# 2.0 Introduction

The role of the NSF in the U. S. Antarctic Program was formally delineated in Presidential Memorandum 6646 issued on February 5, 1982, in which the following decisions were presented:

- The U. S. Antarctic Program shall be maintained at a level providing an active and influential presence in Antarctica designed to support the range of U. S. Antarctic interests.
- This presence shall include the conduct of scientific activities in major disciplines; year-round occupation of the South Pole and two coastal stations; and availability of related necessary logistics support.
- Every effort shall be made to manage the program in a manner that maximizes cost effectiveness and return on investment.

The memorandum also stated that the NSF should budget for and manage the entire United States national program in Antarctica, including logistic support activities, so that the program may be managed as a single package. It was directed that the NSF should draw upon the support capabilities of other government agencies on a reimbursable basis, and commercial support and management facilities should be used where they are cost effective and not detrimental to the national interest.

Three year-round research facilities have been constructed in Antarctica that remain today: McMurdo Station near the Ross Ice Shelf in 1955, Amundsen-Scott Station at the South Pole in 1956, and Palmer Station by the Antarctic Peninsula in 1965. An ice-strengthened research/transport ship and a research icebreaker also were acquired. Since the 1960s the backbone of the program's air transport has been a fleet of ski-equipped C-130 aircraft designated LC-130s. University-based and Federal agency research are supported at the rate of about 125 projects each year. The cost of this inclusive program of infrastructure and science is compared with the cost of U. S. Arctic research programs in Exhibit 1.

Beginning in 1989, the Office of Polar Programs of the National Science Foundation initiated a South Pole Redevelopment Project. The replacement research facilities that had been built at the geographic South Pole in the 1970s were overcrowded and at the end of their design life, having been constructed for an expected life of 15 to 20 years and for a population of 34 men. The station, dedicated in 1975, has 30-year-old structural and environmental technology and supported 172 men and women during this year's austral summer. A facilities evaluation recently conducted by an Alaska-based consultant, Kumin Associates, concluded that

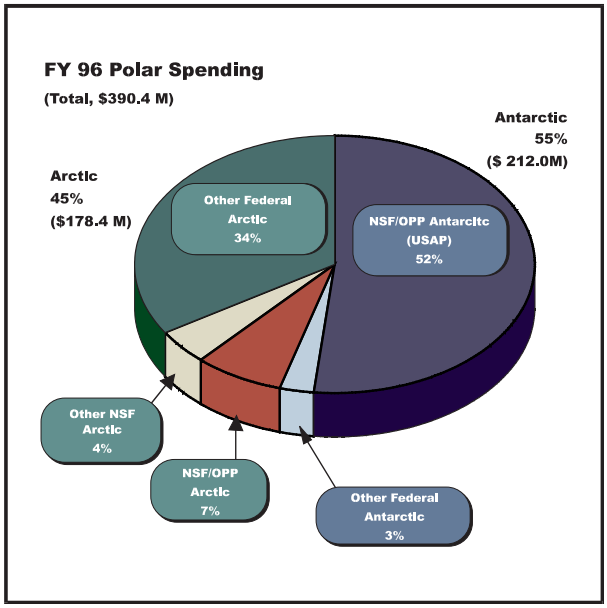


*Exhibit 1*

*Federal Spending for Polar Research. Because the Arctic contains U. S. sovereign territory (Alaska) and the Antarctic does not, the U. S. Government administers research differently in the two polar regions. In the populated Arctic, a dozen Federal agencies perform or sponsor research within the existing infrastructure characteristic of populated states in the U. S. In the Antarctic, which has no indigenous population or infrastructure, the National Science Foundation funds most of the nation's research and research support, and it coordinates land-based research of other agencies.*

within eight to ten years most buildings and several utility systems at the South Pole will have reached the end of their useful life. As the buildings and utilities become more unreliable, safety risks, costs and interruptions to ongoing research will increase. A building code inspection in 1993 revealed over 300 deficiencies of varying degrees of significance. NSF's Polar Safety and Health Officer has implemented numerous administrative controls to reduce safety risks, but additional safety controls will be required as the facilities continue to age, further reducing the efficiency of scientists and operational personnel and increasing costs.

The South Pole Redevelopment Project was reviewed in 1994 by a Non-Advocate Review Panel chaired by Colonel Palmer Bailey of the U. S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory. The panel concluded that there was a need to redevelop the South Pole Station and that the program presented by the Office of Polar Programs to do so was well conceived and based on reasonable and appropriate assumptions. Questions were raised about the possibility of reducing the number of people at the Pole by expanding automation and telescience. Continued input from the user community, as well as from public interest organizations dealing with environ-

mental issues, was encouraged by the Non-Advocate Review Panel. It found that the overall architectural concept of the existing South Pole Station was sound and practical but expressed concern over continued dependence on the sub-snow arches and the use of drifting, aged geosynchronous satellites for communications. The panel concluded by stating that the NSF had a sound concept and a fully adequate plan for replacement of South Pole Station and encouraged the NSF to move forward with the program.

The South Pole Redevelopment Project which would replace the existing station was next reviewed from a scientific perspective by a Blue Ribbon Panel chaired by H. Guyford Stever. In June, 1994, the Stever panel reported its findings that NSF supports scientific programs at the South Pole that 1) can be conducted only at the South Pole, or 2) can be done better there than elsewhere on Earth, or 3) can be done there at lower cost than conducting corresponding research in space. The panel noted that the South Pole provides a unique environment for research in several aspects: location at the rotational axis and proximity to the magnetic axis; circulation of the atmosphere; uninterrupted observation during dark and light periods; cleanliness of the atmosphere; low-water vapor content; the existence of a continental-sized block of extraordinarily transparent ice; a unique tectonic location; low levels of electromagnetic interference; a unique environment for seismology; and a high elevation with flat terrain. The Stever panel concluded that science is the primary justification for the U. S. presence at the South Pole, but substantial non-scientific national values are served as well. Included are international environmental leadership, educational inspiration, and support for responsible governance of a non-sovereign territory.

The Stever panel stated that there was serious need to:

- introduce safer facilities that meet modern construction codes;
- improve the efficiency of the power and heating systems;
- improve the available room for increasingly complex equipment and increased volumes needed for garage space;
- provide reasonable working and living quarters for scientists and support staff;
- reverse the trend whereby the environment has on occasion been degraded; and
- store fuel in a manner which is environmentally responsible.

In September 1995 the Senate Appropriations Committee on the Veterans Administration, Housing and Urban Development, and Independent Agencies, aware that the NSF was considering a South Pole Redevelopment Project, requested the National Science and Technology Council to review U. S. Antarctic Policy. The Panel requested the review to:

> *"...examine the validity of the policy contained in Memorandum 6646, namely the need for a year-round presence, the need for three stations, and the roles of NSF, the Department of Defense, and other Government agencies. The review should examine the policy in the context of the value of the science performed in Antarctica and other U. S. interests. Finally, the review should address the affordability of continued U. S. presence in Antarctica in light of the severe budget environment, and examine options for reducing annual logistical and operational budget needs. At a minimum, budget saving options should include greater international cooperation, less than a year-round human presence, and closing of one or more of the stations."*

The National Science and Technology Council (NSTC) transmitted its report to Congress on April 26, 1996. The report prepared by NSTC's Committee on Fundamental Science determined:

> *"...from a policy perspective the NSTC finds that maintaining an active and influential presence in Antarctica, including year-round operation of the South Pole Station, is essential to U. S. interests.*
>
> *"...that the National Science Foundation has implemented U. S. policy in an effective manner, especially by substantially improving environmental stewardship, by broadening the science program, and by privatizing some operational elements of the Program to reduce costs.*
>
> *"...the USAP research program is of very high quality and of great interest to a broad scientific community.*
>
> *"...that, at the current level of investment, the USAP is cost effective in advancing American scientific and geopolitical objectives and, from a science perspective, [should] support the continuation of three stations with year-round presence.*
>
> *"...the USAP should give highest priority to correcting critical health, safety, and environmental issues at the current [South Pole] Station.*
>
> *"...that an external panel be convened by NSF to explore options for sustaining the high level of USAP science activity under realistic constrained funding levels."*

In response to the NSTC recommendation for an external panel, the Director of the NSF established the U. S. Antarctic Program External Panel on August 16, 1996, and provided Terms of Reference (Appendix II). The Director charged the Panel to "...examine and make recommendations concerning the stations and logistics systems that support the science while maintaining appropriate environmental, safety, and health standards; the efficiency and appropriateness of the management of these support systems; and how and at what level the science programs are implemented. The panel's views and recommendations should include consideration of eventual replacement of the South Pole Station and other infrastructure."

The Director of the NSF also asked the Panel to provide advice on how the USAP can maintain a high quality research program while implementing the U. S. policy in Antarctica under realistic budget scenarios. One scenario the Panel was asked to consider was an overall budget freeze for the USAP science program and for all infrastructure support, including the South Pole Station. It was stated that supplemental funding from other federal agencies or from other sources within NSF was not necessarily to be assumed. The Panel was asked to consider approaches used by other agencies and the private sector in operating remote facilities, as well as new technologies such as robotics that could yield further efficiencies and cost savings. Finally, the Panel was asked to identify areas in which substantial increases in program effectiveness would result from resource reallocation or short-term changes in budget profiles, including capital investments, that could lead to reductions in life-cycle costs.

The present document is the final report of the U. S. Antarctic Program External Panel. It addresses such issues as the need for a U. S. year-round presence in Antarctica, the quality and uniqueness of research programs being conducted in Antarctica under U. S. auspices, and the adequacy of facilities which support on-going and projected activities. It presents 22 specific findings and 12 recommendations that address the budget and management issues raised in the NSF's Terms of Reference.