United States Antarctic Program's environmental education program aimed at fulfilling NSF's role in environmental stewardship of the Antarctic. Such education is central to maintaining the largely undisturbed environment in Antarctica that is the focus of scientific research. Thus, the Don't Pack a Pest campaign complements the innovative and transformative research that NSF funds in Antarctica. In addition, the campaign is part of the United States' ongoing contribution to Antarctic environmental protection as a member of the Antarctic Treaty international community. The campaign also meshes with the international IPY project on non-native species, Aliens in Antarctica.

Does this highlight represent transformative or potentially transformative research? *If so, please explain why. For more information, see Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008 and Important Notice 130: Transformative Research*
No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)
No

What may be the benefits of the proposed activity to society?
Yes

While the Don't Pack a Pest awareness campaign focuses on Antarctica, the issue of non-native species is of worldwide concern. For instance, in the Great Lakes region, zebra mussels accidentally brought to the area on the hulls of ships have had a detrimental effect on local clam and mussel populations and the associated economy. The campaign raises general awareness about non-native species, their potential negative impact on local environments, and mitigating measures that can help prevent introduction of non-native species.
OPP/PEHS 2008

Program Officer: Polly Penhale
NSF Award Numbers:
NSF Contract Numbers:
0000373

NSF Investments: Climate Change, International Polar Year (IPY), Environment (including the importance of fresh water and dynamics of water processes)

Improving the Safety and Productivity of Cold Water Scientific Diving

Highlight ID: 16077, Version: AC/GPA

NSF's United States Antarctic Program (USAP) provided major support to the Smithsonian Institution, the United Kingdom's Natural Environment Research Council (NERC) Facility for Scientific Diving, and Diving Unlimited International, Inc., to hold a comprehensive International Polar Diving Workshop in conjunction with the International Polar Year in March 2007. At the Arctic Marine Laboratory in Ny-Ålesund, Svalbard, Norway, the workshop focused on advances in ice diving technology, new knowledge of the physiological ramifications of extremely cold water, methods and techniques of under-ice research, and diver training procedures specific to polar environments. Michael Lang of the Smithsonian Institution and NSF and Martin Sayer of the NERC Facility for Scientific Diving co-chaired the conference which hosted twenty-nine interdisciplinary polar diving experts from eleven countries.

The Workshop examined developments since the Smithsonian's 1991 Polar Diving Workshop with goals of increasing both the safety and effectiveness of polar scientific diving. The polar diving environment places special physiological stresses on divers, demands unique performance from their equipment, and presents physical hazards not found in warmer environments. In spite of these challenges, USAP and other polar scientific programs have experienced remarkably low incidences of decompression illness and pressure-induced trauma. During the past 19 years, 300 USAP divers completed approximately 11,000 dives without a serious diving-related illness.

The Workshop participants developed eighteen recommendations for polar scientific diving programs that addressed thermal protection, equipment, operations, and training. These recommendations collectively reduce the risks associated with cold water diving and allow research divers to concentrate more on their science objectives. This Workshop and its recommendations directly or indirectly support all four of NSF's Strategic Outcome Goals. In particular, improving the capability and equipment to do research in cold water and under ice contributes to both USAP and other nations' research infrastructure, while enhancing the safety of scientific divers engaged in innovative research and education.

Detailed reports of each session and the consensus recommendations are published in Lang, M.A. and M.D.J. Sayer (eds.) 2007. *Proceedings of the International Polar Diving Workshop,* Svalbard. Smithsonian Institution, Washington, D.C. 213 pp. Available as PDF from www.si.edu/dive.

Primary Strategic Outcome Goal:

- Research Resources (minor facilities, infrastructure and instrumentation, field stations, museum collections, etc.)

Secondary Strategic Outcome Goals:

How does this highlight address the strategic outcome goal(s) as described in the NSF Strategic Plan 2006-2011?
The ability to dive safely and productively in polar waters supports both Discovery and Learning. More directly, the workshop's recommendations and commitment to further research both contribute to the state of the art of polar scientific diving, thereby enhancing the future research capabilities and infrastructure for all participants whose work involves diving. Reducing the risks to polar scientific divers is an important stewardship initiative that supports research excellence.

Does this highlight represent transformative or potentially transformative research? *If so, please explain why. For more information, see Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008 and Important Notice 130: Transformative Research*
No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)
No

What may be the benefits of the proposed activity to society?
No
OPP/PEHS 2008

Program Officer: James Karcher
NSF Award Numbers:
NSF Contract Numbers:
000373

NSF Investments: International Polar Year (IPY), Understanding Complex Biological Systems (including the interfaces of life, physical, and computational sciences)

Antarctic Program / Raytheon Polar Services Company Recognized as Gold Leader in Colorado's Environmental Leadership Program

Highlight ID: 16546, Version: AC/GPA

In 2007 Raytheon Polar Services Company (RPSC), the prime logistical contractor to the NSF's United States Antarctic Program (USAP), was again recognized as a Gold Leader in Colorado's Environmental Leadership Program (ELP). The Colorado ELP encourages and rewards members who exceed state and federal environmental compliance and aim for greater environmental excellence with measurable and verifiable goals. RPSC, based in Centennial, Colorado, was chosen as a Gold Leader for its excellent compliance record, operational Environmental Management System, and demonstration of past achievements and future goals in environmental improvement as part of the USAP.

Among the achievements recognized by the ELP were the 39.6% decrease in water use at McMurdo Station, the 12.6% savings in non-transportation energy use, and the implementation of an on-site thermal treatment unit for fuel-contaminated soil. Ongoing environmental improvement goals include process-related improvements to wastewater treatment, increased use of renewable energy on-station as well as at science field camps, and land and habitat remediation of abandoned or contaminated sites.

RPSC administers a number of projects in Antarctica related to environmental assessment and management, drinking water and wastewater management, spill prevention and control, environmental education and training, waste management, and energy management. RPSC operates all three US Antarctic stations as well as USAP research vessels on behalf of the NSF.

Primary Strategic Outcome Goal:

- Public Understanding of Science and Lifelong Learning

Secondary Strategic Outcome Goals:

How does this highlight address the strategic outcome goal(s) as described in the NSF Strategic Plan 2006-2011?
The United States Antarctic Program has a strong commitment to environmental protection and improvement and Raytheon Polar Services Company's recognition as a Gold Leader is an example of how USAP excels in this area. Protecting the largely undisturbed Antarctic environment supports the innovative and transformative research that NSF funds in Antarctica while advancing NSF's stewardship goal. In addition, environmental excellence is part of the United States' ongoing contribution to Antarctic environmental protection as a member of the Antarctic Treaty international community.

Does this highlight represent transformative or potentially transformative research? *If so, please explain why. For more information, see Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008 and Important Notice 130: Transformative Research*
No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)
No

What may be the benefits of the proposed activity to society?
Yes
The requirements for protection of Antarctica's relatively pristine environment are often beyond those established in the United States. While there is significant technology transfer from the US to Antarctica, Antarctica also provides lessons for increased environmental protection. Water-saving measures, alternative energy use, and environmental remediation in Antarctica set a high standard for environmental practices. Raytheon Polar Services Company's (RPSC) Gold Leader status not only encourages future environmental improvement within RPSC, it also provides an example to other companies and organizations.
OPP/PEHS 2008

Program Officer: Polly Penhale
NSF Award Numbers:
NSF Contract Numbers:
0000373

NSF Investments: Climate Change, International Polar Year (IPY), Environment (including the importance of fresh water and dynamics of water processes)

Environmental Education Maintains U.S. Antarctic Program's High Level of Environmental Protection

Highlight ID: 16560, Version: AC/GPA

The United States Antarctic Program (USAP) maintains a high level of environmental protection in Antarctica according to its obligation under the Protocol on Environmental Protection to the Antarctic Treaty, as implemented under US law as the Antarctic Conservation Act (ACA). In order to inform all USAP participants of the requirements of the Protocol and the ACA, the USAP instituted a mandatory education program for all participants. The program includes instruction from the USAP Environmental Education staff and educational videos on appropriate conduct in Antarctica in order

to maintain environmental values. Videos include "Protecting Antarctica's Environment," which provides the environmental requirements for working on-station and at field camps, and "Dry Valleys Modules 1-3," which provide area-specific guidelines for working in the McMurdo Dry Valleys Antarctic Specially Managed Area (ASMA). Participant briefings are tailored to the specific location of the work conducted by individual participants and is tailored to the work they will be performing while in Antarctica.

The USAP educational videos and training provide practical advice on participant conduct in Antarctica. This includes methods to reduce environmental impact, reduce impact to wildlife, and lessen the risk of accidents that could result in environmental impact. In addition, the video illustrates methods for solid, liquid, and human waste containment; recycling and sorting waste; fuel containment and spill prevention; and water conservation, among other practices. Updated annually, the training videos provide current management practices. The videos also provide background information on the USAP, the Antarctic Treaty, the Protocol on Environmental Protection, and the ACA.

Throughout the austral summer season, over 2500 USAP participants, including research grantees and operations and logistics personnel, will receive the USAP environmental protection and awareness training. Training may occur on-station soon after a participant arrives or may be completed online via the USAP Participant Online Training Program. In addition to the training session, the USAP Environmental Education staff is available throughout the season to answer follow-up questions to the training and assist in environmental protection procedures in the field.

Primary Strategic Outcome Goal:

- Public Understanding of Science and Lifelong Learning

Secondary Strategic Outcome Goals:

How does this highlight address the strategic outcome goal(s) as described in the NSF Strategic Plan 2006-2011?
The United States Antarctic Program's environmental education and training program is central to USAP s ability to do its part in maintaining the largely undisturbed Antarctic environment. As such, USAP is able to protect the habitats and systems that are the subject of the innovative and transformative research that NSF funds in Antarctica. Environmental protection also advances NSF's stewardship goal. In addition, environmental excellence is part of the United States' ongoing contribution to Antarctic environmental protection as a member of the Antarctic Treaty international community.

Does this highlight represent transformative or potentially transformative research? *If so, please explain why. For more information, see Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008 and Important Notice 130: Transformative Research*
No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)
No

What may be the benefits of the proposed activity to society?
Yes
While the USAP environmental education and training program focuses on living and working in Antarctica with minimal impact to the environment and wildlife, many of these practices can be transferred to living and working elsewhere in the world. Decreasing our human environmental footprint is becoming a greater priority worldwide. The USAP education program illustrates methods for solid, liquid, and human waste containment; recycling and sorting waste; fuel containment and spill prevention; and water conservation, among other practices.
OPP/PEHS 2008

Program Officer: Polly Penhale
NSF Award Numbers:
NSF Contract Numbers:

0000373

NSF Investments: Human and Social Dynamics, Environment (including the importance of fresh water and dynamics of water processes)

Efficacy of Vitamin D Supplementation in an Antarctic Ground Analog of Space Flight

Highlight ID: 16590, Version: AC/GPA

Efficacy of Vitamin D Supplementation in an Antarctic Ground Analog of Space Flight
A NASA study conducted during the 2007 austral winter at McMurdo Station measured the dose of vitamin D needed to reach and maintain a desirable vitamin D status in the absence of sunlight. The study yielded useful results not only for long duration space travel, but also for populations on earth with little sunlight exposure, including scientists and support staff at the United States Antarctica Program (USAP) research stations.

Vitamin D has long been known to play a role in calcium metabolism, and recently it has been found to have other important functions in the body. Subjects were recruited from the personnel at McMurdo Station. Blood samples were collected 3 or 4 times during the polar winter, and the diet for 7 days before each blood draw was recorded. Subjects received 400 International Units (IU), 1000 IU, or 2000 IU of vitamin D per day in blinded fashion. An additional group of individuals who chose to participate either did not take the study supplements or took their own vitamin D supplements.

The 400+ tubes of blood were shipped to the Johnson Space Center in Houston in mid-October 2007 for analysis.

The graph shows the concentration of 25-hydroxyvitamin D in the blood, a marker of vitamin D status. Each point is the group average at that time point (± the standard deviation). The horizontal line at 25 nanomoles per liter (nmol/L) represents the point below which severe vitamin D deficiency exists. The horizontal line at 80 nmol/L represents the point that most scientists agree is "optimal" for vitamin D status. (Some scientists place the optimal level at >60 nmol/L or >75 nmol/L.

The higher the dose of vitamin D taken is the higher the average 25-hydroxyvitamin D concentration in the blood will be in June/July and August. Variability between subjects was fairly large. The causes for this variability are under study. For example, some individuals consumed foods higher in vitamin D, causing them to have a greater increase in blood vitamin D levels, and judging by pill counts, some individuals did not take their supplements each day. Final results will be available later this year.

These initial results of the Polar Vitamin D represent the first step toward a better understanding of optimal supplementation for individuals not receiving any sunlight exposure.

Primary Strategic Outcome Goal:

- Disciplinary/Interdisciplinary Research (Anything not covered by one of the 12 categories below.)

Secondary Strategic Outcome Goals:

How does this highlight address the strategic outcome goal(s) as described in the NSF Strategic Plan 2006-2011?
In support of the NSF mission, "...to advance the national health...", this research constitutes discovery of important scientific information needed to achieve national goals of space exploration. The findings are also applicable to public health, especially among populations with little exposure to sunlight. This study represents a productive interagency collaboration between NASA and NSF.

Does this highlight represent transformative or potentially transformative research? *If so, please explain why. For more information, see Report to Congress: Transformative Research at the National Science Foundation, April 16, 2008 and Important Notice 130: Transformative Research*
No

How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc?)
No

What may be the benefits of the proposed activity to society?
Yes
The results of this study may prove useful in updating recommended dietary allowances of Vitamin D in the general population. Maintaining optimal Vitamin D levels may significantly reduce the risk of disease and disability, particularly in vulnerable populations.
OPP/PEHS 2008

Program Officer: Michael Montopoli
NSF Award Numbers:
NSF Contract Numbers:
0000373

NSF Investments: Environment (including the importance of fresh water and dynamics of water processes)