

**Office of Polar Programs**

**\$516,000,000**  
**+\$45,330,000 / 9.6%**

**Office of Polar Programs Funding**  
(Dollars in Millions)

	FY 2008	FY 2009	FY 2009	FY 2010	Change Over	
	Actual	Current Plan	ARRA Estimate	Request	FY 2009 Plan Amount	Percent
Arctic Sciences	\$91.19	\$98.26	\$92.00	\$108.70	\$10.44	10.6%
Antarctic Sciences	59.06	65.25	66.50	72.50	7.25	11.1%
Antarctic Infrastructure & Logistics	240.08	246.87	15.50	273.60	26.73	10.8%
<i>U.S. Antarctic Logistical Support</i>	67.63	67.52	-	67.52	-	-
Polar Environment, Health & Safety	5.91	6.29	-	7.20	0.91	14.5%
U.S. Coast Guard Polar Icebreaking	50.89	54.00	-	54.00	-	-
<b>Total, OPP</b>	<b>\$447.13</b>	<b>\$470.67</b>	<b>\$174.00</b>	<b>\$516.00</b>	<b>\$45.33</b>	<b>9.6%</b>

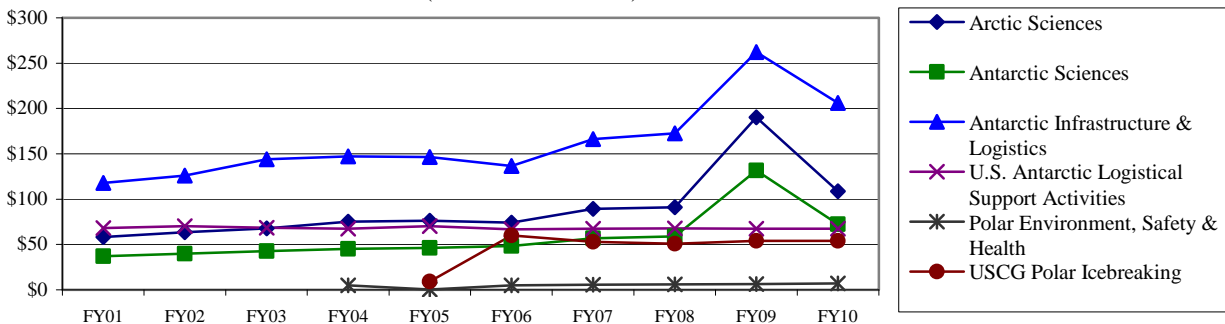
  

Major Components:						
Research and Education Grants	100.71	116.05	151.50	128.30	12.25	10.6%
Centers Programs	4.45	4.00	-	4.00	-	-
Non-Facility Research Infrastructure	5.91	6.29	-	7.20	0.91	14.5%
Facilities O&M	336.06	344.33	22.50	376.50	32.17	9.3%

Totals may not add due to rounding.

Polar research provides insights into earth systems – the atmosphere, oceans and solid earth – that cannot be gained elsewhere. For example, the study of polar ice sheets reveals how the Earth’s climate has changed in the past and provides information essential to predicting future global sea level change. Polar regions also offer important opportunities for environmental research. The extreme sensitivity of polar ecosystems to changes in climate enables study of the linkages between the physical and living components of the coupled earth systems. A key goal of these studies is to predict climate change and its impacts on a regional scale. In addition, 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, and forefront polar research probes how organisms have adapted to the extreme polar environment.

**OPP Subactivity Funding**  
(Dollars in Millions)



NOTE: U.S. Antarctic Logistical Support Activities are shown separately from the Antarctic Infrastructure & Logistics Division, where it is administered.

## **Office of Polar Programs in Context**

OPP is the primary U.S. supporter of fundamental research in polar regions. In addition, NSF provides interagency leadership for U.S. activities in polar regions. In the Arctic, NSF leads research planning as directed by the Arctic Research Policy Act of 1984. The NSF Director chairs the Interagency Arctic Research Policy Committee created for this purpose. In the Antarctic, per Presidential Decision Directive, NSF manages all U.S. activities 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, the Smithsonian Institution, and the Department of Energy. The U.S. Antarctic Program supports the U.S. governance role through the Antarctic Treaty.

Research in polar regions addresses critical aspects of the global earth system – glacial and sea ice, permafrost, terrestrial and marine ecosystems, the ocean, and the atmosphere – that help shape the global environment and climate. This work addresses the Administration’s focus on making the U.S. a leader on climate change and builds on a foundation established during the International Polar Year (IPY) 2007-2009. The vision for IPY established by the National Academy of Sciences/Polar Research Board included an “... intense, coordinated campaign of polar observations, research, and analysis ... that will benefit society by exploring new frontiers and increase understanding of the key roles of the polar regions in globally linked systems.” Although IPY has officially concluded, synthesis of the research results will provide much needed information about the state of the climate and will improve the reliability of the prediction of future climate change. OPP continues to make these investments in climate change research and the necessary observing systems, as well as in climate change education, a high priority. Research in polar regions also offers opportunities for fundamental advances in each of the disciplinary sciences, ranging from the behavior of the Earth’s inner core, the formation of galaxies, the biology of life in the cold and dark, and how Arctic residents and institutions are affected by environmental change.

The Administration is assessing the overarching issues facing the Arctic, including those associated with impacts of climate change, increased human activity, new or additional information needs, and conservation of Arctic resources. This approach will necessarily include identifying any implementation issues associated with the Arctic policy signed by the previous Administration.

Since 1958, the Nation has reviewed its Antarctic programs roughly once a decade to determine whether they are effectively structured, appropriately balanced, and in line with national goals. The landmark Antarctic Treaty will mark its 50<sup>th</sup> Anniversary on December 1, 2009, and the time is particularly ripe for a high-level strategic review of the U.S. program for several reasons: the new South Pole Station is nearing completion, the official International Polar Year activities have just concluded and they point to new research directions and modalities, and the last such strategic review was completed in 1996/1997. In FY 2009, NSF—which administers the Antarctic program on behalf of the U.S. Government—will work with the White House and other federal agencies to plan a new assessment. The results of the review will inform the FY 2013 budget request for NSF and other affected agencies.

OPP’s priorities support national energy security goals. The seasonal and permanent research facilities supported by OPP in the Arctic and the Antarctic are served by sea and air links and have been powered mostly via conventional fuels. Reducing our usage of fossil fuels will reduce our impact on polar and global environments while also improving the quality of measurements in these pristine environments. Our planned increased reliance on renewable energy sources will also reduce our costs over the longer term.

The FY 2010 Request for OPP includes \$4.0 million to leverage activities across the office aimed at increasing support for transformative research. Examples of potential foci for these investments include innovative processes for identifying potentially transformative research, special solicitations and competitions, and increased use of specialized funding mechanisms, notably NSF's EAGER (EARly-concept Grants for Exploratory Research). The challenges facing polar research and research support are well understood. Among the important challenges is the need to identify, predict and mitigate the effects of global and regional climate change on the environment and people. There is also the challenge to create additional flexibility in research support systems at both poles so that new and emerging research frontiers can be supported without undue delay.

### **Office-wide Changes and Priorities**

#### *Climate Research (+\$65.26 million, to a total of \$65.26 million).*

OPP will participate in the broad NSF program that emphasizes a systems approach to climate research, expanding on approximately \$57.0 million already supporting programs in this area. In part, this activity builds on IPY synthesis activities to transform Arctic System Science by shifting greater attention to feedbacks among the different components of the earth system and including them in models that enable more reliable simulations and predictions. The work will include continued focus on measurements to identify the feedback mechanism and increasing emphasis on modeling climate change on more fine-grained regional and temporal bases. An important aspect of this activity includes further study of ecosystem response to changes in the physical environment, including ocean acidification.

#### *Climate Change Education (+\$1.50 million, to a total of \$1.50 million).*

OPP will participate in the NSF-wide program to engage the full spectrum of its awardee community in a new, multidisciplinary, multi-faceted climate change education program, expanding on approximately \$1.30 million already supporting programs in this area. It will enable a variety of partnerships, including those among K-12 education, higher education, the private sector, and related non-profit organizations, in formal and informal settings, as well as relevant education and/or climate-related policymakers. The program will support individual investigators and multidisciplinary teams of STEM researchers and educators in a range of activities, including those local, regional, and/or global in scope. Among a variety of other activities, these partnerships will establish model professional development opportunities for climate policy decision makers.

#### *Energy Security (\$22.0 million).*

The sustained operation of U.S. research facilities in Antarctica hinges on reducing the amount of fossil fuel that must be imported to the stations with the aid of icebreakers. OPP will intensify its efforts during FY 2010 and beyond to improve the energy and operational efficiency of its remote polar research stations and camps in both polar regions through conservation and increased deployment of renewable energy sources. The efforts will range from installing more energy efficient windows and siding to buildings to installing new solar and wind power energy sources and buildings in Greenland and at the South Pole and McMurdo stations. Previous studies conducted with Department of Energy (DOE) experts have demonstrated the long-term economic value of these specific improvements and the work will be carried out in consultation with DOE. The goal is to establish state-of-the-art demonstration facilities in both polar regions by 2013.

#### *Resupply Improvements (\$5.0 million).*

Complete funding for the construction of two two-million gallon fuel tanks at McMurdo Station will be provided. This project is part of the effort to double the fuel storage capacity at McMurdo in order to

mitigate against a failed ship-borne resupply. This level of support will complete the piping and upgrades required to connect existing tanks and to bring the infrastructure into compliance with the USAP Spill Control and Countermeasures Plan. Additional funding will be needed to procure the fuel to fill the tanks. In light of recent and planned energy and fuel conservation initiatives an assessment will be done to determine how many additional tanks will be required. It may be possible to reduce the number of tanks from the five that were initially thought to be needed.

OPP also will assess the feasibility and benefits of shifting the McMurdo Station resupply effort from January to March, when sea ice conditions are normally less of an obstacle. This study could set the stage for implementation of the new resupply plan potentially as early as during FY 2011, subject to funding availability and the conclusions of the study.

*Cyberinfrastructure and Communications (\$8.50 million).*

The science community will realize the greatest possible scientific benefit from large and varied polar data sets by infusing data management efforts with new concepts in computational thinking, data visualization and inter-operability, and virtual organizations. This is especially important as synthesis of the varied results of International Polar Year research begins. Funding will sustain communications capability from South Pole Station via the next-generation NASA satellite – Flight 3, or “F3”. A change in NASA’s charging scheme is expected to increase usage costs considerably.

*Graduate Research Fellowships (+\$200,000, to a total of \$200,000).*

OPP will fund two new fellowships, targeted toward Diversity in Polar Science. These fellowships are primarily for persons from underrepresented groups in science who wish to pursue graduate research degrees in fields of science supported by OPP. Eligibility, application, and review criteria are the same as for applicants in other fields.

### **Program Evaluation and Performance Improvement**

The Performance Information chapter describes the Foundation’s performance evaluation framework, which is built upon the four strategic outcome goals in NSF’s Strategic Plan: *Discovery, Learning, Research Infrastructure, and Stewardship*. Performance evaluation is conducted at all levels within the Foundation, using both qualitative and quantitative measures – including an agency-wide annual review of research and education outcomes by an external expert committee and periodic reviews of programs and portfolios of programs by external Committees of Visitors and directorate Advisory Committees. In FY 2010, OPP plans for Committees of Visitors to review Arctic Sciences, Antarctic Sciences, and Antarctic Infrastructure & Logistics as well as select aspects of the Polar Environment, Health & Safety (PEHS) Office. Aspects of PEHS requiring medical input are reviewed annually by a Medical Panel. Other performance indicators, such as funding rates, award size and duration, and numbers of people supported on research and education grants, are also factored into the performance assessment process.

**Number of People Involved in Office of Polar Programs Activities**

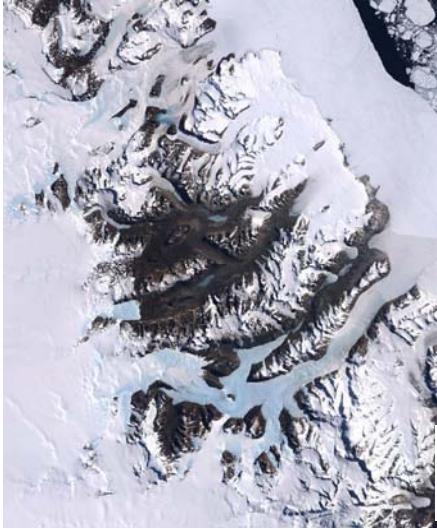
	FY 2008	FY 2009	FY 2009	FY 2010
	Estimate	Estimate	ARRA	Estimate
			Estimate	
Senior Researchers	1,019	1,120	1,155	1,157
Other Professionals	693	730	745	742
Postdoctorates	106	118	136	128
Graduate Students	390	415	460	445
Undergraduate Students	250	263	275	276
<b>Total Number of People</b>	<b>2,458</b>	<b>2,646</b>	<b>2,771</b>	<b>2,748</b>

**Office of Polar Programs Funding Profile**

	FY 2008	FY 2009	FY 2010
	Estimate	Estimate	Estimate
<b>Statistics for Competitive Awards:</b>			
Number of Proposals	863	1,046	1,080
Number of New Awards	234	532	310
Regular Appropriations	234	287	310
ARRA	-	245	-
Funding Rate	27%	51%	29%
<b>Statistics for Research Grants:</b>			
Number of Research Grant Proposals	825	1,009	1,042
Number of Research Grants	201	498	278
Regular Appropriations	201	253	278
ARRA	-	245	-
Funding Rate	24%	49%	27%
Median Annualized Award Size	\$148,364	\$155,800	\$154,900
Average Annualized Award Size	\$183,616	\$191,600	\$192,680
Average Award Duration, in years	2.7	2.8	2.8

## Recent Research Highlights

- **New Satellite Map of Antarctica:** The most detailed satellite map ever produced of Antarctica combines more than 1,100 hand-selected Landsat satellite scenes digitally compiled to create a single, seamless, cloud-free image. The map is the first major outcome of the International Polar Year (2007-2009), and represents the true spirit of the international collaboration between the United States and the United Kingdom. The map and raw data are freely available to the world community of scientists, educators, and the general public; it is available online from the U.S. Geological Survey, the NSF-supported Antarctic Geospatial Information Center, and resources such as Google Earth. The map is a critical snapshot of Antarctica's ice sheets – a fundamental tool for scientists. It will be used in every discipline from biology to geology to glaciology, to answer scientific questions and to plan fieldwork in the vast unexplored tracts of Antarctica.



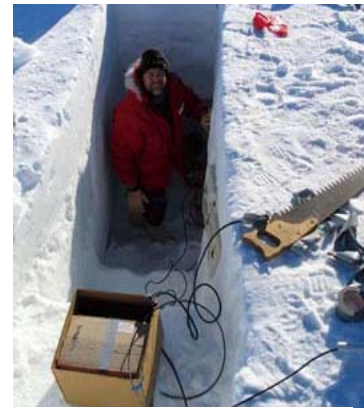
This image shows the McMurdo Dry Valleys, a major research focus for the US Antarctic Program. The region hosts the largest ice free areas of Antarctica. *Credit: Landsat Image Mosaic of Antarctica (LIMA) Project.*

- **Loss of Arctic Sea Ice Observed in 2007:** In September 2007, the extent of sea ice in the Arctic Ocean was 23 percent less than the previous record set in 2005. Results from an array of buoys deployed as part of the Arctic Observing Network showed an extraordinarily large amount of bottom melting in the Beaufort Sea associated with this retreat. This observation indicates local melting of sea ice was largely the result of excess heat in the ocean's surface waters, not excess heat in the atmosphere. A synthesis of satellite observations and weather forecast data is consistent with this conclusion. The conditions in the Beaufort Sea – more open water leading to more solar heat absorbed resulting in more melting and more open water – is a classic ice-albedo feedback signature. Understanding the nature of the changes in the Arctic sea ice cover is vital, since it is an indicator and amplifier of global climate change.



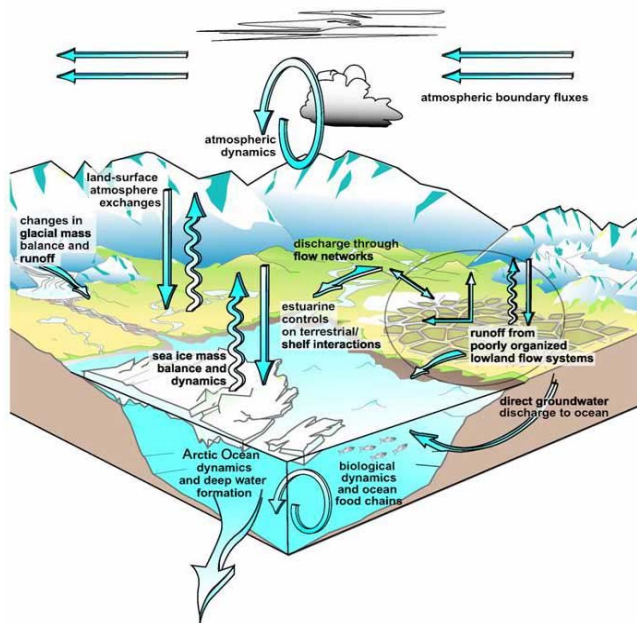
Melting sea ice in the Arctic Ocean. *Credit: J. Harbeck.*

► **Surprising Connection between Alaskan Storm and Antarctic Iceberg Calving:** Seismometers deployed on the Ross Ice Shelf and a number of icebergs adrift in the Ross Sea revealed that the dominant seismological signal is generated by sea swell in the tropical and extratropical Pacific Ocean. In one case, a severe storm in the Gulf of Alaska generated an ocean swell that caused the break-up of a giant iceberg floating near the coast of Antarctica more than 8,300 miles away. This work provides evidence, for the first time, that ocean storminess in parts of the world away from Antarctica could have an impact on the ice sheet. Previous work in the North Atlantic showed that a large amount of iceberg calving took place simultaneously all around the edge of the North Atlantic. The discovery of the link between storms in one part of the global ocean and iceberg calving in another part could provide a mechanism to explain this discovery.



Trench in which seismometers were deployed on iceberg C-16. Credit: Tim Parker.

► **Is the Arctic Freshwater Cycle Intensifying?:** A team of researchers led by the University of New Hampshire wants to know if the Arctic Freshwater Cycle is intensifying, and, if so, why and what are the implications? To answer these questions, the team is investigating links among land, ocean, and atmosphere in the Arctic Hydrological Cycle. The team of engineers, chemists, hydrologists, oceanographers, atmospheric scientists, and global modelers attacked the problem by first establishing a hydrological budget for the Arctic, examining past data sets and publications for changes in various components of the system, and then looking for trends in the changes that suggest an acceleration of the process. They also conducted heuristic modeling studies to generate questions to pose to complex computer models. They conclude the system is changing and very probably doing so at an increasing pace. This may lead to significant impacts for humans and biotic systems in the arctic.



This view of the Arctic hydrological cycle shows key links among land, ocean, and atmosphere. Fully quantifying the coupling of these components within the Arctic and to the larger Earth system remains an important yet unresolved research issue. The hydrological cycle is inextricably connected to all biological and chemical processes occurring in the biosphere, atmosphere, and cryosphere. Hydrologic interactions with terrestrial and aquatic ecosystems and their biogeochemistry control all life in the pan-Arctic region. Credit: Vörösmarty, C. J., L. D. Hinzman, B. J. Peterson, D. H. Bromwich, L. C. Hamilton, J. Morison, V. E. Romanovsky, M. Sturm, and R. S. Webb.

► **Experiencing Climate Change: Assessing Knowledge, Resilience, and Adaptation among the Viliui Sakha:** George Mason University researchers are investigating the resilience of Arctic peoples to changes in their local environments due to global climate change. In particular, they want to see what information the Viliui Sakha - a group of native people in northeastern Siberia - need to gain a more holistic understanding of global climate change to bolster their ability to adapt. Viliui Sakha are native horse and cattle breeders inhabiting the Viliui River regions of northwestern Sakha Republic in Russia. The four-village, three-year study is a collaborative effort involving the active participation of the targeted communities, field assistants, native specialists, an in-country research team, and an international collaborator. In 2004, while surveying inhabitants of four villages, the principal investigator found that 90 percent of participants expressed their concern about local climate change, that it was causing unprecedented change in local areas, and that it threatened to undermine subsistence.



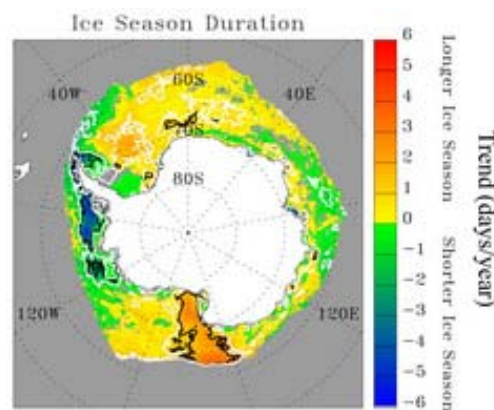
Researcher Susan Crate accompanied by Viliui Elders. Credit: Susan Crate.

► **Ocean Acidification and Polar Ecosystems:** Ocean acidification arises due to the ocean's absorption of carbon dioxide, followed by a series of naturally occurring reactions involving carbonate, bicarbonate, and the hydrogen ion. Calcium carbonate is an essential skeletal component for many marine organisms, including coral and shell-bearing invertebrates. Undersaturation of oceanic waters, with respect to carbonate, could promote shell dissolution or inhibit shell formation. Polar ecosystems are particularly vulnerable to ocean acidification because cold water holds more carbon dioxide. A team of researchers from California State University, the University of Rhode Island, and the University of California at Santa Barbara is studying the response of Southern Ocean pteropods, an important group of zooplankton, at the genetic level, to calcification stress. Research to date on sea urchin larvae reveals that shell-forming genes have highly elevated activity, and larval skeletons are less developed when the larvae are subjected to undersaturated seawater.



The pteropod *Limacina helicina*. Credit: Russ Hopcroft, University of Alaska, Fairbanks.

► **What Is Happening to the Antarctic Sea Ice Cover?:** The total amount of Antarctic sea ice in a given year isn't changing dramatically but there are big changes in particular regions. Previous studies have shown decreases in sea ice in the western Antarctic Peninsula and southern Bellingshausen Sea and increases in the Western Ross Sea region. Researchers from Columbia University, Clarkson University, and the College of William and Mary recently analyzed satellite observations from 1979-2004 to determine that sea ice is retreating a month earlier and advancing a month-and-a-half later in the former region and is retreating a month later and advancing a month earlier in the latter region. These trends are strongly correlated to changes in atmospheric pressure patterns. This study suggests that one consequence of climate change may be added regional change in Antarctic sea ice cover.



Trend (days/year) in ice season duration over 1979 to 2004. Ice season duration is defined as the time elapsed between the autumn ice edge advance and the subsequent spring ice edge retreat. The black/white contours delimit the 0.01/0/10 significance levels. Total changes over the 26 year period show the western Antarctic Peninsula/southern Bellingshausen Sea region to have a shorter ice season duration by  $85 \pm 20$  days, a decrease caused by a later autumn sea ice advance (by  $54 \pm 9$  days) and an earlier spring sea ice retreat (by  $31 \pm 10$  days). In contrast, the western Ross Sea region shows a longer ice season duration (by  $60 \pm 10$  days), an increase caused by an earlier autumn sea ice advance (by  $31 \pm 6$  days) and a later spring sea ice retreat (by  $29 \pm 6$  day) (Stammerjohn et al, JGR, in press). Credit: Sharon Stammerjohn.



**ARCTIC SCIENCES**

**\$108,700,000**  
**+\$10,440,000 / 10.6%**

**Arctic Sciences Funding**

(Dollars in Millions)

	FY 2009		FY 2009		Change Over	
	FY 2008	Current	ARRA	FY 2010	FY2009 Plan	
	Actual	Plan	Estimate	Request	Amount	Percent
<b>Total, ARC</b>	<b>\$91.19</b>	<b>\$98.26</b>	<b>\$92.00</b>	<b>\$108.70</b>	<b>\$10.44</b>	<b>10.6%</b>
Major Components:						
Research and Education Grants	47.60	56.95	85.00	61.95	5.00	8.8%
Facilities	43.59	41.31	7.00	46.75	5.44	13.2%
<i>Research Support &amp; Logistics</i>	<i>43.59</i>	<i>41.31</i>	<i>7.00</i>	<i>46.75</i>	<i>5.44</i>	<i>13.2%</i>

**Summary of FY 2010 Request**

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. The Research Support & Logistics program assists researchers with Access to the Arctic, improves safety and environmental stewardship, and increases the ability of researchers to share plans and results with local Arctic communities. In general, 59 percent of the ARC portfolio is available for new research grants. The remaining 41 percent funds continuing grants made in previous years, and research support and logistics.

The Arctic is at the forefront of global climate change. Observations have revealed an estimated 14 percent per decade reduction in 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 funds a broad range of activities to provide an integrated understanding of environmental change in the Arctic, including study of significant, system-scale environmental change and its human dimension, as well as education.

The Research Support & Logistics program is driven by and responds to research and education funded by the Division. Funding is provided directly to grantees or to key organizations that provide or manage Arctic support and logistics. Emphasis will be placed on improving access to and the energy security of the remote facilities used by Arctic researchers and educators.

Support for the **Arctic Observing Network** (AON) remains level at \$12.0 million in FY 2010. AON is a cornerstone in interagency and international efforts to provide a comprehensive data stream for modeling and other focused studies, by incorporating observing-system simulation experiments and through greater participation by Arctic communities and linkages to other nations' efforts.

Funding for **Energy Security** continues at \$8.0 million in FY 2010 to provide logistical and other support to the research program, including potential fuel and transportation cost increases. This includes consideration of remote research support at the enterprise level, implementing building efficiencies, the use of renewable energy, and transportation options in the context of a system designed to meet the needs of a focused research program and reduce the carbon footprint.

Arctic Sciences will provide \$35.45 million in support of **Climate Research**, the broad NSF program that emphasizes a systems approach to climate change. This activity builds on and goes beyond IPY synthesis activities to transform Arctic System Science by shifting greater attention to high-level synthesis informed by modeling and observations and using cyberinfrastructure to improve the ability to predict and model regional climate change.

**Ice Sheet Modeling** support will increase by \$1.25 million, to a total of \$3.0 million, to improve ice sheet modeling and dynamical modes of response to climate warming, a key focus area for research identified by the community.

Arctic Sciences **Cyberinfrastructure** funding will increase by \$3.50 million, to a total of \$4.0 million, to realize the greatest possible scientific benefit from large and varied polar data sets by infusing data management efforts with new concepts in computational thinking, data visualization and inter-operability, and virtual organizations. This is especially important as synthesis of the varied results of International Polar Year research begins.

Arctic Science will provide \$750,000 to support **Climate Change Education**, the NSF-wide program to engage the full spectrum of its awardee community in a new, multidisciplinary, multi-faceted climate change education program. It will enable a variety of partnerships, including those among K-12 education, higher education, the private sector, and related non-profit organizations, in both formal and informal settings, as well as relevant education and/or climate-related policymakers. The program will support individual investigators and multidisciplinary teams of STEM researchers and educators in a range of activities, including those local, regional, and/or global in scope. Among a variety of other activities, these partnerships will establish model professional development opportunities for climate policy decision makers.

**Social Sciences** within the Arctic Sciences division will increase funding \$500,000, to a total of \$4.0 million, to build on results from the natural science component of the Bering Sea Ecosystem Study to explore the dynamic relationship between the Bering Sea ecosystem and the humans who constitute an integral component of that system of critical importance to their sustainability and in defining the vulnerability of indigenous communities and extractive industries.

**ANTARCTIC SCIENCES**

**\$72,500,000**  
**+\$7,250,000 / 11.1%**

**Antarctic Sciences Funding**

(Dollars in Millions)

	FY 2009	FY 2009	ARRA	FY 2010	Change Over	
	FY 2008	Current			FY 2009	FY 2009 Plan
	Actual	Plan	Estimate	Request	Amount	
<b>Total, ANT</b>	<b>\$59.06</b>	<b>\$65.25</b>	<b>\$66.50</b>	<b>\$72.50</b>	<b>\$7.25</b>	<b>11.1%</b>
Major Components:						
Research and Education Grants	53.11	59.10	66.50	66.35	7.25	12.3%
Centers	4.45	4.00	-	4.00	-	-
<i>STC: Center for Remote Sensing of Ice Sheets</i>	<i>4.45</i>	<i>4.00</i>	-	<i>4.00</i>	-	-
Facilities	1.50	2.15	-	2.15	-	-
<i>IceCube Neutrino Observatory</i>	<i>1.50</i>	<i>2.15</i>	-	<i>2.15</i>	-	-

**Summary of FY 2010 Request**

Antarctic Sciences (ANT) funds research in all areas of science that can only be done, or is best done, in Antarctica. Antarctic Sciences 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 fosters linkages across the disciplines in order to better advance understanding of Antarctic climate as a system. Antarctic Sciences 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, 40 percent of the Antarctic Sciences portfolio is available for new research grants. The remaining 60 percent is used primarily to fund continuing grants made in previous years.

Support increases for synthesis activities to advance understanding of the Antarctic system in a global context as well as advancing understanding of biotic systems during time of change. Other priorities include exploration, in collaboration with Swedish scientists, research questions related to oceanography in the Southern Ocean; funding to support development of instrumentation and equipment for making critical scientific observations; and operations and research funding for the IceCube Neutrino Observatory.

Antarctic Sciences is the NSF managing organization for the CRESIS Science & Technology Center – Center for the Remote Sensing of Ice Sheets – that aims to advance understanding of ice sheet dynamics and the contribution of major polar ice sheets to sea level rise in both the north and the south. Through new technologies and collaborative programs, CRESIS seeks to significantly improve models of ice sheet dynamics.

IceCube is the world’s first high-energy neutrino observatory, located deep within the ice cap under the South Pole 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. Since FY 2007, construction of the IceCube Neutrino Observatory has been sufficiently advanced to allow initial operations and research activities.

Antarctic Sciences will provide \$28.81 million for **Climate Research** to participate in the broad NSF program that emphasizes a system approach to climate change. This activity builds on and goes beyond IPY synthesis activities and includes ecosystem response to change (including ocean acidification), atmospheric sciences, and advancing ice sheet dynamics research and modeling to reduce uncertainties in future sea level rise.

**Remote Instrumentation** funding will increase \$3.0 million, to a total of \$7.0 million, and fund development of instrumentation and equipment for making critical scientific observations with the potential to transform data collection, monitoring, and modeling in all areas of Antarctic science and to reduce the energy required to support field work. Examples of instrumentation and equipment include gliders, oceanographic drifters, and sensors and systems for airborne research.

Antarctic Sciences will provide \$750,000 for **Climate Change Education**, the NSF-wide program to engage the full spectrum of its awardee community in a new, multidisciplinary, multi-faceted climate change education program. It will enable a variety of partnerships, including those among K-12 education, higher education, the private sector, and related non-profit organizations, in both formal and informal settings, as well as relevant education and/or climate-related policymakers. The program will support individual investigators and multidisciplinary teams of STEM researchers and educators in a range of activities, including those local, regional, and/or global in scope. Among a variety of other activities, these partnerships will establish model professional development opportunities for climate policy decision makers.

**ANTARCTIC INFRASTRUCTURE & LOGISTICS**

**\$263,730,000**  
**+\$26,730,000 / 10.8%**

**Antarctic Infrastructure and Logistics Funding**

(Dollars in Millions)

	FY 2008 Actual	FY 2009 Current Plan	FY 2009 ARRA Estimate	FY 2010 Request	Change Over FY2009 Plan	
					Amount	Percent
<b>Total, AIL</b>	<b>\$240.08</b>	<b>\$246.87</b>	<b>\$15.50</b>	<b>\$273.60</b>	<b>\$26.73</b>	<b>10.8%</b>
Major Components:						
Facilities	240.08	246.87	15.50	273.60	26.73	10.8%
<i>U.S. Antarctic Facilities &amp; Logistics</i>	<i>172.45</i>	<i>179.35</i>	<i>15.50</i>	<i>206.08</i>	<i>26.73</i>	<i>14.9%</i>
<i>U.S. Antarctic Logistical Support</i>	<i>67.63</i>	<i>67.52</i>	-	<i>67.52</i>	-	-

**Summary of FY 2010 Request**

Antarctic Infrastructure and Logistics: Operations and Science Support

Antarctic Infrastructure & Logistics supports research through a network of stations, labs, equipment, and logistics that enable research activities in Antarctica. This includes operation of a year-round inland research station at the South Pole; two year-round coastal research stations (McMurdo and Palmer) 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 wing aircraft and helicopters; and icebreakers for channel breaking and ship escort at McMurdo Station. The division uses a mix of government and civilian contract service providers for research support activities in Antarctica.

U.S. Antarctic Logistical Support

The U.S. Antarctic Logistical Support budget line funds support provided by the U.S. Department of Defense (DoD). DoD operates as a primarily 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 109<sup>th</sup> 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 resupply of McMurdo Station; bulk fuel purchased from the Defense Logistics Agency; and reimbursement for use of DoD satellites for communications.

Funding remains level for **Science and Logistical Support** at \$12.0 million in FY 2010, recognizing potential fuel, transportation, and labor cost increases. This includes increasing the number of LC-130 missions back to pre-FY 2009 levels and will involve funding significant maintenance for one of the NSF-owned aircraft.

Priority is given to continued implementation of **Energy Security** projects, such as improving the efficient use of utilities and capturing heat generated from station generators at McMurdo Station, Antarctica. Included is funding to complete the McMurdo Power Plant project to allow for more energy

efficient power production. The total cost of this project is approximately \$18.0 million, with the final increment of \$1.25 million expected to be spent in FY 2010. Also included are funds to begin construction of the facilities needed to consolidate the three McMurdo airfields into one, including development of high-speed access and road networks (\$50,000). This project is expected to take approximately two years to complete.

FY 2010 funding for **Energy Conservation** includes \$9.25 million to continue implementation of a broad range of energy improvements to reduce energy usage and increase reliance on alternative energy, such as wind power at McMurdo, wind and solar power at South Pole, and improvements to the heat trace system for McMurdo Station and the waste heat loop systems for all Antarctic stations.

The Antarctic Infrastructure and Logistics Division is planning for additional costs of up to \$7.50 million that may be needed to transition from one support contractor to another early in the fiscal year to fund the **Antarctic Support Contract**.

**South Pole Communications** costs will increase by \$5.0 million, to a total of \$7.0 million, to sustain communications capability from South Pole Station via the next-generation NASA satellite – Flight 3, or “F3”. A change in NASA’s charging scheme is expected to increase usage costs considerably.

**Resupply Improvements for McMurdo Fuel Storage** will continue, providing \$5.0 million to complete funding for the construction of two two-million gallon fuel tanks. This project is part of the effort to double the fuel storage capacity at McMurdo Station in order to mitigate against a failed ship-borne resupply. This funding will complete the line piping and upgrades required to connect existing tanks and to bring the infrastructure into compliance with the USAP Spill Control and Countermeasures Plan. Additional funding will be needed to procure the fuel to fill the tanks. In light of recent and planned energy and fuel conservation initiatives an assessment will be done to determine how many additional tanks will be required to support the strategic resupply initiative. It may be possible to reduce the number of tanks from the five that were initially thought to be needed.

**POLAR ENVIRONMENT, HEALTH & SAFETY**

**\$7,200,000**  
**+\$910,000 / 14.5%**

**Polar Environment, Health & Safety Funding**

(Dollars in Millions)

	FY 2009	FY 2009	ARRA	FY 2010	Change Over	
	FY 2008	Current			FY 2009	FY2009 Plan
	Actual	Plan	Estimate	Request	Amount	
<b>Total, PEHS</b>	<b>\$5.91</b>	<b>\$6.29</b>	<b>\$0.00</b>	<b>\$7.20</b>	<b>\$0.91</b>	<b>14.5%</b>
Major Components:						
Non-Facility Research Infrastructure	5.91	6.29	-	7.20	0.91	14.5%
<i>Polar Environment, Health &amp; Safety</i>	<i>5.91</i>	<i>6.29</i>	<i>-</i>	<i>7.20</i>	<i>0.91</i>	<i>14.5%</i>

**Summary of FY 2010 Request**

The Office of Polar Environment, Health & Safety (PEHS) within OPP manages and oversees the environmental, safety, and health aspects of research and operations conducted in polar regions. It ensures compliance with environmental, safety, and health related regulatory, statutory, and international treaty requirements. PEHS has overall responsibility for guiding the implementation of both environmental protection and stewardship to minimize the environmental impact of OPP-supported activities in polar regions. The office also develops and oversees programs to ensure the safety and health of all participants.

Funding will increase for safety and health program oversight and measures to safeguard the health and safety of researchers and support personnel. Increased funding will continue recognized environmental leadership in the international community through development of stewardship material, training, and management plans.

A priority for PEHS is establishment, through \$1.0 million in funding, of an **Electronic Medical Records System** to lower health care costs and improve delivery of health care services.





**U.S. COAST GUARD POLAR ICEBREAKING**

**\$54,000,000**  
**\$0 / 0%**

**U.S. Coast Guard Polar Icebreaking Funding**

(Dollars in Millions)

	FY 2008	FY 2009	FY 2009	FY 2010	Change Over	
	Actual	Current Plan	ARRA Estimate	Request	FY2009 Plan Amount	Percent
<b>Total, USCG Icebreaking</b>	<b>\$50.89</b>	<b>\$54.00</b>	-	<b>\$54.00</b>	-	-
Major Components:						
Facilities	50.89	54.00	-	54.00	-	-
<i>U.S. Coast Guard Polar Icebreaking</i>	<i>50.89</i>	<i>54.00</i>	-	<i>54.00</i>	-	-

**Summary of FY 2010 Request**

From FY 2006 through FY 2008, NSF funded the operations and maintenance of the United States Coast Guard's (USCG) three polar icebreakers: *Polar Sea*, *Polar Star*, and *Healy*.

As directed by Congress, NSF and USCG have been reviewing the existing Memorandum of Agreement (MOA) that provides guidance for NSF reimbursement to USCG for maintenance and operation of the polar icebreakers. In addition, we continue to work together to address the implementation issues associated with maintenance and training requirements for the *Polar Sea* and *Healy*. As of FY 2009, *Polar Star* no longer falls under the MOA, and USCG will begin refurbishing this ship with the separate funding it received in FY 2009. The FY 2010 Request retains budget authority for operation and maintenance of *Polar Sea* and *Healy* with NSF because scientific research is still the critical and principal use for these vessels.

The USCG icebreaking cost is in addition to the cost of icebreakers and ice-capable ships engaged by the Arctic Sciences and the Antarctic Infrastructure & Logistics divisions.

