

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

**Polar Research Board
US National Committee for IPY**

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INTERNATIONAL POLAR YEAR UPDATE ON ACTIVITIES: UNITED STATES

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The United States does not have a secretariat as its lead for organizing its IPY activities. The lead federal agency is the National Science Foundation, and as many as 12 other agencies are participating. The nongovernmental lead is the US Polar Research Board, part of the National Academy of Sciences, which serves as the US National Committee for IPY and in this role has focused to date on facilitation, coordination, and communication.

National Science Foundation:

NSF has the overall leadership for IPY in the United States, both coordinating all government efforts and having specific funding to allocate to projects. In its role as government lead, NSF provided the attached detailed "Report on US Federal Agencies' Planning." Also attached is a recent announcement of the first phase of education and outreach activities selected for funding. The NSF's FY07 budget for IPY is \$62M, and it could be extrapolated an initial estimate of FY08 as well. NSF is leading an Interagency Public Affairs working group that is meeting to help agencies coordinate their outreach activities.

Polar Research Board/USNC for IPY:

In its role as the nongovernment lead, the US Polar Research Board/US National Committee provided significant early energy to help the IPY concept gain momentum. The Board began its IPY work with a preliminary planning workshop in fall 2002; the Board conducted a survey of National Academy of Sciences and National Academy of Engineering members in winter 2003 to gather views on the value of an IPY and used this input to provide credibility to the planning. The PRB established a website for community interaction on IPY in spring 2003, and used internal Academy endowment funds to establish a US National Committee for the International Polar Year. This first committee made significant progress in gathering community input on the overall scope and nature of US participation in IPY, and weaving that input into a report, "A Vision for International Polar Year 2007-2008" (May 2004). The broad themes identified by the United States in that report are:

- Assess large-scale environmental change and variability in the polar regions
- Conduct studies of coupled human-natural systems in the polar regions
- Explore new scientific frontiers, from the molecular to the planetary scale
- Design and implement multidisciplinary polar observing networks
- Provide critical scientific infrastructure (both physical and human) and technology that leaves enduring benefits

The PRB worked with international partners to help gain International Council for Science endorsement of the IPY concept, and assisted the work of the original ICSU IPY Planning Group, including assistance in writing the ICSU report “A Framework for International Polar Year.” Members of the PRB and the initial National Committee gave talks and posters at more than a dozen conferences and meetings, met with officials in NSF, NOAA, NASA, USGS, State Department, ONR, and other agencies and organizations to brief them on IPY planning and solicit their ideas for making it successful.

In 2004, the PRB hosted an Implementation Workshop with the purpose of bringing agencies together to discuss their potential goals for IPY and produced a workshop report. The PRB has been careful to facilitate a truly interactive and community based planning process, highlighting opportunities for agencies to use IPY to meet existing missions and goals. As the ongoing US National Committee for IPY, the PRB has the following functions:

- stimulate discussion about IPY in the United States,
- serve as a central portal for US communications with the ICSU-WMO Joint Committee for IPY,
- encourage agency participation and coordination,
- provide strategic thinking and a neutral venue for advancing IPY discussions in the United States,
- organize subgroups and discussions, as needed, to accomplish specific IPY planning and coordination functions, and
- provide assistance to education and outreach activities.

In September 2006, the USNC chair, Dr. Robin Bell, testified about IPY in two congressional hearings (US House of Representatives, Committee on Science and US Senate, Joint Meeting of Committee on Commerce and Committee on Foreign Relations). This was a very important opportunity to speak directly to Congress and all the witnesses were well received. We continue to interact with congressional staff and are encouraged by their level of enthusiasm.

As time allows, the USNC is trying to assist in selected IPY activities, like pairing up a board member to provide advice on an IPY-related engineering competition and educational cruise. The Board is helping younger scientists form an IPY Task Force for Early Career Scientists, and toward this end we will host a series of conference calls and email discussions and seek other ways to help scientists early in their careers to leverage IPY to advance their work and help build the IPY legacy of encouraging a “next generation of researchers.” The Board continues to issue a bimonthly e-newsgram and maintain an IPY website (www.us-ipy.org) designed for the science community to keep abreast of IPY planning. The Board has an extensive list of potential other opportunities to contribute to IPY communication and coordination but to date has not been awarded funds to support these efforts.

**The International Polar Years 2007-2009
Report on U.S. Federal Agencies' Planning**

**Compiled by the National Science Foundation
September 18, 2006**

The years 2007-2009 will mark the 50th anniversary of the International Geophysical Year (IGY) and of the third International Polar Year. This period has been designated the fourth International Polar Year (IPY) by the National Academies of Sciences (NAS), the International Council of Science (ICSU), the World Meteorological Organization (WMO), the Arctic Council and by many other international organizations. The National Science Foundation (NSF) was designated by the President's Office of Science and Technology to be the lead U.S. agency in organizing IPY activities.

Preparations are underway worldwide to make IPY a period of intense activity that promises, in the words of the NAS publication *A Vision for the International Polar Year*, to "further our understanding of physical and social processes in the polar regions, examine their globally-connected role in the climate system, and establish research infrastructure for the future, (and) ... serve as a mechanism to attract and develop a new generation of scientists and engineers with the versatility to tackle complex global issues" (see <http://books.nap.edu/catalog/11013.html>).

The 1957-1958 IGY and IPY activities greatly increased our knowledge of the world around us and provided profound legacies that continue to benefit research and researchers today. These activities also resulted in the 1959 Antarctic Treaty, which "promotes international scientific cooperation including the exchange of research plans and personnel and requires that results of research be made freely available". The U.S. played a leading role in shaping and implementing the 1957-1958 IGY activities and plans to do so again in 2007-2009. IPY activities planned for this period are consistent with Agency missions and the NAS report of an implementation workshop (*Planning for the International Polar Year: Report of the Implementation Workshop*, <http://books.nap.edu/catalog/11110.html>). U.S. activities during IPY 2007-2009 will focus on research, education and public outreach efforts, and will be coordinated among the Federal agencies and international partners that support research in polar regions.

NSF is creating a website as part of its work to coordinate IPY activities among the agencies: <http://www.us-ipy.gov/>. This site includes updates on the various agencies' programs, as well as information on IPY for a general audience and for scientists interested in obtaining IPY funding from the U.S. government. The following is an updated (as of September 18, 2006) discussion of Federal agency planning for the International Polar Year.

NATIONAL SCIENCE FOUNDATION

The upcoming International Polar Year is a unique opportunity to continue the legacy of international science years of the past, including IPY 1882-1883, IPY 1932-1933, and the International Geophysical Year of 1957-1958. Each of these bursts of internationally coordinated research and exploration opened the polar regions for exploration and science, led to significant discoveries about our planet, and left a long-term legacy of data and observations for future generations. In particular, the IGY of 1957-58 brought a tremendous increase in our ability to predict weather worldwide, to measure the thickness of the antarctic ice sheets, and to

understand the dynamics of the Earth's magnetosphere. However, there are still significant gaps in our understanding of the polar regions and the processes that structure polar environments. For example, the relationships between processes that drive long-term and short-term climate change in the Arctic are not well understood, nor do we have empirical observations sufficient to sort them out. In the Antarctic and in Greenland, the ice sheets that contain 70% of the fresh water on earth are moving and thinning. In both polar regions, many organisms are adapted to withstand prolonged periods of darkness and extreme cold, yet we do not understand how these adaptations evolved or how these organisms may respond to increased variability in the polar environment.

The National Science Foundation has initiated support for the International Polar Year in a variety of ways, emphasizing three major research areas and also education and outreach in an Announcement of Opportunity that was released in January 2006. These areas of emphasis will help implement the goals developed by ICSU and the U.S. National Academies. They have evolved within the research community as high-priority topics derived from workshops and existing science programs. Education and outreach are also areas where NSF, with its partners in other agencies, can make a significant impact on the understanding of how polar regions influence society and the global environment. Thus, NSF has a particular interest in conducting activities in the polar regions that will leave a lasting legacy of data, observing capabilities, and educational resources for scientists and educators of the future.

Within NSF, the Office of Polar Programs will take the leadership role in implementing these activities. Partnerships for IPY will occur at many levels – within NSF, through interagency collaborations, and in the international arena. All the NSF directorates and the Office of International Science and Engineering have expressed interest in collaborating with OPP on IPY activities. Federal Agencies such as NOAA, NASA, NIH, USGS, DOE, EPA and the Smithsonian Institution, as well as the national science agencies of other countries, have closely related interests. Thus, maximizing the value from partnerships is a key overarching theme for NSF as we plan for IPY.

NSF and IPY in FY06

The Office of Polar Programs (OPP) and the Directorate for Education and Human Resources (EHR) committed over \$12 million in FY06 to initiate activities in four major areas:

Establishment of a multi-national circum-Arctic observing system, with emphasis on the Study of Environmental Arctic Change (SEARCH) Program

SEARCH is a broad interdisciplinary, multi-scale interagency program with the core goal of achieving a predictive understanding of recent and ongoing changes in the arctic environment. In addition to understanding how changes in the Arctic are interrelated, SEARCH will investigate the links between arctic change and global processes and will assess the impacts that arctic change may have throughout the Northern Hemisphere. SEARCH will evaluate the possibility that observed changes in the Arctic can be used to anticipate changes elsewhere on the globe.

For the period of the IPY, NSF's principal interest related to SEARCH is the implementation of an Arctic Observing Network (AON). The purpose of AON will be to understand environmental change in the Arctic System and its interplay with global oceanic and atmospheric circulation. AON will employ an arctic-wide coverage of standard integrated measurements, long-term observations, and modeling and analysis.

Research related to the Bering Ecosystem Study (BEST) is underway under the IPY umbrella. The Bering Sea supports one of the most productive fisheries in the world, contributing about

40% of all finfish and shellfish landings in the United States, yet it is one of the least-studied areas of U.S. waters. In recent years, it has become evident that this seasonally ice-covered sea is subject to decadal changes in climate that have resulted in abrupt and unexpected changes in the ecosystem. Of particular concern is the possibility that the combined effects of climate change and fisheries removals may shift marine ecosystems into alternate stable states that may have a lower yield of species valuable to people. Identifying the mechanisms driving ecosystem change, including social and cultural factors, in the Bering Sea is a key research need.

Ice Sheet Stability, Dynamics and History

The global ice sheets are dynamic features that contain unprecedented records of climate over the past several hundred thousand years. Future changes in the ice sheets of both polar regions will affect sea level, and this is one of the major uncertainties in Intergovernmental Panel on Climate Change (IPCC) climate models. In Antarctica, we expect to emphasize studies of the stability and history of the major ice sheets. How do they work, how fast are they changing, and what will they be like in the future decadal to century time frame? Inquiry into these questions involves direct studies of ice sheet dynamics but also includes work to understand processes important for interaction of ice sheets with the lithosphere, oceans, and atmosphere. The combination of space-based and surface-based studies is critical to success in this area.

A detailed study of changes in the behavior of the Antarctic and Greenland ice sheets is also a topic of IPY research. One component of this comparative work includes obtaining a high-temporal resolution ice core in West Antarctica for comparison with the climate records obtained from the Greenland ice cores. There will likely be an opportunity to leverage logistics support to the ice core camp with support for other ground-based activity in West Antarctica and to couple detailed ground- and space-based observations. The work in West Antarctica might include traverse-based studies, or other types of work that will be possible from our logistical hubs, that could be linked to related work in East Antarctica as well as study of change in the Ross Sea region.

Because of the long lead time required for developing and implementing ice coring programs, NSF is also looking at the IPY as an avenue to create an international collaborative framework to facilitate international ice coring projects beyond the IPY. The Center for Remote Sensing of Ice Sheets (CReSIS), a Science and Technology Center led by the University of Kansas and supported jointly by NSF and NASA, will conduct and foster multi-disciplinary research that will result in technology and models necessary to achieve a better understanding of the mass balance of the polar ice sheets (e.g., Greenland and Antarctica) and their contributions to sea level rise. The focus areas for CReSIS relate closely to the goals of IPY.

The Antarctic drilling program (ANDRILL) is a multinational ocean drilling program currently underway that is focused on extracting sediment cores from the Antarctic continental shelf. This activity will also contribute to the broader IPY goal of understanding ice sheet dynamics

Frontiers In Polar Biology: Life in Extreme Cold and Prolonged Darkness

Ecologically important biogeochemical processes begin before the traditional operational season in polar regions and continue beyond the end of the traditional field season. Living organisms are known to continue functioning at temperatures well below freezing and during periods of prolonged darkness. New technologies (genomics, proteomics, etc.) offer the opportunity to gain a deep understanding of how organisms have adapted to these extreme environments. The Long Term Ecological Research (LTER) sites at Toolik Field Station in Alaska, at Palmer Station on the Antarctic Peninsula, and in the McMurdo Dry Valleys, as well as research platforms operating in the Arctic and Southern Oceans, offer the opportunity to bring these new technologies to bear in research on the polar regions. A recent NAS report, *Frontiers in Polar Biology in the Genomics Era* (<http://books.nap.edu/catalog/10623.html>) describes potential research benefits of these new tools. Within NSF, there is interest in OPP and in the Biological Sciences and Geosciences Directorates in this area of research. OPP has examined the technical feasibility of extending antarctic operations into the austral fall and early winter and may be able to implement this capability by 2007. Supporting winter work elsewhere in the polar regions will require evaluation of options on a case-by-case basis.

Education and Outreach

OPP has maintained strong support for linking research in the polar regions with formal education and outreach to the public. NSF has fostered U.S. scientists' interests in sharing their research with broad audiences. Many polar researchers have been successful in seeking support from education programs for more directed efforts, such as NSF's IGERT and GK-12 programs as well as Arctic Research and Education and Geosciences Education. Strong international partnerships in educational activities have developed in association with research programs in both polar regions. In the Arctic, such partnerships include U.S. collaboration with groups from Russia, Greenland, Iceland, Canada, Denmark, Norway, Sweden, and Finland. In the Antarctic, partnerships include U.S. collaborations with many nations that participate in the Scientific Committee on Antarctic Research (SCAR).

OPP sponsored a workshop in June 2004

(www.ideo.columbia.edu/~mkt/PolarED_Web.htm) to bring together educators, researchers, media and museum outreach experts, agency representatives, and others to discuss effective mechanisms to conduct education and outreach in support of the IPY. The workshop highlighted many of the education and outreach efforts that have already been supported by OPP, including Teachers Experiencing Antarctica and the Arctic (TEA), which was co-funded with NSF's Elementary, Secondary and Informal Education Division, Teachers and Researchers Exploring and Collaborating (TREC), Antarctic Artists and Writers Program, various journalists in the field, museum exhibits, and Research Experiences for Undergraduates (REU).

There is significant interest within NSF's Education and Human Resources (EHR) directorate in utilizing the inherently interesting features of the polar regions, including their remoteness and extreme conditions, to direct attention to scientific research and the importance of the polar regions to the global system. Other agencies such as NASA and NOAA have robust polar research and education programs interested in supporting IPY efforts. NSF is developing the foundation for international and interagency partnerships to bring together support and expertise from the community of researchers and educators. Another area where NSF can have a

significant IPY impact is in research on distant education, both in terms of technology and in terms of the science of learning as it applies to different cultures. The aim of these efforts is to develop highly visible, long-lived education and outreach products for IPY research and to provide opportunities for educating the next generation of polar researchers, the public, and policy makers.

As this document goes to print, OPP and EHR are set to make the education awards resulting from the FY06 IPY solicitation. The science awards from the FY06 solicitation are on track to be announced before the end of October.

NSF and IPY in FY07

The Directorates of Biological Sciences, Geosciences, Social, Behavioral and Economic Sciences, and the Office of International Science and Engineering have joined OPP and EHR in expanding the four foci established for FY06. The Agency has requested \$61.57 million in its Budget Request for this purpose.

NSF is preparing a second solicitation that will support IPY science and education proposals in FY07. This solicitation will build on the momentum of the FY06 solicitation and broaden the science themes. For example, research on life in the cold and dark will expand to address human and biotic systems, providing opportunities for scientists to address fundamental questions about social, behavioural, and/or natural systems that will increase our understanding of how humans and other organisms function in the extreme environments of the polar regions. Studies on environmental change will specifically take advantage of the Arctic Observing Network developed during FY06 to support research that advances the understanding of the physical, geological, chemical, human, and biological drivers of environmental change at the poles, their relationship to the climate system, their impact on ecosystems, and their linkages to global processes.

In addition to large-scale projects such as those mentioned above, NSF plans to support IPY activities that address the ICSU and NAS guidelines in a broad spectrum of areas, particularly research that addresses opportunities in the social sciences, systematic and biotic diversity surveys (e.g., the ongoing Census of Marine Life), implementation of observing systems, and research in the Southern Ocean on the transport and fate of nutrients and carbon.

One example of research in the social sciences is the study of endangered languages in arctic cultures, where we have the opportunity to create a legacy of knowledge that will inform future generations of scholars while at the same time strengthening local cultures. The Documenting Endangered Languages (DEL) program is a multi-year funding partnership between NSF and the National Endowment for the Humanities (NEH) to support projects to develop and advance knowledge concerning endangered human languages. This program is made urgent by the imminent death of an estimated half of the 6000-7000 currently used human languages. Working with the SBE Linguistics Program, the OPP Arctic Social Sciences Program has identified DEL as a natural IPY project. The unfortunate situation of the estimated 52 arctic indigenous languages is no exception to the international prognosis. Following the first DEL Announcement of Opportunity, over 10% of the proposals were to research arctic languages and the DEL Management Group anticipates over 10% of the recommended proposals to be for research in the arctic region. NSF and NEH have agreed to funding for DEL for three years with an evaluation and possibility for renewal in 2008. Thus, IPY provides an opportunity to bring publicity and resources to the pressing issue of endangered languages in the Arctic.

With regard to the implementation of observing systems, the National Ocean Partnership Program, through the Ocean-US office, is pursuing the establishment of an Integrated Ocean Observatory System (IOOS). The IOOS is planned to include three “Regional Associations” in Alaska, including the Chukchi Sea and North Slope, Bering Sea, and NE Pacific. NSF is working with the National Oceanic and Atmospheric Administration and local groups to identify and to support these regional associations. NSF is working with the research community in Barrow, Alaska, to develop a plan for a major observatory to be located in that community, with an emphasis on research that contributes to SEARCH and other high-priority arctic programs. Within NSF, participants in these activities include OPP, CISE, and ENG. To enable the IOOS and to provide for a new generation of polar research, NSF is committed to supporting work in developing and deploying novel instrumentation. New work is especially needed in chemical and biological sensors (for example, nutrients and plankton). In addition, a new set of platforms that must be developed for making and transmitting observations from under the ice pack, including both gliders and autonomous underwater vehicles. Finally, NSF’s experience in deploying the first shore-based polar observatory off Palmer Station in January 2006 will be invaluable in planning other polar coastal observatories.

Strong emphasis is again placed on education and outreach, which will support stand-alone education proposals that specifically invigorate science, technology, engineering, and mathematics (STEM) education in the context of the IPY: formal science education projects at the K-12, undergraduate, or graduate level; informal science education projects for the broader public; and coordination and communication for IPY education projects. IPY provides a timely opportunity to advance the goals of the American Competitiveness Initiative (ACI).

Logistics Support

Arctic and Antarctic Research Support and Logistics are supported through contracts and other agreements. These arrangements provide flexible mechanisms that are capable of supporting a wide range of potential science and educational activities. NSF also works with the U.S. Coast Guard, NOAA, University-National Oceanographic Laboratory System (UNOLS), the Canadian Coast Guard and others to provide shipboard facilities for marine research in both polar regions. Other support is available in the Arctic through a cooperative agreement with the Barrow Arctic Science Consortium (BASC) in Barrow, Alaska, to provide research support and logistics for researchers working on the North Slope of Alaska and a cooperative agreement with the Institute of Arctic Biology at the University of Alaska Fairbanks to support operation of the Toolik Field Station, an NSF LTER site. Cooperation with other national polar research programs offers an avenue for supporting international projects.

One aspect of logistics support that is being explored is the feasibility of supporting year-round research or extending the research season at additional locations in the polar regions (currently only South Pole, McMurdo, and Palmer stations in the Antarctic and Summit, Greenland are staffed for year-round research activities). Year-round research and research in remote areas is complicated and expensive to execute, yet is necessary to provide adequate spatial and temporal coverage to address research questions. Evolving technology has made it possible to collect many measurements remotely through instrumentation or through the use of remotely operated vehicles. There are many improvements to be made to the technology to ensure consistency of data collection under extreme conditions and make use of renewable energy sources. Sensors could be integrated into a network that upload data via satellites in real-time. Upgrades and improvements of existing infrastructure include: improvements in the information

technology infrastructure at research hubs such as Barrow, Alaska; development of unmanned sensor networks in the Arctic and Antarctic; development of remote power for sensors, particularly using renewable resources; and improvements in field research facilities (e.g., laboratory space and equipment, living quarters, communications and safety).

Data Management

The legacy of data created during IGY was instrumental in enabling many of the scientific advances in the decades following the IGY. Likewise, comprehensive management of the volumes of data to be generated during the IPY will be critical to ensuring that it is useful and available to future researchers and educators.

Archival and distribution functions for data required for support of arctic and antarctic IPY research are distributed among all the U.S. national data centers. These data are held in global archives at the National Climatic Data Center (climatology and meteorology), at the National Oceanographic Data Center (oceanography), at the National Geophysical Data Center (seismology, geomagnetism, marine geology and geophysics, solar and ionospheric studies, ecosystems, topography, and paleoclimatology), and at the National Center for Atmospheric Research (upper atmosphere and ionospheric studies). Data sets for a vast array of cryosphere-specific variables in the Arctic (sea ice, snow cover, permafrost, etc.) are archived and distributed through the National Snow and Ice Data Center (NSIDC) and the World Data Center for Glaciology in Boulder, Colorado (<http://www.ngdc.noaa.gov/wdc/>). These also include satellite-derived measurements, in-situ observations, and ancillary information from the Antarctic and the Arctic that have been supported by NASA, NOAA, and NSF. NOAA/NESDIS/NCDC in Asheville, NC holds the global satellite data archives for polar-orbiting satellites.

For data management, a new focus on "Virtual Observatories" is being developed and promoted by the "Electronic Geophysical initiative Year" (<http://www.eGY.org>). As more researchers provide their data on individual or institutional Web or FTP sites, rather than submitting to data centers, the current "push data" approach (where the data must be submitted to the National and World Data Centers System) is now becoming more difficult to implement. Therefore, the worldwide data management community is focusing on providing more effective access to globally distributed data sets via the "pull data" concept. The eGY group and the ICSU World Data Centers Panel are working toward a convergence of data centers into "data clearinghouses," while the Virtual Observatories are developing a network of interconnected data holdings and retrieving/visualizing software that constitutes the worldwide "data fabric." NSF is supporting, under the broader umbrella of CyberInfrastructure, the concept of Virtual Observatories as a means of managing relevant data for IPY.

DEPARTMENT OF ENERGY (DOE)

DOE is planning to support the International Polar Year in a variety of important ways through the following programs:

- Atmospheric Radiation Measurement Program
- Climate Change Prediction Program

ATMOSPHERIC RADIATION MEASUREMENT PROGRAM (ARM)

The ARM Program will continue its year round operation at the North Slope of Alaska (NSA) site. This site is providing data about cloud and radiative processes at high latitudes. These data

are being used to refine models and parameterizations as they relate to the Arctic. The NSA site is centered at Barrow and extends to the south to the vicinity of Atkasuk, and to the east to Oliktok Point. DOE will also support IPY-related proposals to conduct experiments using either the NSA site and/or the ARM Mobile Facility.

CLIMATE CHANGE PREDICTION PROGRAM (CCPP)

The CCPP will continue research to develop coupled climate models. The CCPP is developing ocean and sea ice models that are components of the Community Climate System Model (CCSM). In addition to coupled climate simulations, researchers apply the ocean and sea ice models to a variety of ocean and sea ice problems, including eddy-resolving ocean simulations, studies of the thermohaline circulation, and polar ice feedbacks. CCPP also supports analyses of the causes and consequences of biases in the mean climate and circulation of the Arctic.

ACTIVITIES OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) THAT SUPPORT THE OBJECTIVES OF THE INTERNATIONAL POLAR YEAR (IPY) MARCH 2007-MARCH 2009

NOAA began planning for IPY activities in the fall of 2004. Initial ideas were packaged into 11 broader themes and submitted to the IPY International Program Office in January 2005 as “expressions of intent.” Over the next few months, the IPY International Program Office encouraged scientists to prepare more collaborative proposals, resulting in around 200 “integrated projects” that now define the international effort for the IPY. All of NOAA’s original submissions are included in these integrated projects. This document summarizes the initial plans and provides an update to expected IPY activities during FY 2007 to FY 2009.

EXPLORATION

1. Ocean Exploration in Polar Regions

NOAA’s Office of Ocean Exploration (OE) may support multiple projects in both the Arctic and Antarctic in conjunction with the International Polar Year (IPY). OE solicited specific projects for IPY via Federal Register announcements in calendar years 2005 and 2006. OE also expects to solicit IPY-related projects during the calendar year 2007 Federal Register notice. Ocean Exploration together with the NOAA Arctic Research Program and the Russian Academy of Sciences plan to facilitate an expedition to the Pacific Arctic in 2008, as part of the ongoing RUSALCA (Russian American Long-term Census of the Arctic) program.

OBSERVATIONS

2. Causes and Impacts of Recent Changes in the Pacific Arctic

Unprecedented minima of sea ice area have occurred in the Pacific Arctic during the four most recent summers. Summer 2003 and 2004 brought record forest fires and drought to eastern Siberia and Alaska after a decade of warm springtime temperature anomalies. In surrounding seas there has been a northward shift of ice-dependent marine animals, with pelagic species such as pollock favored over bottom-feeding flatfish. Many Pacific Arctic changes are continuing, despite the observation that climate indices such as the Arctic Oscillation were negative or neutral for six of the last nine years. The Pacific Arctic may be having a larger role in shaping the persistence of Arctic change than has been previously recognized. We will work with our partners to carry out observations in this area to measure movement of water through the Bering Strait, gather observations about physical change in

the state of the ocean in the Bering and Chukchi Seas, and study impacts of physical change on marine ecosystems in this region. Bering Strait mooring programs will be conducted, as well as mooring and ship-board studies in the eastern Bering Sea. Limited ship-board studies will be made in ice-free areas in the vicinity of Bering Strait and Chukchi Sea in association with mooring cruises.

3. Polar Atmospheric Observatories and Field Campaigns

As part of the IPY project "International Arctic System for Observing the Atmosphere", a system of strategically located, long-term Atmospheric Observatories will be developed around the Arctic to carry out both routine measurements made at meteorological stations and intensive measurements at the surface and through the depth of the atmosphere. Measured quantities can include solar radiation, aerosols, air chemistry, trace gases, cloud properties, water vapour, ozone, temperatures, winds, precipitation, surface albedo and stratospheric properties. These measurements are essential to calibrate and validate satellite sensors and to improve the reliability of climate models. The Atmospheric Observatory partnership includes the United States, Canada, Russia, Norway, Finland, and China. NOAA's existing baseline observatories at Barrow Alaska and South Pole will continue to focus on measurements of trace gases and aerosols. The flask-sampling program has 15 polar stations that collect atmospheric samples for trace gas measurement. The Climate Research Program supports investigations of atmospheric processes that affect climate in polar regions. In the Arctic, a new observatory at Eureka Canada will operate during the IPY and the observatory at Barrow Alaska will continue. The observatory at Tiksi Russia will be partially operational. These three observatories will focus on measurements of clouds, radiation, and trace gases. Both Barrow and South Pole will offer logistic support to scientists for IPY projects if they can provide their own science support. The flask-sampling program will continue and research efforts will be supported on ozone, haze and aerosol/cloud/climate interactions in the Arctic.

NOAA/NCDC plans to install a Climate Reference Network (CRN) site configuration at the Russian Arctic observing site in Tiksi (dependent on final FY07 budget). Preliminary planning has already begun in concert with the IPY's International Arctic Systems for Observing the Atmosphere (IASOA), and installation is tentatively planned for the summer building season in the August/September 2007 timeframe. This installation is not only in support of the IPY, but is also in line with a longer term effort on the part of the US GCOS Program Office to install reference surface observing sites in unique high elevation and high latitude location environments.

4. Polar stratospheric Ozone Depletion Observations

As a part of the International Geophysical Year in 1957, column ozone measurements were initiated at South Pole, Antarctica using Dobson spectrometers. In 1985, the annual stratospheric ozone depletion over Antarctica - the "Antarctic Ozone Hole"- was identified. In less than 5 years it was proven that the ozone hole was caused by human emitted fluorochlorocarbons (CFCs) and the ozone hole has become a globally recognized "poster child" for showing how humans can cause global scale changes. The Arctic stratospheric ozone changes, though lesser in magnitude than the Antarctic ozone hole, are by no means of lesser importance. Key studies will be undertaken in the Arctic to monitor these changes. Routine observations of ozone will continue at Barrow and South Pole during the IPY.

5. Antarctic Living Marine Resource (AMLR) Survey

The principal objective of the NOAA AMLR research program is to collect the scientific information needed to detect, monitor, and predict the effects of harvesting and associated activities on target, dependent, and related species and populations of the Antarctic marine living resources and the ecosystem(s) of which they are a part. A 35-day ship-based research program is planned for FY07.

PREDICTION AND MODELING

6. Short-term Arctic Predictability (STAP)

This scientific study will explore the variability, and associated predictability of weather, sea ice, ocean wave, and land surface processes in the Arctic region in the 3-90 days time range, with special emphasis on improving forecast guidance for high impact events in the 3-14 day lead time range. NOAA will complete a study of northwest Alaskan coastal waves during the IPY. NOAA will also participate in sea ice studies at both poles aimed at improving measurement of ice thickness and forecasting. The NOAA THORPEX program is expected to make observations and introduce forecast products to improve weather and intraseasonal forecasts for the Arctic.

7. Advances in Satellite Products and Their Use in Numerical Weather Prediction

Spatially comprehensive observations of the atmosphere in the data-sparse polar regions significantly and positively impact high latitude numerical weather predictions. In addition, errors in model forecasts for the high latitudes often propagate to the mid-latitudes, implying that improvements to high latitude forecasts will result in better mid-latitude forecasts. These findings provide the motivation to improve our ability to measure the state of the polar regions with satellites and to expand the use of these data in Numerical Weather Prediction systems. NOAA will participate in IPY projects to improve the application of satellite sensors to environmental problems in the polar regions.

8. Arctic Climate Modeling

The general goal of this project is to improve predictions of the Arctic environment on timescales ranging from seasonal to climate change. Thus, our research will focus on analyzing and modeling the physical processes and connections between the Arctic and the rest of the globe. NOAA's Geophysical Fluid Dynamics Laboratory will continue to improve global climate models that including polar processes.

9. Arctic System Reanalysis (ASR)

A concerted effort during the IPY (2007-2008) to construct pan-Arctic atmosphere-ocean-ice-land data sets, and to assimilate and enhance these with a high-resolution (coupled) reanalysis system optimized for the Arctic region, will provide researchers with an unprecedented description of the Arctic environment over the past several decades. The operational analysis system (post 2008) expected to be a legacy of this activity would provide constantly updated depictions of the Arctic environment, and foster improved short- and medium-range weather forecasts as well as seasonal climate outlooks. Improved understanding of Arctic climate processes resulting from development of the ASR will lead to better global climate models, in turn reducing uncertainty in projected future climate states of the Arctic. The ASR will also serve as a vehicle for diagnostic evaluation of ongoing changes in the Arctic system.

DATA, OUTREACH AND DECISION SUPPORT

10. NOAA's Data, Information, and Change Detection Strategy for the IPY

NOAA's fundamental data management responsibilities will be to securely archive IPY datasets and ensure that these and relevant polar data are easily accessible for current and

future users. NOAA will utilize the existing World Data Center (WDC) System and NOAA's National Geophysical Data Centers in order to serve as a clearinghouse and facilitator for data-management issues and will work with IPY participants to ensure that International Council of Scientific Unions/World Meteorological Organization (ICSU/WMO) IPY Data Committee guidelines are followed. NOAA will also ensure that international standards such as the Open Archival Information System Reference Model and the ISO19115 metadata standards are met.

NOAA intends to build and maintain a pan-Arctic view of climate variability and change that will serve decision makers with information products. These range from baseline atlases against which future assessments can be carried out, to the Near Realtime Arctic Change Indicator Website, where information on the present state of Arctic ecosystems and climate is given in historical context. NOAA data centers will assist NOAA scientists to archive their IPY data. NOAA will continue to acquire historical data and present it on the Arctic Change Indicator Website to describe the state of the Arctic climate over the past 150 years, allowing a better context for new data collected during the IPY.

11. Decision support for increasing adaptive capacity to climate change and variability in Alaska and the Arctic.

The cornerstone of the National Oceanic & Atmospheric Administration's (NOAA) Regional Climate Decision Support program for Alaska and the Arctic is to establish an integrated program spanning stakeholder-influenced research and development of decision-support tools for the sustained delivery of customer services. This includes establishing in Alaska a Regional Integrated Sciences & Assessments (RISA) and a Regional Climate Center (RCC) with formal liaisons to NOAA's National Weather Service and the State Climatologist Office to foster growth of climate services.

NOAA is part of the U.S. presence in the Arctic Council (AC). The AC plans to conduct several assessments during the IPY period, including the Arctic Marine Shipping Assessment, an assessment of the Arctic carbon cycle, and others. NOAA will provide expertise and financial support within available resources. NOAA plans to initiate the Alaska RISA soon through the Univ. of Alaska, and as a five-year effort, it will operate during the IPY, but not at the full-performance level. Through the Regional Climate Centers program, an "Alaska desk" may be established in association with the Alaska RISA. NOAA expects to contribute staff time and limited financial support to the Arctic Council climate-related assessment tasks during the IPY.

The National Ice Center (NIC) is a U.S. Government agency that brings together elements from the Department of Commerce - NOAA, the Department of Defense - NAVY, and the Department of Homeland Security - US Coast Guard (USCG) to support coastal and marine sea ice operations and research globally. The mission of the NIC is to provide the highest quality strategic and tactical ice services tailored to meet operational requirements of U.S. national interests. Over the Arctic, particularly, the NIC provides operational strategic basin-scale sea ice charting with the production of a hemispheric and over 30 individual regional charts, sea ice tactical ice navigation support, Chukchi Sea and Beaufort Sea ice seasonal forecasts, support for the development of a sea ice climatology for the Arctic, and management of the U.S. Interagency Arctic Buoy Program (USIABP). NIC is participating directly or indirectly in an increased number of research and application cooperative projects with other national and international groups as part of International Polar Year (IPY) activities throughout 2007 and 2008.

NOAA's National Data Centers handle a wide variety of Arctic data. An affiliated data center, the National Snow and Ice Data Center (NSIDC), CIRES, University of Colorado, has a NOAA NESDIS supported program (nsidc.org/noaa/) to produce and manage selected data sets. Significant data sets are the Online Glacier Photograph Collection of over 3000 photographs dating to the late 1800s; upward looking sonar data from submarines, providing estimates of sea ice thickness; and the Sea Ice Index, a site that shows, with graphical products, trends and anomalies in sea ice cover. Overall, the NOAA@NSIDC program emphasizes data rescue and in situ data. This emphasis helps collect and maintain the long time series with broad spatial coverage that is necessary to track and attribute arctic change. The program complements the activities of the Distributed Active Archive Center, a NASA funded center at NSIDC that supports the bulk of NSIDC's activities. In addition to data activities, NOAA supports approximately half of the operating cost of the World Data Center for Glaciology, Boulder, library. The archival activities of this library are becoming more visible as preparations for IPY gather momentum.

12. Formal and Informal Education

The Climate Program Office is leading a NOAA-wide effort with respect to the IPY. The Climate Literacy Working Group (CLWG), based at the Climate Program Office, is coordinating NOAA-wide IPY education and outreach activities with the NOAA Office of Education. The NOAA IPY effort is part of the NSF led interagency IPY education effort and will collaborate and coordinate their efforts with agencies participating in the forth IPY. Several formal and informal education initiatives are focusing primarily on teacher professional and science center or museum exhibitions, however several formal lesson plans will be developed as part of our IPY efforts. Several current example IPY efforts are listed below:

IPY/NSTA Symposia: These are exciting Symposia designed for grade 5–8 educators in celebration of the International Polar Year (IPY), will delve into science content and educational activities developed by NASA, NOAA, and NSF. These symposia will happen at the NSTA national conference in March 2007.
<http://institute.nsta.org/fall06/ipyice/symposium.asp>

IGLO is a project of the Association of Science-Technology Centers, an international organization of science centers and museums dedicated to furthering the public understanding of science. IGLO's goals are to raise public awareness about the impact of global warming and the state of climate science, position science centers globally as recognized leaders in public engagement with science and support the aims and objectives of the IPY. NOAA, NASA and NSF are sponsors of the initiative. <http://www.astc.org/iglo/>

Climate Change in the Arctic Ocean is a teacher professional development and mass media project aboard the NABOS 2006 Arctic Expedition aboard Icebreaker Kapitan Dranitsyn.
<http://www.naturalsciences.org/education/arctic/>

13. Public Outreach –

NOAA's Climate Program has expanded its Regional Integrated Sciences and Assessments (RISA) program to Alaska. The Alaska RISA is a 5-year program designed to address regionally important climate issues to aid policy- and decision-making. The Alaska RISA

program could contribute significant results to our understanding of key climate related challenges facing the state and would allow for innovative partnerships with neighboring countries.

DEPARTMENT OF STATE AND DEPARTMENT OF HEALTH AND HUMAN SERVICES (DHHS)

Arctic Human Health Initiative (AHHI)

The Arctic Human Health Initiative (AHHI) will advance the joint research agenda of the Arctic Council, an eight-nation intergovernmental forum for sustainable development and environmental protection, in the areas of infectious disease monitoring, prevention, and response; the effects of anthropogenic pollution, UV radiation, and climate variability on human health; and telehealth innovations. Specifically, the leaders of these research programs will build on their years of circumpolar collaboration to extend the International Circumpolar Surveillance network of hospitals and public health facilities into Russia and include additional infectious diseases of concern, to continue monitoring contaminants in human blood and tissues to reveal temporal and spatial trends and to combine experiences from the rapidly expanding disciplines of biomarker research and molecular epidemiology with these monitoring programs, and to extend circumpolar cooperation on telehealth, particularly to Arctic regions in the Russian Federation. In addition, the AHHI will draw on the outstanding leadership of the Arctic Council member states' national and international research programs in the areas of human genomics, hypothermia/hibernation, and health impacts of climate change (including spread of zoonotic and arboviral diseases in the Arctic).

Fogarty International Center (FIC) has been the designated focal point for Arctic issues at the National Institutes of Health (NIH). One of FIC's key roles is advancing bilateral and multilateral ties between and among governments, institutions, and scientists working on circumpolar issues. In this, FIC has been collaborating with other NIH Institutes and DHHS agencies in the development of symposiums and research programs, as well as actively exploring other opportunities for trans-NIH and interagency collaboration (e.g., with NSF, NASA, etc.), such as mental health. As an example, two major conferences on inhalant abuse and suicide were spearheaded by FIC with partnership from National Institute of Drug Abuse (NIDA) and National Institute on Mental Health (NIMH) in 2004 and 2005. With mental health being one of the most significant concerns for the AHHI, FIC has been working with the Polar Research Board at the National Academies of Science in the development of a study focused on mental health in the Arctic. In addition to these activities, in FY05, NIH spent 22 million on research programs in the Arctic. Some of the major areas of research included interactions of genetics and environment, cancer, cardiovascular and mental health disease burdens. Overall, across DHHS, multiple agencies have been engaged in working on the improvement of health and health care in the Arctic. For example, SAMHSA spent 21.2 million in FY05, as it continues to provide services directed at the prevention and treatment of mental health and substance abuse problems in the Arctic. The U.S. Centers for Disease Control and Prevention (CDC), one of the leading agencies at DHHS has been developing partnerships and collaborations in the Arctic focused on improvement of public health and healthcare provision. In addition, CDC has been the leader of the AHHI steering group, which has been working with the International Union for Circumpolar Health (IUCH), FIC and other stakeholders in the development of outreach and public education programs focused on the promotion of good health for Arctic residents and better integration of the findings of Arctic health research.

U.S. Geological Survey (USGS)

The U.S. Geological Survey serves the United States by providing reliable scientific information to

- Describe and understand the Earth
- Minimize loss of life and property from natural disasters
- Manage water, biological, energy, and mineral resources; and
- Enhance and protect our quality of life.

The USGS will participate in the IPY through extension and enhancement of programmatic activities in research, assessment, and monitoring in the polar regions that support the scientific mission of the organization and address the themes and goals of the IPY. These activities span the biologic, geologic, hydrologic, geographic, and information sciences. While planning is still ongoing, we anticipate our major IPY activities will include:

Products to be released by the USGS during IPY:

- Satellite Image Atlas of Glaciers of Asia, Alaska, and Iceland (<http://www.glaciers.er.usgs.gov/html/chapters.html>)
- State of the Earth's Cryosphere at the Beginning of the 21st Century: Glaciers, Snow Cover, Floating Ice, and Permafrost
- Petroleum Resource Assessment of the Arctic

USGS World Petroleum Assessment of 2000 estimated that approximately 25% of the remaining oil and gas resources of the world reside in the Arctic. This follow-on study will examine Arctic basins in more detail and report on oil and gas resource potential of unexplored basins, and the initial results should be completed during the IPY.

- Landsat 7 Image Map of Antarctica (LIMA)

The LIMA will create three high-quality remotely-sensed mosaics of Antarctica from more than 1200+ Landsat scenes in cooperation with the British Antarctic Survey, funded by the National Science Foundation.

Analysis of long term monitoring from the polar regions:

The USGS has been monitoring permafrost temperature in the Arctic, three Benchmark Glaciers for climate change, glacier geometry, glacier mass balance, glacier motion, and stream runoff, and marine mammals for many decades. The results of those monitoring efforts will be examined, analyzed and reported on during the IPY.

- Permafrost Temperature Monitoring
- Benchmark Glaciers
- Marine Mammals: polar bears and walruses
- Sea Ice

Initiation of new study: Yukon River Basin – Rates and Effects of Permafrost Thawing in the Arctic

The USGS is working with a consortium of US and Canadian Federal, State, and Provincial agencies, university scientists, and tribal organizations to initiate a major project to understand and predict climate-induced changes to the air, water, land, and biota within the Yukon River Basin (YRB). This collaborative scientific effort, using the YRB and adjacent coastal ocean as a representative landscape unit, will provide a benchmark for tracking and understanding changes occurring throughout the Arctic and Sub-arctic region.

USGS will be highlighting our Facilities and Resources for Arctic and Antarctic Research

- US National Ice Core Laboratory, USGS, Denver, CO

The U.S. National Ice Core Laboratory (NICL) stores, curates, and facilitates study of ice cores recovered from the polar regions of the world. It provides scientists with the capability to conduct examinations and measurements on ice cores, and it preserves the integrity of these ice cores in a long-term repository for current and future investigations. Ice cores contain an abundance of climate information --more so than any other natural recorder of climate such as tree rings or sediment layers. <http://nicl.usgs.gov/>

- US Antarctic Resource Center, USGS, Reston, VA

The U.S. Antarctic Resource Center (USARC) is the Nation's depository for Antarctic maps, charts, geodetic ground control, satellite images, aerial photographs, publications, slides, and video tapes. These resources are items produced by Antarctic Treaty nations in support of their activities in Antarctica and provided to the USARC in compliance with a standing resolution of the treaty providing for exchange of information. usarc.usgs.gov

- USGS Alaska Science Center, Anchorage, AK

A Center of Excellence for the Department of the Interior to address important natural resources issues and natural hazards assessments in Alaska and circumpolar regions through long-term data collection and monitoring, research and development, and assessments and applications. Their mission is to provide scientific leadership and accurate, objective, and timely data, information, and research findings about the earth and its flora and fauna to Federal and State resource managers and policy makers, local government, and the public to support sound decision making regarding natural resources, natural hazards, and ecosystems in Alaska and circumpolar regions. <http://alaska.usgs.gov/index.php>

- McMurdo Long Term Research (LTER) Program

The USGS provides cooperative support to the McMurdo Long Term Research program for water resources data collection and related activities. The support provided is in the form of field assistance, guidance, and review of surface-water data collection by INSTAAR and University of Colorado researchers in the McMurdo Dry Valleys (Taylor Valley and Wright Valley) of Antarctica. Cooperation is also provided in the form of guidance and support

for and access to USGS databases and streamflow-records processing applications.

- Antarctic Seismic Data Library System (SDLS)

The SDLS is an Antarctic-Treaty-mandated effort under the auspices of the Scientific Committee on Antarctic Research (SCAR) to collate and make openly available for research purposes all marine multichannel seismic reflection data (MCS) acquired in Antarctic regions (i.e., south of 60 degrees South). The SDLS was implemented in 1991 under USGS sponsorship, but since about 1996, the SDLS has been run jointly by USGS (with NSF-OPP and USGS funding) and Osservatorio Geofisico Sperimentale (OGS, Trieste, Italy). The seismic library has branches in 10 countries, with two branches in the U.S. MCS data are sent to the SDLS by data collectors, are put onto CD-ROM and distributed to SDLS branches where they can be viewed and used under the SDLS guidelines specified in SCAR Report #9 (and addendums). To date, 60 CD-Roms holding more than 120,000 km of stacked MCS data have been produced for SDLS branches.

- Web-enabling the US Antarctic Photography Collection from the USGS Earth Resources Observation Science (EROS) Center

For more the 30 years, it has been USGS's privilege to archive and serve the US Antarctic Program, the international Antarctic research community, and the public with access to the US Antarctic aerial photography collection held at the USGS Center for Earth Resources Observation and Science (EROS) center at <http://eros.usgs.gov/>. This collection consists of an estimated 400,000 frames of historical aerial photography dating back to the 1940s. This collection is the best collection of Antarctic aerial photography held by any country and that its value to the Antarctic research community will only increase with time as work and research continues in Antarctica.

However, neither online metadata, browse images, photographs nor film products are available via the Internet for the USAP Antarctic aerial photography collection. New technology and improved digitizing methods have made it possible to digitize the original aerial film rolls creating browse and medium resolution images of each frame. We propose to link the digitized USAP aerial photography browse and medium resolution image files to the USARC paper map-line plots and web-enable the digitized collection in such a way that users could download images over the Internet at no cost to the user. Implementation of the proposal will result in an integrated on-line query, browsing and delivery capability for all historical USARC photography in the USGS EROS Center.

- Antarctic Geographic Placenames

The USGS operates the U.S. Board on Geographic Names in conjointly with other Federal agencies. In accordance with recommendations of the Advisory Committee on Antarctic Names (ACAN), United States Board on Geographic Names (USBGN) approves all new names to be used in government use in Antarctica by the United States.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA's contributions to IPY likely will involve ongoing activities (operating satellites, continuing ground networks, and scientific research), some episodic activities (satellite snapshots and field campaigns), new efforts related to the development and deployment of sub-orbital capabilities (aircraft and unmanned aerial vehicles), and coordination of remote sensing observations with in situ measurements supported both by NASA and other agencies – primarily the National Science Foundation.

Currently, NASA operates nearly 20 satellites that collect information about the polar regions. The Ice Cloud and Land Elevation Satellite (ICESat) was specifically designed to measure changes in the elevation of the Earth's great ice sheets and the ice sheet processes that are manifest in the surface topography in unprecedented detail. In addition, the mission has revealed new information about recent thickness characteristics of sea ice in the entire Arctic and Antarctic regions. Other recently-launched Cloudsat and Calipso missions are providing 3-dimensional information on the structure of the Earth's atmosphere, and as with all near-polar orbiting satellites, coverage will be maximum in the polar regions.

NASA has demonstrated success in the past in developing comprehensive polar observations through international collaborations with the Canadian Space Agency (CSA) to carry out the Antarctic Mapping Mission and the Arctic Snapshot of Arctic sea ice characteristics at very high spatial resolution. We expect to continue to develop these international efforts through a coordination of activities with our colleagues at space agencies in other countries.

NASA also has polar missions that reach beyond Earth, including the PHOENIX Mission that will land near Mars North Pole in 2008, the Lunar Recon Orbiter that will map lunar polar regions for the first time in 2008, and the Mars Recon Orbiter (MRO) that will explore Martian polar regions from orbit. Polar analogues in Mars exploration are vital; for instance, scientists have used Earth's polar regions to simulate Mars for over 30 years. For instance, the Dry Valleys of Antarctica are the best "Mars analogue" known on Earth, and activities in support of human exploration of space have been conducted in the Canadian Arctic. These polar environments continue to serve as important test-beds in support of activities related to NASA's Vision for Space Exploration.

NASA issued a solicitation for IPY research proposals in 2006. Specific research topics solicited were:

1. Integrated analysis of multiple satellite data sets, enhanced validation of NASA satellite data sets in polar regions needed for improving their interpretation by models, and/or the integrated analysis of satellite and related suborbital data addressing the scientific questions defined by NASA in its *Earth Science Enterprise Strategy* (at http://earth.nasa.gov/visions/ESE_Strategy2003.pdf) that can be addressed in the context of IPY;
2. Individual US investigator participation in field activities carried out as part of IPY, especially US participation in multinational field campaigns to take place in the primary IPY timeframe from March 2007–March 2009.
3. Integrated regional modeling of the polar regions (including the terrestrial, oceanic, atmospheric, biospheric, and cryospheric components of these regions and their interactions) that takes advantage of synergies between the enhanced international

observational capabilities that will be available during the IPY time frame and NASA satellites;

4. Definition studies for potential US-led, focused IPY activities that integrate field work (typically using NASA-provided suborbital platforms), satellite data analysis, and modeling to address IPY-related science questions and provide enhanced validation for NASA satellite data products in the unique geophysical and/or biogeochemical conditions found in the polar areas. At this point in time, proposals for conduct of and/or participation in significant multi-investigator, US led field-based activities beyond these definition studies are not solicited; and
5. Development of remote-sensing instruments suitable for implementation on uninhabited aerial vehicles (UAVs) such as are likely to be available for use during the IPY time frame (March 2007-March 2009). Such instruments would make contributions to IPY contributing to our knowledge of the unique geophysical and/or biogeochemical conditions found in polar regions in one or more areas, including: (a) providing early demonstration of instrumental approaches that may be suitable for use on future satellites, (b) providing enhanced calibration/validation information for NASA satellites (and/or those of our international partners), (c) providing more comprehensive information about polar regions that complements that available from satellite sensors to be operating in the IPY time frame, or (d) any combination of the above. Given the limited time and funding available, it is expected that such development would be based on currently available airborne instrumentation with significant heritage aboard onboard-piloted platforms, but for which modification to meet the requirements of potential UAVs would be required. Proposers should identify potential UAV platforms as part of their proposals, but need not make arrangements for their use. If proposals in this area are selected, NASA would provide and pay for any flight opportunities involving the use of the newly developed instrument during the IPY time frame.

The evaluation of proposals submitted in response to this solicitation is still underway, but proposals selected from responses to our IPY solicitation will form the basis of a significant portion of our IPY research portfolio. In the context of The Vision for Space Exploration, other areas of investment may include:

- Utilizing polar regions as a stepping stone to exploring other planetary environments
- Understanding poles of other planets and similarities and differences to those on Earth.

NASA continues to study the Earth as a system through the unique sampling capability afforded by remote sensing. During the IPY and beyond, we will continue to develop this capability to understand polar processes, the role of the polar regions in the Earth's environment, and the nature of poles on other planets in our solar system.

U.S. DEPARTMENT OF AGRICULTURE (USDA)

The U.S. Department of Agriculture plans to continue its mission related activities in the Alaska region through its various mission areas, in particular through the Research, Extension and Economics Mission Area and the Natural Resources and Environment Mission Area.

The Agricultural Research Service (ARS) will continue its work towards preserving Alaskan plant diversity through its preservation and archiving of high latitude plant germplasm through traditional seed collocation and modern molecular methods. The U.S. Forest Service through the Pacific Northwest Research Station is responsible for the management of the Alaskan boreal forest and will continue its commitment in support of the Bonanza Creek LTER, which

takes place at the Bonanza Creek Experimental Forest. The Natural Resources Conservation Service (NRCS) will continue to provide assistance to state, Native Alaskan, and private landowners through the USDA Farm Bill. The Forest Service and NRCS will continue their joint activities in permafrost and wetland soil research. The Cooperative State Research, Education and Extension Service (CSREES) will continue its research support for the Agricultural Experimental Research Stations and educational support for the University of Alaska, the Alaska land-grant institution. Legislated funding for research, education and extension activities through the Hatch Act, Evans-Allen Act and the McIntire-Stennis Act will continue to be administered by CSREES. Competitive funding for research through the National Research Initiative and for education such as the Alaska-Native and Native-Hawaiian Educational Grants Program will be offered by various CSREES programs. CSREES will also continue its extension activities through the Alaska Cooperative Extension Service. CSREES is currently contributing to the interagency Study of Environmental Arctic Change (SEARCH) by providing resources to a 2006-2007 joint solicitation with EPA and NASA for proposals on climate change, land use and invasive species. SEARCH is one of the primary activities of NSF for the IPY and the USDA will continue to work with the interagency working group of SEARCH to promote joint interests in Alaska.

SMITHSONIAN INSTITUTION (SI)

The Smithsonian is prepared to engage in a variety of research, education, and outreach programs in support of IPY-4. Some of the following plans – all of which have been developed with interagency collaboration – are already underway; others need further discussion and are offered here as ideas for consideration.

1. Of all U.S. Governmental agencies, the Smithsonian probably has the longest record of association with IPY activities, because of its critical role in the First U.S. IPY field expeditions of 1881-1884, in caring for its collections, and publishing its proceedings. Hence SI participation in IPY 2007-8 will include both historical and contemporary dimensions.
2. The SI contribution will be based upon the Institution's time-tested strengths: (1) the research of its scientific personnel; (2) special value of its museum collections as national treasures; and (3) its broad public outreach program, coupled with the unique position of Smithsonian museums on the National Mall and their special attraction to the general public and the nation.
3. On the scientific side, the SI is already playing the leading role in framing the U.S. socio-cultural and Native studies programs based upon staff expertise through the NMNH Arctic Studies Center and the value of its ethnological collections (see below). An ASC Arctic ethnologist is playing a key role for planning the IPY 2007-2008 socio-cultural agenda as a member of both the U.S. National IPY Committee and the main ICSU-WMO Joint Committee for the International Polar Year. The ASC will continue its leading role in the socio-cultural planning through its meetings, symposia, publications, exhibits, coordination activities, and other means.
4. Smithsonian scholars are also active in other fields of Arctic and Antarctic research, particularly in biology, paleontology, ocean, and astrophysics studies that will be included in the Institution's IPY program. SI is also curates the U.S. National Antarctic Meteorite collection.

5. The Smithsonian offers to organize and host a national IPY symposium at the beginning of the IPY 2007-2008 activities, with the participation of the leading SI scientists and representatives of other agencies and research institutions.
6. SI is eager to offer its Arctic and Antarctic collections (ethnological, botanical, zoological, mineral, films and archival materials, etc.) and to facilitate all types of IPY collection research as its contribution to the inter-agency IPY 2007-2008 program. Of particular value are the ethnological and biological collections from Barrow, Alaska and Ellesmere Island (Greeley Expedition) Arctic Canada from the First IPY 1881-1884 expeditions, as well as scientific instrument collections and records of the early IPY stations; and the instrument collections from the IGY at the Air and Space Museum.
7. SI offers its space and personnel resources to serve as the key IPY interagency hub for Education, Outreach, and Public Communication during 2007-2008 (and even earlier), through its museum programs, outreach, and exhibit ventures.
8. Proposed IPY Events for the National Mall:
 - a) The first event will be the opening of the new Smithsonian exhibit, *The Arctic: A Friend Acting Strangely* (June 2005), focused on the current impacts and science of arctic environmental change. This exhibit has been produced with financial support from NOAA and NSF will be a part of the NMNH "Global Links" Exhibition Program.
 - b) As noted above, we propose organizing a national IPY symposium at the beginning of the IPY period (2007).
 - c) As part of this symposium, SI will organize a small exhibit on the history of the early U.S. IPY efforts based upon its collections, instruments, and photographic and documentary records. We invite other agencies to join us in exhibiting objects or graphic materials related to their own contributions to the U.S. IPY efforts.
 - d) In collaboration with the University of Colorado (INSTAAR) we propose mounting a special exhibit called *Artifacts On Ice: The Emerging Archeology of Glaciers*, featuring the 8000 year old evidence of humans, artifacts, animals, and climate science being recovered from melting high-altitude glaciers in the Pacific Northwest.
 - e) The fifth—and the major—Smithsonian public contribution could be a much larger exhibit, such as *Science at the Poles: IPY 2007-2008*, to publicize its preliminary results and major accomplishments. This might take place in early or mid-2010, and as a major public venture, would have to be supported by substantial agency contributions.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA plans to support other agencies' IPY efforts through its Environmental Monitoring and Assessment Program (EMAP), and its involvement in the Global Earth Observation System of Systems (GEOSS). For 15 years, EMAP has developed cost-effective and policy relevant probabilistic sampling approaches for freshwater and marine resources. EPA has supported monitoring of coastal resources in South Central and Southeastern Alaska, as well as freshwater monitoring in Central Alaska. The state of Alaska has submitted an IPY "Expression

of Intent” for Arctic and Bering Sea Coastal Assessments. EPA will give non-budgetary support to this proposal. Other agencies also may wish to support this effort, and perhaps support a larger potential effort of developing a circumarctic or even circumpolar coastal monitoring program using EMAP approaches, to obtain baseline conditions. This larger effort could be done in the context of IPY 2007-2008.

EPA is involved in GEOSS as a data collector, integrator, and user. Also, EPA is co-chair of the GEO Secretariat’s User Requirements and Outreach Subgroup. EPA is interested in how the oceans observing network is expected to be included under GEOSS, and how all the other earth observations overlap with IPY. EPA looks forward to collaborating with other agencies in GEOSS activities related to the IPY.

International Polar Year Funds Research and Exploration by Teachers, Students and the Public

NSF awards nine grants for IPY education activities

September 20, 2006

People worldwide now have the once-in-a-lifetime opportunity to research and explore the Arctic and Antarctic regions through the International Polar Year (IPY), which begins in March 2007. More than 100 countries will undertake projects involving students, teachers and the public to increase understanding of the Earth's polar regions. The aim is to create an indelible impression on future scientists, engineers, and educators and a lasting legacy of science.

The National Science Foundation (NSF) announces nine projects funded to create a variety of educational programming, materials, multimedia, presentations and field experiences to engage the public during IPY--a concerted, worldwide scientific research effort to advance understanding about the effects of Earth's remote polar regions on global climate systems; to bring about fundamental advances in many areas of science; and to inspire men and women to pursue careers in science and engineering.

IPY 2007 is a history-making event that builds on three previous international science years, IPY 1882, IPY 1932, and the International Geophysical Year in 1957, which changed the face of modern geoscience. IPY 2007 will take place over two calendar years to allow researchers to conduct two annual observing cycles in each polar region.

The White House Office of Science and Technology Policy has identified NSF as the lead federal agency for coordinating U.S. IPY activities.

NSF Director Arden Bement noted that the new education grants, as part of larger portfolio of NSF science and education initiatives for IPY, will not only stimulate interest in the important federally funded polar research occurring during IPY, they will also help achieve an important IPY goal: leaving a scientific and education legacy for future generations.

"This effort has the potential to create a legacy for decades, one that will benefit the nation as well as the science and engineering community more specifically," Bement said. "By linking the public's fascination with things polar to outreach that conveys the excitement of research and discovery, we can attract a new generation of Americans into science and engineering careers while contributing to a better-informed public."

Through a cooperative effort of its Office of Polar Programs and its Education and Human Resources directorate, NSF funded nine projects, totaling \$5.7 million, to support informal education projects--those that primarily involve science museums, television broadcast, radio and other media--and formal education from kindergarten through graduate school.

Institutions from El Paso, Texas to Fairbanks, Alaska will use the grants for such diverse purposes as taking graduate and undergraduate students to Antarctica where they will learn about and conduct polar research, to build experiences that lead them to careers in science, engineering and mathematics, to projects featuring polar researchers in science centers across North America.

The grants also support radio, television, Internet and podcast features, museum exhibits, live broadcasts from research vessels and stations at the poles, and provide opportunities for classroom teachers to conduct field research in the Arctic and Antarctic and bring real science to their schools and communities.

During the two years of IPY, public audiences of all ages, through formal or informal education venues, will have the opportunity to join the excitement. Whereas the 1957 IPY took place before the world's first satellite was launched, IPY 2007-2009 takes place at a time when direct communication via satellite and other technological advances make it possible to include a worldwide audience in real time to witness discoveries and share in the research endeavor.

While the United States will participate prominently in IPY research and education, NSF encourages students, teachers, the media and others to join in IPY events and share the global enthusiasm during this extraordinary opportunity.

A list of the grantees and their projects follows.

Informal Science Education

IPY: Engaging Antarctica

Principal investigator: J. Michael Farrell, University of Nebraska-Lincoln The project's goal is to increase public awareness and understanding of Antarctic geological research and discovery by producing an episode of the public television series NOVA that will feature the Antarctic Drilling Project (ANDRILL), complemented by multi-faceted outreach. The program will air on the Public Broadcasting Service in the fall of 2008.

Polar-Palooza

Principal investigator: Geoffrey Haines-Stiles, Geoffrey Haines-Stiles Productions Polar-Palooza will take scientists and multimedia presentations on a national tour of science centers, museums, libraries and schools across North America, including Canada and Mexico, under the title *Stories from a Changing Planet*. High-definition video taped on location at the poles, audio and video podcasts, and special-education and outreach activities for targeted audiences will augment the live presentations. *Stories from a Changing Planet* will provide diverse audiences with an opportunity to meet and interact directly with polar experts, and to appreciate why the poles and research done relate directly to their lives.

Live from the Poles: A Multimedia Educational Experience

Principal investigators: Christopher Linder, Woods Hole Oceanographic Institution, and Paul Fontaine, Museum of Science Boston The project brings together science centers, polar researchers and broadcast media to expose the general public, teachers and students to the stories of four polar research expeditions. Features will focus on important research themes of IPY through current projects in the Arctic and Antarctic.

Pole to Pole

Principal investigator: Moira Rankin, Soundprint Media Center, Inc This project will use multi-part radio documentaries, short radio features, and an audio and educational clearinghouse and related educational Web site on scientific research in the polar regions to reach a broad public audience. There will be at least four 30-minute documentaries per year and 40 to 50 shorter features during IPY. The programs will be produced and broadcast by

National Public Radio, the British Broadcasting Corp., Australian Broadcasting Corp., Deutsche-Welle, and Radio New Zealand.

Formal Science Education: Graduate and Undergraduate Education

Adapting SENCER to the Arctic--Improving Polar Science Education as a Legacy

Principal investigator: Lawrence Duffy, University of Alaska Fairbanks Science Education for New Civic Engagements and Responsibilities (SENCER) is an approach to undergraduate course development supported by NSF. The university's Department of Chemistry and Biochemistry, the Honors Program, Alaskan Native Science and Engineering Program, and Environmental Quality Engineering program will use the SENCER model to create the course "Environmental Radioactivity, Stewardship and People in the North".

IPY-ROAM: International Polar Year Research and Education Opportunities in Antarctica for Minorities

Principal investigator: Craig Tweedie, University of Texas El Paso This project focuses on involving minority students in polar research to support their pursuit of careers in science. Fifteen undergraduates, five graduate students and five high-school science teachers will be selected nation-wide to participate a 3-week expedition from Tierra del Fuego to Antarctica. The participants will learn about the Antarctic system, Antarctic research, exploration and history, and conduct research projects of their own design in collaboration with the onboard team of researchers and mentors.

Fostering Collaborative Interdisciplinary Relationships among the "New Generation" of Polar researchers Participating in the IPY

Principal Investigators: Susan Weiler, Whitman College, and Sheldon Drobot, University of Colorado, Boulder The Next Generation Polar Research Symposium will bring together past, current, and "new" polar investigators from diverse natural- and social-science disciplines to cultivate cross-disciplinary interactions during IPY. The purpose is to provide the new generation with a common sense of history and purpose, increase their understanding of each others' work, give them insights for conveying the essence of polar regions and their particular research beyond academia, and promote connections among researchers during IPY and in the years ahead.

Formal Science Education-K-12 and Classroom Teachers

Polar TREC-Teachers and Researchers Exploring and Collaborating

Principal Investigator: Wendy Warnick, Arctic Consortium of the U.S. For three years, Polar TREC will send teachers to the Arctic and Antarctic as members of research teams for professional enhancement through hands-on experiences that will advance polar-science education by bringing together K-12 educators and polar researchers. Building on the existing model (<http://www.arcus.org/TREC/index.php>), 36 teachers will spend 2 to 6 weeks in the Arctic or Antarctic studying a topic relevant to IPY, with "Live from IPY" calls, Internet presentations, and podcasts from the field, daily teacher journals, interactive bulletin boards, photo galleries, online multimedia learning resources and activities, and participation in CARE (Connecting Arctic/Antarctic Researchers and Educators) Web meetings to translate field experiences into the classroom and beyond.

Teachers Domain--Polar Sciences

Principal Investigator: Theodore Sicker, WGBH Education Foundation This project will develop existing resources associated with IPY 2007 into classroom resources, leveraging the inherent appeal of the polar regions to teach related science issues and their relevance to the Earth system. This initiative builds upon and expands the power, scope, and established user base of WGBH's Teachers' Domain (www.teachersdomain.org), a featured portal in the National Science Digital Library. WGBH will develop a "Polar Sciences" special collection of 20 rich-media resources, along with a lesson plan that integrates these resources and addresses curricular needs at middle- and high-school grade levels.

-NSF-

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Related Websites

Testimony of NSF Director Arden L. Bement , Jr., a:

http://www.nsf.gov/about/congress/109/alb_ipy_092006.jsp

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