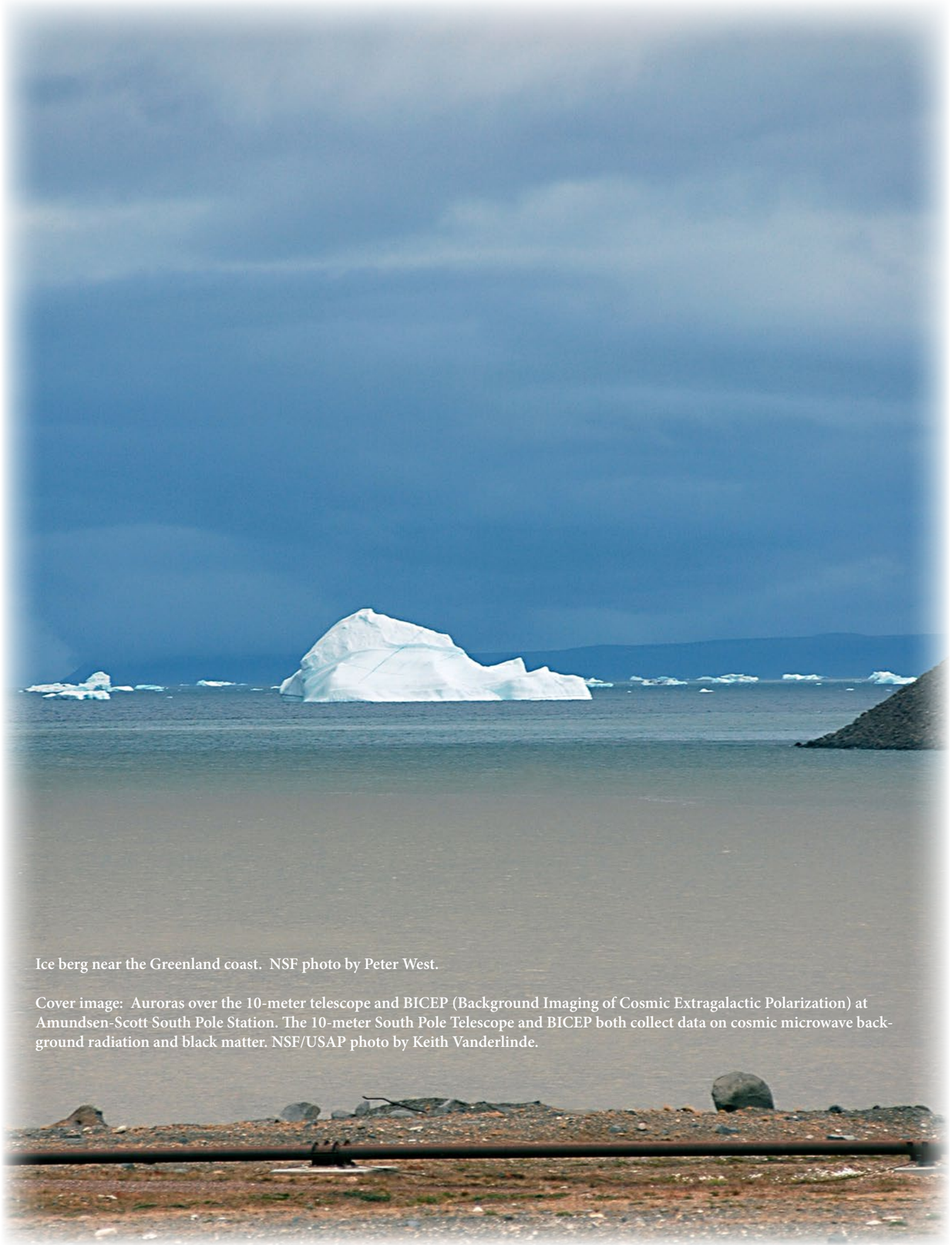
National Science Foundation

Polar Vision 2012-2017

The Division of Polar Programs promotes creative and innovative scientific research, engineering, and education in and about the polar regions, catalyzing fundamental discovery and understanding of polar systems and their global interactions to inform the nation and advance the welfare of all people.



Ice berg near the Greenland coast. NSF photo by Peter West.

Cover image: Auroras over the 10-meter telescope and BICEP (Background Imaging of Cosmic Extragalactic Polarization) at Amundsen-Scott South Pole Station. The 10-meter South Pole Telescope and BICEP both collect data on cosmic microwave background radiation and black matter. NSF/USAP photo by Keith Vanderlinde.

The Division of Polar Programs (OPP) supports fundamental discovery in the Arctic and Antarctic. The polar regions offer unrivaled vantage points from which to learn about the Earth, life, the solar system, and the Universe.

The Arctic and Antarctic are environmentally sensitive, and patterns observed there have direct implications for changes in global climate processes, for future sea-level rise, and thus, for life everywhere. Fundamental discoveries in polar regions range from newly observed ecosystems to the nature of subatomic particles.

The often harsh, remote, but starkly beautiful Arctic and Antarctic fascinate the public. Polar Programs promotes public engagement through both formal and informal venues. While the Antarctic is the only continent devoted to scientific research, the Arctic is a place where oceans, nations, and cultures converge. Along side the study of physical and biological systems, Polar Programs supports scientific research on the complexity of the social and cultural systems of arctic residents and recognizes that rapid environmental changes present challenges and opportunities for the nations and the indigenous peoples of the circumpolar north. To fulfill its leadership role at both poles, the Division provides specialized, highly coordinated logistical support and effectively manages resources for researchers and educators supported by NSF, other US federal agencies, and other national and international partners.

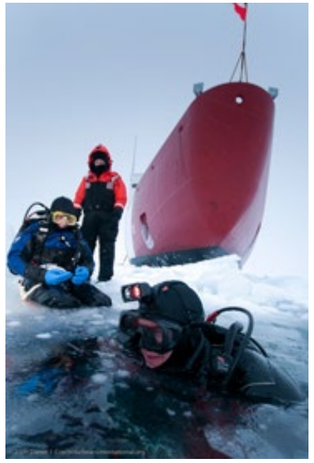
A New Year's halo at the West Antarctic Ice Sheet camp near the drilling arch. Photo by Don Voigt.

Polar Programs makes critical investments in research as well as in infrastructure and logistics, health, safety, and environmental stewardship. The Division maintains portfolios of innovative research that include atmosphere and ocean sciences, biology, geology, geophysics, glaciology, social science, space science, and astrophysics. Advances in disciplinary research foster Polar Programs' integrated programs that address complex system-level questions, serving as a potential model for interdisciplinary science at NSF and in other contexts.

Recognizing that good ideas come from many places, the Division encourages feedback and ideas from all research and education communities, including those in the academic, government, and private sectors, and those resident in the Arctic. We are committed to enhancing diversity within our program. In the polar community we support a diverse community as an important contribution to the NSF strategic goal of performing as a model organization.

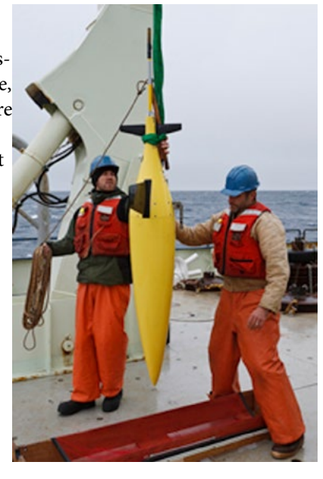
Fundamental to Polar Programs are the opportunities afforded by the unique polar environments as natural observatories, platforms for discovery, and complex and changing systems with global impacts. The organizing principles below convey both the challenges and opportunities of polar research.

Arctic Ocean divers in the front of the Polar Sea (photo by Daniel Cox), The *Laurence M. Gould* near Petermenn Island (photo by Christine Hush), an unmanned plane (photo by placeholder)



Access – Provide responsible, safe, and cost-effective access to remote regions for observation and discovery. Advance technologies, data handling, and visualization to create opportunities for innovation. Minimize environmental footprint and costs while ensuring continued access to research stations, remote sites, and research vessels. Enhance access through interagency and international partnerships. Expand access through robotic and automated data gathering and visualization strategies.

Seagliders travel through the polar oceans and under sea ice to measure ocean properties. They navigate autonomously until they surface to transmit data and receive instruction by satellite phone, as infrequently as once in 6 months. They measure sea-water properties vertically to depths of 1,000 m (3,300 feet) every 5 km (2 miles). They are part of a network of instruments for observing ocean change. Photo from Craig Lee.



Outlet glaciers buttress the massive Greenland ice sheet. Surface warming, especially oceanic, has caused outlet glaciers to retreat, increasing the flow rate off of the continent and ice calving to the sea. When continental ice reaches the ocean and melts, it raises sea level globally. Climate change influences the warming rate and ice retreat. Scientists use numerical models, satellite sensors, and local instruments to study ice sheets. Photo by Placeholder

A conductivity temperature depth sensor (photo by Daniel Cox), Greenland Educational tour (photo by Laura Lukes), West Antarctic ice core (photo by Kendrick Taylor).

System – Strive for a system-level understanding of how the polar regions function and influence the Earth as a whole. Reveal past connections to better predict and prepare for the future. Probe physical, biological, and human interactions at the local level as well as global connections. Integrate observations and modeling toward improved predictive capability.

Education – Educate the public about polar science while assessing the effectiveness of these efforts. Prepare the future workforce by promoting education in polar science. Embrace new means to broaden participation of underrepresented groups and enhance diversity throughout the polar research enterprise.

Polar Programs supports training courses for graduate students from around the world to study Antarctic organisms, with an emphasis on the genetic foundation of their adaptation to extreme cold. The courses, ongoing since 1994, stress polar connections to global system and have brought more than 200 students and faculty to Antarctica. Photo by Jimmy Lee.

Scientists have found that the microbial communities living below the Greenland ice sheet can affect the rate at which the underlying rock is worn down, as well as the amount of nutrients in meltwater. These tiny organisms that live between hundreds of meters of ice and bedrock may help us understand future cycles of nutrients, carbon flows, and the mechanism that causes the ice sheet to slide towards the sea. Photo from ?

As part of an international collaborative project examining how climate change is affecting reindeer herding societies, anthropologists and reindeer herders in Sakhalin discuss herding practices of the Saami and Inupiaq peoples in Sweden and Alaska. Photo by Vladislava Vladimirova

Wind turbines supply energy to McMurdo Station and New Zealand's Scott Base, saving about 240,000 gallons of diesel fuel per year. Their construction was a joint United States and New Zealand project.

People – Recognize the influence of polar changes on people across the globe. Improve communication to ensure that people obtain scientific information. Honor the special commitment and responsibility toward indigenous peoples of the circumpolar north. Foster collaboration and cooperation among and between scientists and indigenous peoples in all aspects of the natural and social world.

Sustainability – Foster research on polar processes that can impact the well-being of future societies and ecosystems. Adopt and practice sustainable and environmentally responsible logistics and infrastructure activities. Cultivate the next generation of polar researchers.

Collaboration – Continue to support innovative polar research projects that involve several disciplines and/or address the interests of more than one nation. Seek new ways to overcome structural and cultural barriers across disciplines, countries, or regions. Engage Arctic residents and local communities to benefit from a two-way exchange of knowledge. Build on and strengthen international collaboration for research support.

When permafrost (frozen soil) thaws, once-stored carbon is released to the atmosphere, and the softened ground causes structures to collapse. Some coastal communities that have been inhabited for centuries are forced to relocate as the thawing permafrost is eroded by wave action and river flow. Improved understanding of the presence and behavior of permafrost is needed to inform building practices and settlement strategies.

IceCube, a powerful neutrino detector, will be able to sense a supernova in our galaxy. It is an array of 5,000 sensors buried up to 1.5 miles deep in the ice at the South Pole. Data are transmitted by satellite. Polar Programs leads this 11-nation collaboration. This picture shows a detector being lowered into a drill hole.

Who We Are

The U.S. Antarctic Program

The Antarctic program supports research on astrophysics, atmospheric sciences, earth sciences, glaciology, integrated system science, oceanography, and organisms and ecosystems. The program operates three year-round stations, numerous summer field research camps, automated geophysical observatories, weather stations, and the research vessels *Nathaniel B. Palmer* and *Laurence M. Gould*.

Presidential Memorandum 6646 designates NSF as the single point manager of the U.S. Antarctic Program (USAP) for the U.S. Government. Through USAP, the United States maintains an active and influential national presence by supporting a scientific research program consistent with the terms of the Antarctic Treaty.

The Arctic Program

The Arctic program supports observing networks and research in the natural sciences, social sciences, and system science. Research support and logistics are provided for field work, facility operations, and data acquisition and collection. The program operates year-round facilities in Greenland and other facilities in Alaska, helps to coordinate research support on U.S. ships operating in arctic waters, and facilitates research access throughout the Arctic. The program anticipates support of research aboard the new research vessel Sikuliaq when it comes on line in 2014.

The NSF Director chairs the Interagency Arctic Research Policy Committee under the President's National Science and Technology Council. National Security Presidential Directive 66 and Homeland Security Presidential Directive 25 designate NSF to lead the U.S. in advancing Arctic research and scientific international cooperation.

Polar Environment, Health and Safety

Research and operations in the remote and environmentally harsh polar regions must be conducted responsibly. The Polar Environment, Health and Safety (PEHS) group develops policy for and oversees operational aspects of environmental protection, safety, and health.

The Antarctic Treaty System, with its Agreed Measures for the Conservation of Fauna and Flora (1964) and its Protocol on Environmental Protection (1991), prescribes comprehensive protective measures. The U.S. commitment to these principles is met through compliance with U.S. laws and regulations.

The Polar Programs Team

As a division in Geosciences, Polar Programs works with the Earth, Atmospheric and Geospace, and Ocean Sciences and with other offices and directorates of the National Science Foundation. OPP Program Officers provide essential expertise to conduct the review and oversight of disciplinary and system science at the poles and to recognize the broader implications of the research. They serve as key conduits to the research, engineering, and logistics communities as well as to their peers across the Foundation and at other national and international agencies. Together with our Geosciences colleagues, Polar Programs is poised to meet challenging infrastructure and logistics requirements for the most meritorious science, engineering, and educational activities in some of the most remote and extreme environments on earth. Together, the OPP team provides national leadership to advance and support the needs of fundamental polar research.