

OFFICE OF POLAR PROGRAMS**\$464,900,000**

The FY 2008 Budget Request for the Office of Polar Programs (OPP) is \$464.90 million, an increase of \$26.80 million, or 6.1 percent, over the FY 2007 Request of \$438.10 million.

Office of Polar Programs Funding

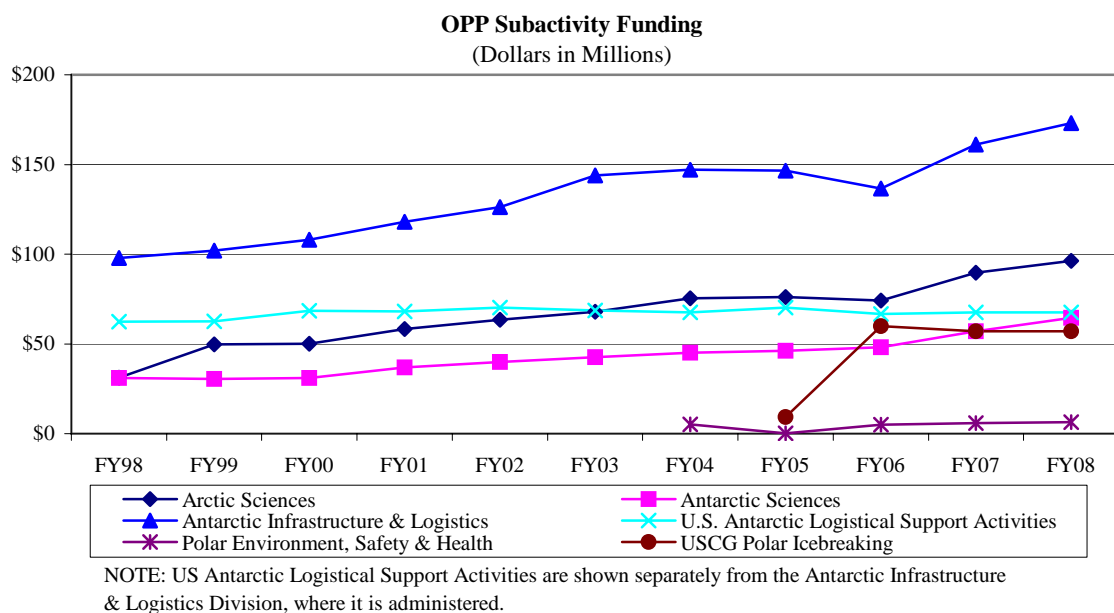
(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Arctic Sciences (ARC)	\$74.21	\$89.59	\$96.27	\$6.68	7.5%
Antarctic Sciences (ANT) ^{1/}	48.21	56.98	64.49	7.51	13.2%
Antarctic Infrastructure & Logistics (AIL)	203.17	228.61	240.66	12.05	5.3%
<i>U.S. Antarctic Logistical Support Activities</i>	66.66	67.52	67.52	-	-
Polar Environment, Safety & Health (PESH)	5.01	5.92	6.48	0.56	9.5%
USCG Polar Icebreaking	59.94	57.00	57.00	-	-
Total, OPP	\$390.54	\$438.10	\$464.90	\$26.80	6.1%

Totals may not add due to rounding.

^{1/}The Science & Technology Center for Remote Sensing of Ice Sheets is included in the Antarctic Sciences Division.

The Office of Polar Programs supports most of the research in polar regions funded by the National Science Foundation. The Arctic and Antarctic are premier natural laboratories whose extreme environments and geographically unique settings enable research on phenomena and processes not feasible elsewhere. For example, the cold dry environment and high altitude at the South Pole make it the world's best location for key astrophysics measurements. Polar research provides insights into earth systems – the atmosphere, oceans, and solid earth – that cannot be gained elsewhere, and study of the polar ice sheets reveals how the Earth's climate has changed in the past. Polar regions also offer unusual opportunities for environmental research, as the sensitivity of polar ecosystems to small changes in climate renders them important bellwethers for abrupt or potential future change. An additional area of forefront research probes how organisms have adapted to the extreme polar environment. Since FY 2006, NSF has had the responsibility for funding the cost of U.S. Coast Guard (USCG) icebreakers that support scientific research in polar regions.



RELEVANCE

Research in polar regions addresses polar aspects of the global earth system – glacial and sea ice, terrestrial and marine ecosystems, the ocean, and the atmosphere – that help shape the global environment and climate. In addition, it offers opportunities for fundamental advances in each of the disciplinary sciences, ranging from the behavior of the Earth’s inner core to the formation of galaxies, from the biology of life in the cold and dark to how Arctic residents are affected by environmental change. OPP funding will support the development and implementation of the enhanced observation systems needed to trace these shaping influences on a regional basis. It will also support research to elucidate the interactions among them and how they impact the polar environment. The work will include studies of the natural climate records from the past contained in ice cores and earth sediments. Much of this research will be carried out in collaboration with scientists in other countries, promoting international partnerships.

NSF provides interagency leadership for research planning as directed by the Arctic Research Policy Act of 1984. The NSF Director chairs the Interagency Arctic Research Policy Committee (IARPC) created for this purpose. In addition, per Presidential Decision Directive, NSF manages all U.S. activities in the Antarctic as a single, integrated program, making research possible in Antarctica by scientists supported by NSF and by U.S. mission agencies. The latter include the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, and the Department of Energy. The U.S. Antarctic Program supports the U.S. governance role through the Antarctic Treaty. NSF is also responsible for several international research partnerships in polar regions.

International Polar Year:

In FY 2008, NSF will continue funding for International Polar Year (IPY) 2007-2009 research, infrastructure and education. The vision for IPY established by the National Academy of Sciences (NAS)/Polar Research Board includes an “... intense, coordinated campaign of polar observations, research, and analysis that will be multidisciplinary in scope and international in participation.... that will

benefit society by exploring new frontiers and increasing understanding of the key roles of the polar regions in globally linked systems.”

As the lead agency supporting polar research, NSF will continue to provide U.S. leadership in IPY through the work of its grantees, in coordination with other agencies, and by developing partnerships with other nations. In FY 2006, emphasis was placed on establishing an Arctic Observing System in support of the Study of Environmental ARctic CHange (SEARCH), on Polar Ice Sheet Dynamics and Stability, and on studies of Life in the Cold and Dark, particularly at the genomic level. Work in FY 2007 and FY 2008 builds on these themes and expands to new ones identified in research community planning activities. These include understanding and characterizing environmental change through studies of systems and drivers, impacts on subsystems, and interactions among components.

Another focus of IPY will be the maintenance of existing standardized data sets, creating new scientific collections, and ensuring their availability to current and future generations of researchers. These will help frame the answers to current and as yet unknown questions. Led by NSF’s Office of Polar Programs, several of NSF’s disciplinary-based research directorates, NSF’s Directorate for Education and Human Resources, and the Office of International Science and Engineering will participate actively in this work. As stated in the President’s announcement on the ACI, “the bedrock of America’s competitiveness is a well-educated and skilled workforce,” which is emphasized in NSF’s mission. IPY provides an ideal opportunity to advance this goal by involving students in the international research venture.

Summary of Major Changes by Division

FY 2007 Request, OPP.....	\$438.10
Arctic Sciences	+\$6.68
Increased funding for a broad range of studies on and about the Arctic environment and basic processes, including study of significant, Arctic system-scale environmental change and its human dimension.	
Antarctic Sciences	+\$7.51
Increased support to begin ramp-up of scientific operation and research utilizing the IceCube Neutrino Observatory; increased emphasis on development of instrumentation for critical observations of the Antarctic, including the ice sheet, the underlying continent, and the surrounding ocean and atmosphere; increased support for observation, analysis, and modeling associated with International Polar Year research.	
Antarctic Infrastructure & Logistics	+\$12.05
Increased funding focuses on continuing investments in activities to improve the resupply capability to support McMurdo and South Pole Stations. Major investments in this area include completion of the project to increase bulk fuel storage at McMurdo Station and the procurement of inland traverse equipment. Other priorities include increased communications capability for South Pole Station and replacement of the Palmer Station pier.	
Polar Environment, Safety & Health	+\$0.56
Funding will support efforts to further modernize medical, dental, and safety capabilities for Arctic and Antarctic field science.	

USCG Polar Icebreaking	+\$0.00
<p>Since FY 2006, NSF has been responsible for funding the USCG's three polar icebreakers. While costs for fixed expenses such as personnel will increase, maintenance costs are expected to decrease. Therefore, overall costs are expected to remain the same in FY 2008.</p>	
Subtotal, Changes	+\$26.80
FY 2008 Request, OPP.....	\$464.90

Summary of Major Changes in Office-Wide Investments (Dollars in Millions)

FY 2007 Request, OPP.....	\$438.10
----------------------------------	-----------------

<u>Discovery Research for Innovation</u>	+\$4.79
--	---------

Remote Sensing Instrumentation (+\$2.0 million)

Support development of instrumentation (sensors, communications, etc.) and equipment for making critical scientific observations, either as remote installations, as sensors mounted on vehicles or aircraft, or as instruments critical for the scientific analysis of recovered samples. This will create opportunities for all areas of Antarctic science.

IceCube Neutrino Observatory (+\$2.79 million)

IceCube exemplifies the ACI's emphasis on development of unique facilities and instruments that enable discovery and advancement. IceCube will be the world's first high-energy neutrino observatory and will be located deep within the icecap under the South Pole Station in Antarctica. It represents a new window on the universe, providing unique data on the engines that power active galactic nuclei, the origin of high-energy cosmic rays, the nature of gamma ray bursters, the activities surrounding supermassive black holes, and other violent and energetic astrophysical processes. The IceCube Neutrino Observatory is expected to be fully operational in FY 2011, with segments of the detector transitioning to operations as they are completed. Science operations and research costs will be shared by the collaborating institutions, domestic and foreign. Funding is requested in FY 2008 for initial science operations (+\$1.50 million) and scientific exploitation (+\$1.29 million) as the Antarctic Sciences Division's part of the partnership with the Physics Division.

<u>Transformational Facilities and Infrastructure</u>	+\$15.61
---	----------

U.S. Antarctic Program Resupply (+\$15.05 million)

Accelerate projects to diversify resupply of the USAP, including the final increment for increasing fuel storage capacity at McMurdo (+\$6.10 million, providing a two-year capacity in the event of a ship-borne resupply failure), Palmer Pier replacement (+\$2.17 million, ensuring continuity of pier-side cargo and personnel embarkation/debarkation), and alternative methods of resupplying South Pole Station via air and ground (+\$6.78 million, including traversing materials from McMurdo in order to reduce the cost of delivery and the number of required LC-130 flights).

South Pole Infrastructure (+\$2.0 million)

Increase power generation capability and fuel storage at South Pole Station to support new

science projects.

USAP IT Network (+\$1.0 million)

Begin replacement of legacy software systems, which have become unsupportable and are incompatible with current requirements to safeguard data and personal information.

Environment, Safety & Health (+\$0.56 million)

Increase funding for safety and health measures in remote field research and program oversight, includes adopting electronic medical records systems, enhancing telemedicine capabilities, and reviewing medical standards and guidelines.

South Pole Telescope (+\$2.0 million)

The South Pole Telescope (SPT) is another example of the investments OPP is making to provide researchers with the facilities and instruments required to further scientific discovery. Research conducted using this telescope will test fundamental theories about the origin of the universe and advance understanding of the nature of dark energy and dark matter, which are now thought to be the major components of the universe. SPT will begin operation in FY 2007 and be completely operational in FY 2008. Funds in FY 2008 will be used to deliver and install the final components of the telescope.

Defer Williams Field Runway relocation in order to fund the completion of the South Pole Telescope as described above. (-\$2.0 million)

Completed Projects (-\$3.0 million)

As projects are completed or near completion, funds are reallocated to ongoing projects or to new projects that are described below. The SHALDRIL project is ending, and there will be cost reductions in the Microwave Landing System and McMurdo Bandwidth projects.

International Polar Year (IPY) Leadership

+\$6.40

IPY Logistics (-\$5.0 million)

IPY logistics spending decreases as IPY logistics funding peaks in FY 2007 to enable polar research and education projects for both years of IPY.

IPY Research (+\$5.0 million)

An increase in IPY research funding is made possible by the advanced funding of IPY logistics described above.

Climate Change Research (+\$5.70 million)

Accelerate climate change research and the associated observing and modeling systems, with increased emphasis on human impacts. These projects foster advancement, collaboration and innovation on the complex scientific inquiry into climate change, involving and strengthening international partnerships to accelerate the progress of science worldwide.

Life in the Cold and Dark (+\$0.70)

Adding to initial investments made during FY 2006-07, fund infrastructure and logistics to enable winter research at the LTERs at Toolik Field Station, Alaska and Summit, Greenland. Essentially nothing is known about how living organisms function in extreme polar environments once winter darkness and cold commence, because scientists have been unable to gain access to these regions during these times. These investments would introduce limited capability for access, opening up new opportunities for fundamental research concerning adaptations and other processes.

Subtotal, Changes +\$26.80

FY 2008 Request, OPP..... \$464.90

NSF-WIDE INVESTMENTS

In FY 2008, the Office of Polar Programs will support research and education efforts related to broad, Foundation-wide investments in a number of areas, including NSF’s multidisciplinary priority areas and the Administration’s interagency R&D priorities.

OPP NSF-wide Investments
(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Biocomplexity in the Environment	\$0.77	\$0.83	-	-\$0.83	-100.0%
Climate Change Science Program	10.50	10.50	10.50	-	-
Cyberinfrastructure	26.24	26.24	26.24	-	-
Human and Social Dynamics	0.20	0.20	0.20	-	-
International Polar Year	10.00	47.27	47.27	-	-
Mathematical Sciences	0.20	0.10	-	-0.10	-100.0%

Biocomplexity in the Environment: This priority area ends in FY 2007. With the conclusion of this priority area, key components of investment for bio/ecosystem studies will be transferred to core programs for continued support.

Climate Change Science Program: This program provides the Nation and world with the science-based knowledge to predict change, manage risk, and take advantage of opportunities resulting from climate change and climate variability. OPP focuses on climate change in the polar regions, as well as interactions with global climate.

Cyberinfrastructure: Cyberinfrastructure support will be provided for the Arctic Systems Sciences (ARCSS) Data Coordination Center that serves as a central point for deposition of data deriving from ARCSS-funded research. Support is also provided for Arctic modeling, distributed field sites, and autonomous flux towers. In the Antarctic, funds support data center/data repositories, 3-D bathymetric data fusion, and environmental monitoring, both marine and terrestrial. In addition, support is provided for the engineering, operations and maintenance, and security of information technology systems.

Human and Social Dynamics: This priority area will support innovative research on the dynamics of human social-cultural systems and individual behavior, as well as human decision-making and risk in the polar regions.

International Polar Year: The IPY activities will provide support for the vision established by the National Academy of Sciences/Polar Research Board which includes an "... intense, coordinated campaign of polar observations, research, and analysis that will be multidisciplinary in scope and international in participation.... that will benefit society by exploring new frontiers and increasing understanding of the key roles of the polar regions in globally linked systems."

Mathematical Sciences: This priority area ends in FY 2007. With the conclusion of this priority area, key components of investment in mathematic modeling will be transferred to core programs for continued support.

QUALITY

OPP maximizes the quality of the R&D it supports through the use of a competitive, merit-based review process. The share of research funds that were allocated to projects that undergo external merit review was approximately 86 percent in FY 2006, the last year for which complete data exist. OMB's definition of competitive, merit-based review does not include contracts, therefore support for the U.S. Antarctic Program support contract, although a competitively bid contract that undergoes a high degree of review, both internal and external, is not considered competitive, merit-based review for this calculation. If included, it would raise the percentage significantly.

To ensure the highest quality in processing and recommending proposals for awards, OPP convenes Committees of Visitors (COV), composed of qualified external evaluators, to review each program every three years. These experts assess the integrity and efficiency of the processes for proposal review and provide a retrospective assessment of the quality of results of NSF's investments. The Arctic Sciences and the Antarctic Sciences divisions conducted COVs during FY 2007.

OPP also receives advice from the Office of Polar Programs Advisory Committee (OAC) on such issues as: the mission, programs, and goals that can best serve the scientific community; how OPP can promote quality graduate and undergraduate education in the sciences it supports; and priority investment areas in polar research. The OAC meets twice a year. Members represent a cross-section of polar research, with representatives from different disciplines, and include a balanced representation of gender, members of underrepresented groups, and geographic regions.

PERFORMANCE

The FY 2008 Budget Request is aligned to reflect funding levels associated with the Foundation's four strategic outcome goals stated in the FY 2006-2011 Strategic Plan. These goals provide an overarching framework for progress in fundamental research and education and facilitate budget and performance integration.

**Office of Polar Programs
by Strategic Outcome Goal**

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Discovery	\$85.46	\$92.45	\$106.48	\$14.03	15.2%
Learning	4.63	6.43	5.39	-1.04	-16.2%
Research Infrastructure	299.26	336.93	350.74	13.81	4.1%
Stewardship	1.18	2.29	2.29	-	-
Total, OPP	\$390.54	\$438.10	\$464.90	\$26.80	6.1%

Totals may not add due to rounding.

Recent Research Highlights

► **New Antarctica Museum Exhibition:** One of America’s warmest locations has become an educational doorway to the coldest place on Earth. The Louisiana Museum of Natural History opened a new exhibition called "Experience Antarctica," designed by three NSF awardees at Louisiana State University (LSU). Aimed at K-12 students, it is housed in a Quonset-hut-shaped structure with corrugated walls to enhance the Antarctic feel, and features frost on the windows, sounds of a frigid wind howling outside, and 10 hands-on educational stations that provide information about Earth’s southernmost continent.

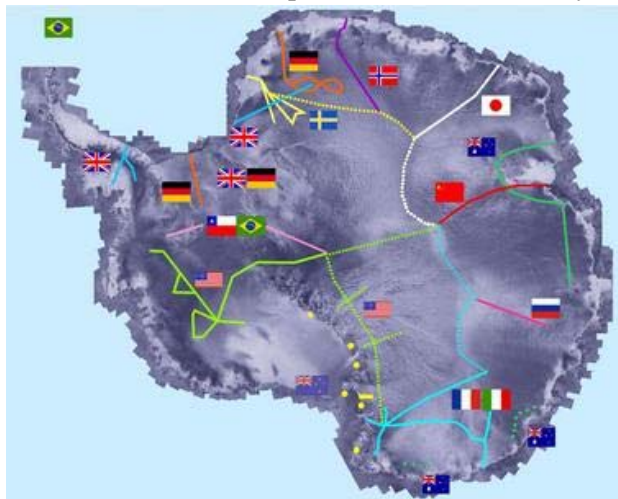


Students at the "Experience Antarctica" exhibit.
Credit: Dr. Sophie Warny, LSU

Topics include the effect of plate tectonics on Antarctica’s present state, paleontology (such as the presence of fossil dinosaurs on the continent), climate change and sea-level rise, geography and changing daylight at the bottom of the world, geology, astronomy and environmental concerns, among others.

The LSU group designed the program as part of the research community’s commitment to the broader impacts of NSF-funded projects. The main LSU Principal Investigator involved, Sophie Warny, also participated in “SciGirls” — summer-camp science programs jointly sponsored by PBS Kids, Dragonfly TV and Louisiana Public Broadcasting. The three week-long sessions focused on women with careers in a number of scientific fields. (ANT)

► **ITASE (International Trans Antarctic Scientific Expedition):** Starting in 2005, a major NSF-supported Antarctic research program will move into new territory. The International Trans-Antarctic Scientific Expedition (ITASE) is a 20-nation consortium of researchers whose members have been traversing the Antarctic for years, gathering data on changes in ice mass, atmospheric chemistry, ocean and air circulation, temperature variation and cycling of carbon, nitrogen and sulfur — to name only a few. Eventually, scientists hope to create a comprehensive record of conditions on the continent over the past few hundred years.



ITASE traverse routes overlaid on Radarsat imagery. Credit: SCAR ITASE Project Office, Climate Change Institute, University of Maine.

The U.S. part of the effort (US ITASE, funded by NSF) has previously concentrated on West Antarctica, where American scientists had a long-standing research effort. But during the 2006-2008 austral field seasons (roughly November to February), US ITASE will extend its traverses into East Antarctica.

The West Antarctic phase of US ITASE resulted in many important insights, including:

- Temperatures are still within the range of natural variability of the last 200 years, except on the Antarctic Peninsula, and are closely associated with changes in major atmospheric circulation patterns.
- Mass balance variability is primarily controlled by the topography at the junction of ice and underlying rock.
- Much of the natural variability in the westerly wind strength is attributed to decadal and longer scales of solar variability that impact production of ozone and the temperature gradient over Antarctica and the Southern Ocean.



US ITASE traverse platform. Credit: SCAR ITASE Project Office, Climate Change Institute, University of Maine.

Data collected by US ITASE and its international partners are available to a broad scientific community and will contribute to many of the goals of the International Polar Year (IPY) 2007-2009. US ITASE has an extensive program of public outreach and provides significant opportunities for many students to experience multidisciplinary Antarctic research. (ANT)

► **Northern Science Education:** Students from dense urban areas too often lack the opportunity to work and study in international field settings. The Northern Science Education project in Iceland is designed to fill that need. As one of NSF's Research Experiences for Undergraduates programs, it

provides a way for students from the inner city (primarily from the City University of New York, many of whose students come from populations underrepresented in science) to experience a variety of science disciplines at active research sites in a foreign country.



The Northern Science Education (NSE) project brings undergraduates to an archaeological field site where researchers are investigating the relationships among climate, environment, and the ancient inhabitants of Iceland. The project works closely with the Archaeological Institute of Iceland and provides opportunities for students to interact with their Icelandic peers. Prior to the field season, students are given classroom training in the relevant scientific fields, including intensive laboratory training and special internships through the American Museum of Natural History in New York City.

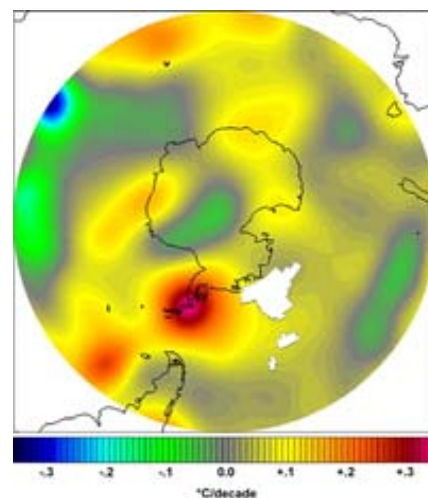
Students of the Northern Science and Education REU excavate an archaeological site in Iceland. *Credit: Dr. Sophia Perdikaris, City University of New York Brooklyn College.*

During the field season students continue "classroom" lectures in archaeology, paleoethnobotany, and geology/glaciology, which supplement their field data collection. Each student has an individual project that is formulated and carried out during the season in Iceland. Once they return to their home institutions, they analyze the data, write papers (several of which have been published in peer-reviewed journals), create posters and give presentations at conferences. Over the past four years, out of fewer than 30 NSE participants, 15 are pursuing graduate school in science, three have earned their way into Phi Beta Kappa, two have won competitive graduate scholarships, and three are K-12 teachers. (ARC)

► **Antarctic Temperature Changes, 1958-2002:** For the first time since the International Geophysical Year in 1957, scientists have made a realistic estimate of a half-century of trends in Antarctic climate, based on measurements of surface temperatures and advanced statistical techniques. Antarctic temperature changes have potentially major consequences for the global system. Yet scientists' ability to map those changes has been limited, due to the large area and the highly heterogeneous network of surface stations in Antarctica. That fact, in turn, has led to a confusing mix of results reported to the public.

Now, however, utilizing temperature data from 21 manned observing sites and 73 automated weather stations, together with cooperative ship reports from the surrounding oceans, the NSF-supported investigators produced a high-quality trend assessment.

The results show that the most prominent trend in annual surface air temperature for 1958-2002 is the significant warming over the Antarctic Peninsula. Other characteristics are a slight warming in coastal Antarctica, and actual cooling over regions of central Antarctica and parts of the Southern Ocean. The Antarctic Peninsula warming is strongest in autumn and winter, but is



Gridded linear trends (degrees Centigrade/decade) of annual surface air temperatures for the period from 1958 to 2002. The white area indicates no observations. *Credit: John Walsh, Univ. of Alaska.*

apparent in all seasons. Results of the research are available at <http://igloo.atmos.uiuc.edu/ANTARCTIC/> (ANT)

► **The Importance of Fungi-Plant Symbiosis:** A new technique that was originally developed to understand Arctic mushrooms has begun to shed light on ecosystems around the world — and could have application to improved farming practices.

The research began with the well-known symbiosis between mushrooms and other soil fungi, and certain plants. When the nitrogen is scarce, the fungi will transport the vital nutrient from the soil to the plant roots, and receive plant sugars in return. The challenge for scientists is to measure this process.

To meet this challenge, John E. Hobbie and Erik A Hobbie, working at the NSF-funded Arctic Long Term Ecosystem Research site at Toolik Lake, Alaska, developed a new method based on the measurement of nitrogen isotopes. Using it, they found that 61-86 percent of the nitrogen in the plants is provided by the fungi, and 8-17 percent of the plants' photosynthetic carbon is provided to the fungi for growth and respiration.

Because this kind of fungi-plant relationship is quite widespread in nature — and because nitrogen scarcity is quite common — this approach should help interpret ecological observations at many other research sites, and could even have application to agriculture. (ARC)

Other Performance Indicators

The tables below show the number of people benefiting from OPP funding, and trends in award size, duration, number of awards, and funding rate.

Number of People Involved in OPP Activities

	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate
Senior Researchers	786	860	900
Other Professionals	668	740	780
Postdoctorates	123	140	150
Graduate Students	356	390	410
Undergraduate Students	237	260	280
Total Number of People	2,170	2,390	2,520

NOTE: FY 2007-8 estimates are based on the expected impact of IPY on OPP's funding profile.

OPP Funding Profile

	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate
Statistics for Competitive Awards:			
Number	240	300	325
Funding Rate	31%	35%	37%
Statistics for Research Grants:			
Number of Research Grants	193	250	300
Funding Rate	27%	31%	33%
Median Annualized Award Size	\$132,234	\$136,200	\$143,000
Average Annualized Award Size	\$150,488	\$155,000	\$162,700
Average Award Duration, in years	2.7	3.0	3.0

NOTE: FY 2007-8 estimates are based on the expected impact of IPY on OPP's funding profile.

Arctic Sciences

\$96,270,000

The FY 2008 Budget Request for Arctic Sciences (ARC) is \$96.27 million, an increase of \$6.68 million, or 7.5 percent, over the FY 2007 Request of \$89.59 million.

Arctic Sciences Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Arctic Sciences (ARC)	\$74.21	\$89.59	\$96.27	\$6.68	7.5%
Major Components:					
Research & Education Projects	43.06	44.69	52.67	7.98	17.9%
Facilities					
Research Support & Logistics	31.15	44.90	43.60	-1.30	-2.9%

Totals may not add due to rounding.

About Arctic Sciences:

In the 1990's, global atmospheric models began to converge in their predictions that the Arctic would be at the forefront of global climate change. It now appears that those models were reasonably accurate in that regard. Observations have revealed an estimated 14% per decade reduction in summer sea ice extent in the Arctic, and significant summer melting of the Greenland Ice Sheet. These and many other phenomena are forcing change and uncertainty in traditional Arctic populations, present challenges and opportunities for industry and commerce, and have the potential to affect the global population through changes in sea level.

Arctic Sciences (ARC) is organized into several programs that support social science, earth system science and a broad range of natural science. Educational projects are also supported. Beginning in 1999, OPP established a Research Support and Logistics program to assist researchers with access to the Arctic, improve safety and environmental stewardship, and increase the ability of researchers to share plans and results with local Arctic communities.

The goal of the Arctic Sciences Division is to gain a better understanding of the Earth's physical, biological, geological, chemical, social, and cultural processes, and the interactions of ocean, land, atmosphere, biological, and human systems in the Arctic. ARC and other NSF programs support projects that contribute to the development of the next-generation of researchers and scientific literacy for all ages through education, outreach, and broadening participation in science, technology, engineering and mathematics. Program representatives from OPP and other NSF programs that support arctic research coordinate across NSF, including joint review and funding of arctic proposals and mutual support of special projects with high logistical costs.

In general, 59% of the ARC portfolio is available for new research grants. The remaining 41% funds continuing grants made in previous years, and research support and logistics.

Arctic Sciences Priorities for FY 2008:

- **Understanding Environmental Change in the Arctic** — Increase the use of modeling and synthesis to determine the nature and extent of current Arctic-system scale changes and the role of these changes as part of the global system.
- **Arctic Observing Network** — Continue to enhance an internationally supported, sustainable network to provide critical observations of the Arctic environment and use cyberinfrastructure tools to form a true network from the existing group of sites.
- **Bering Sea Ecosystem Study** — The eastern Bering Sea supports highly productive marine ecosystems that annually generate roughly 50% of all fish and shellfish landings in the United States. Models and observations suggest that the ecosystem will experience change. The Bering Sea Ecosystem Study is designed to develop an understanding of the effects of a varying sea-ice cover on the shelf ecosystem, project the potential changes in response to anticipated climate variations on decadal time scales, and assess the vulnerability and sustainability of local communities to such changes.
- **Human Systems in Polar Regions** — Humans have been an integral part of the arctic polar environment for the last 10,000 or more years. Indigenous peoples as well as recent migrants into the region have influenced and been influenced by the natural environment. IPY will encourage studies that advance the understanding of our species' place in the complex system of polar phenomena.
- **Improve research infrastructure** — Improve year-round access, capacity, and effectiveness of research sites in Alaska and throughout the Arctic.

Changes from FY 2007:

- \$2.0 million moves from IPY logistics to IPY research, as logistics are fully funded in FY 2007.
- An increase of \$5.70 million to accelerate climate change research using both modeling and observational systems including the human aspects of the change.
- An increase of \$0.70 million to improve year-round capacity and effectiveness at NSF-supported field stations in the Arctic.
- An increase of \$0.28 million to support additional integration of education with research during IPY.

Antarctic Sciences

\$64,490,000

The FY 2008 Budget Request for Antarctic Sciences (ANT) is \$64.49 million, an increase of \$7.51 million, or 13.2 percent, over the FY 2007 Request of \$56.98 million.

Antarctic Sciences Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Antarctic Sciences (ANT)	\$48.21	\$56.98	\$64.49	\$7.51	13.2%
Major Components:					
Research & Education Projects	44.26	52.53	60.04	7.51	14.3%
Centers Programs					
STC: Center for Remote Sensing of Ice Sheets	3.95	4.45	4.45	-	-

Totals may not add due to rounding.

About Antarctic Sciences:

The Antarctic continent and the Southern Ocean constitute about 7% of the surface of Earth and are important components of the Earth system. The continent contains records of geological processes that reveal the role of the Antarctic in the long-term evolution of the planet including records of the evolution of life on Earth. The region hosts organisms and ecosystems that have evolved and adapted to survive and thrive in extreme cold and long periods of darkness. The ice sheets hold detailed records of past climatic conditions, including direct samples of the atmosphere, that reach back 800,000 years, and perhaps more. The annual formation and breakup of sea ice around the continent is a major phenomenon that drives ocean circulation and has a major impact on Earth's heat budget. The ice sheets, surrounding ocean, and atmosphere are also key systems that must be understood in order to advance our understanding of sea level change and its role in climate change. In addition to these aspects of understanding the Antarctic and its role in Earth processes, the high plateau of East Antarctica, and South Pole Station in particular, are unrivaled with respect to the conditions they offer for a wide array of astronomy and astrophysical research.

The goal of Antarctic Sciences (ANT) is to enable research in all areas of science that can only be done, or is best done, in Antarctica. This is done through funding disciplinary and cross-disciplinary programs that encompass the geosciences, biosciences, and physical sciences. ANT enables research on Earth's physical, biological, geological, glaciological, oceanographic, and atmospheric processes in Antarctica as well as on interactions between the ice sheets, the underlying continent, the surrounding ocean, and the overlying atmosphere toward a comprehensive understanding of Antarctica's role in the evolution of Earth and life on Earth, as well as the Antarctic environment's role in the whole Earth system. In particular, a new programmatic emphasis will foster linkages across the disciplines in order to better advance understanding of Antarctic climate as a system. ANT also enables research in astronomy and astrophysics to advance understanding about high energy phenomena such as supernovae and events associated with black holes, about the nature of dark energy and dark matter which is now known to be a major component of the universe, as well as advance general understanding about the origin and evolution of the universe.

In general, 32% of the ANT portfolio is available for new research grants. The remaining 68% is used primarily to fund continuing grants made in previous years.

Antarctic Sciences Priorities for FY 2008:

- **International Polar Year (IPY)** - Building on partnerships developed during the early stages of IPY, Antarctic Sciences has the following priorities:
 - **East Antarctic Ice Sheet and lithosphere system** — The goal is to achieve a basic understanding of both the ice sheet and underlying lithosphere in central East Antarctica, as well as an understanding of the major processes and interactions that control ice sheet change.
 - **Life in the polar night** — The goal is to advance understanding of seasonal environmental change during the transitions between relative warmth and abundant light of summer and the extreme cold and dark of winter, and to advance knowledge about how organisms and ecosystems have adapted and evolved to survive and thrive.
 - **Paleoclimate records from central West Antarctica** — The goal is to exploit the deep ice core recovered from the WAIS-Divide site for climate records that can be compared to the Greenland Ice Core record to advance understanding of polar climate change, particularly the processes and timing of abrupt climate change.
- **Astronomy and Astrophysics** – Increase the research exploitation phase for two major new discovery instruments that are expected to begin science operations in 2007 – the IceCube Neutrino Observatory and the 10m South Pole Telescope. These two projects are expected to enable discovery of new phenomena and to achieve understanding about the origin and evolution of the universe.

Changes from FY 2007:

- **Remote Sensing Instrumentation** – an increase of \$2.0 million to support development of instrumentation and equipment required for critical observations in all areas of Antarctic science.
- **IceCube Neutrino Observatory** – an increase of \$2.79 million to enable early science operations (\$1.50 million) for the part of the detector array that has been completed (estimated to be 20 of 70 detector strings) and research (\$1.29 million) to exploit data returned from the growing array. This represents ANT's contribution to joint funding for IceCube science operations and research with the Division of Physics within the Directorate for Mathematical and Physical Sciences.
- **International Polar Year** – an increase of \$2.72 million to the core programs to support the U.S. leadership role in IPY. Anticipated emphasis will be on ice sheet studies, East Antarctic lithosphere, and Antarctic systems.

Antarctic Infrastructure & Logistics

\$240,660,000

The FY 2008 Budget Request for Antarctic Infrastructure & Logistics (AIL) is \$240.66 million, an increase of \$12.05 million, or 5.3 percent, over the FY 2007 Request of \$228.61 million.

Antarctic Infrastructure & Logistics Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Antarctic Infrastructure & Logistics (AIL)	\$203.17	\$228.61	\$240.66	\$12.05	5.3%
Major Components:					
Facilities					
Operations & Science Support	136.51	161.09	173.14	12.05	7.5%
U.S. Antarctic Logistical Support Activities	66.66	67.52	67.52	-	-

Totals may not add due to rounding.

About Antarctic Infrastructure & Logistics:

Operations & Science Support

Antarctic Infrastructure & Logistics (AIL) supports the science community through a network of stations, laboratories, equipment, and logistical capabilities that enable research activities in Antarctica. This includes operation of a year-round inland research station at the South Pole (90° south latitude); two year-round coastal research stations (McMurdo at 78°S and Palmer at 64°S) with extensive laboratory, transportation, housing, communication, and computing capabilities; summer camps (as required for research); icebreaking research ships--the *Laurence M. Gould* and the *Nathaniel B. Palmer*; a fleet of ski-equipped LC-130 airplanes operated and maintained by the Air National Guard; U.S. Air Force inter-continental transport; small fixed winged aircraft and helicopters; and icebreakers for channel breaking at McMurdo Station.

AIL uses a mix of government and civilian contract service providers to conduct oversight and research support activities in Antarctica. The largest of these contracts is an operations and maintenance contract with Raytheon Polar Services Company of Centennial, Colorado.

Back-up Icebreakers. Since 2004, AIL has contracted with civilian operators to provide back-up icebreaking support to the U.S. Coast Guard due to heavy ice conditions in the McMurdo Sound region and maintenance issues with the USCG polar icebreakers. During FY 2005 and 2006, AIL contracted with FESCO, a Russian company, for the icebreaker *Krasin*. During FY 2007, AIL was able to contract for the services of the Swedish research icebreaker *Oden*. Ice conditions in the McMurdo Sound region appear to be returning to “normal”. The USCG, however, continues to recommend that back-up icebreakers be available. This recommendation, together with continuing concerns over the reliability of the USCG Polar Class icebreakers, makes it prudent to plan to continue to secure back-up icebreaking services in FY 2008. This cost is in addition to the cost of “United States Coast Guard Polar Icebreaking” discussed later.

U.S. Antarctic Logistical Support Activities

The U.S. Antarctic Logistical Support Activities budget line funds support provided by the U.S. Department of Defense. The DoD operates as a primary logistical support provider on a cost-reimbursable basis. Major funding elements of DoD support include: military personnel, LC-130 flight operations, maintenance, and facilities support of the 109th Airlift Wing (AW) of the New York Air National Guard in Scotia, New York and Antarctica; transportation and training of military personnel supporting the U.S. Antarctic Program; support for air traffic control, weather forecasting, and electronic equipment maintenance; the charter of Air Mobility Command Airlift and Military Sealift Command ships for the re-supply of McMurdo Station; bulk fuel purchased from the Defense Logistics Agency; and reimbursement for use of Department of Defense satellites for communications.

Antarctic Infrastructure & Logistics Priorities for FY 2008:

- A major focus for AIL in FY 2008 is support of IPY activities. This includes extensive field efforts in West Antarctica for studies of Ice Sheet Dynamics and extending the science support operating season at McMurdo station and the Dry Valleys for studies of Life in the Cold and Dark.
- The ability to resupply McMurdo and South Pole stations will be diversified and strengthened as the fuel storage capacity at McMurdo station is increased and the surface traverse to South Pole becomes operational.
- Two additional major capital infrastructure projects include increasing the high bandwidth communication capability at the South Pole to support the 10m South Pole Telescope and IceCube, and the first phase of construction to replace the pier at Palmer Station which is critical to allow resupply ships to dock at the station.

Changes from FY 2007:

- An increase of \$6.10 million to continue the procurement and construction of additional fuel tanks for McMurdo Station;
- An increase of \$6.78 million to study and implement alternative methods of resupplying South Pole Station via air and ground;
- An increase of \$2.17 million for continued design, engineering studies, and advance procurements to support the replacement of the Palmer Station Pier;
- An increase of \$2.0 million to enhance the power generation capability and fuel storage at South Pole Station to support new science projects;
- An increase of \$1.0 million to begin replacement of legacy software systems which have become unsupported and are incompatible with current requirements to safeguard data and personal information;
- \$2.0 million to deliver and install the final components of the South Pole Telescope is funded by deferring the Williams Field Runway Relocation project; and
- A decrease of \$3.0 million for complete and near-complete projects (SHALDRIL project is ending, and there will be cost reductions in the Microwave Landing System and McMurdo Bandwidth projects) and \$3.0 million from IPY logistics.

Polar Environment, Safety & Health

\$6,480,000

The FY 2008 Budget Request for the Polar Environment, Safety & Health (PESH) is \$6.48 million, an increase of \$56,000 thousand, or 9.5 percent, over the FY 2007 Request of \$5.92 million.

Polar Environment, Safety & Health Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
Polar Environment, Safety & Health (PESH)	\$5.01	\$5.92	\$6.48	\$0.56	9.5%

About Polar Environment, Safety & Health:

Established in December 2005, the Polar Environment, Safety & Health (PESH) Office within OPP manages and oversees the environmental, safety, and health aspects of research and operations conducted in polar regions. PESH has overall responsibility for guiding the implementation of both an environmental perspective that provides appropriate protection and stewardship of the environment; and a safety and health perspective, including oversight of medical activities and of OPP-sponsored activities in polar regions. PESH also ensures compliance with environmental, safety, and health related regulatory, statutory, and international treaty requirements.

Polar Environment, Safety & Health Priorities for FY 2008:

In FY 2008, PESH will focus on reviewing, updating, and completing a USAP Safety Manual; revising the USAP Medical Screening Guidelines to reflect advances in on-ice diagnostic and treatment capabilities and in medical science. Continuing attention will be paid to identifying and addressing health and safety risk factors responsible for illnesses and injuries in the polar regions.

Changes from FY 2007:

- An increase of \$56,000 thousand for safety and health measures in remote field research and program oversight, for updating USAP medical screening guidelines, and for additional health and safety measures to support IPY “winter science.”

United States Coast Guard Polar Icebreaking

\$57,000,000

The FY 2008 Budget Request for United States Coast Guard (USCG) Polar Icebreaking is \$57.0 million, equal to the FY 2007 Request of \$57.0 million.

USCG Polar Icebreaking Funding

(Dollars in Millions)

	FY 2006 Actual	FY 2007 Request	FY 2008 Request	Change over FY 2007 Request	
				Amount	Percent
USCG Polar Icebreaking	\$59.94	\$57.00	\$57.00	-	-

About U.S. Coast Guard Polar Icebreaking:

Since FY 2006, NSF has been responsible for funding the USCG’s three polar icebreakers. The agencies cooperate under a Memorandum of Agreement that includes guidance for planning and scheduling. It sets forth the terms and conditions for reimbursement to the USCG from NSF. NSF and the USCG work together to formulate operations and maintenance plans and associated funding requirements. NSF is responsible for ascertaining the needs of other federal agencies and for securing USCG program plans for accommodating them, on a reimbursable funding basis.

NSF will shortly convene an external expert review of the USCG’s requests for maintenance funding for the *Polar Star* and *Polar Sea*, and the *Healy*. Thus, while costs in FY 2008 are currently expected to remain the same as in FY 2007, there is the possibility that the review may validate a requirement to perform more or less maintenance on the ships pending a national policy determination.

This USCG icebreaking cost is in addition to the cost of back-up icebreakers discussed in “Antarctic Infrastructure & Logistics.”

