

1.0 EXECUTIVE SUMMARY

Antarctica is the coldest, driest, windiest, remotest, and highest (on average) continent. The United States has been involved continuously in Antarctic projects for over 40 years. The U. S. Antarctic Program External Panel (hereafter “the Panel”) perceives that the U. S. Antarctic Program (USAP) has three principal justifications and objectives: presence, science, and stewardship. National prestige is involved in participation in activity in Antarctica, particularly at the South Pole, much as there is in involvement in the space program.

The stated U. S. policy toward Antarctica is that the continent should be maintained as a peaceful territory, free of national claims and available for the benefit of all humankind. The Antarctic Treaty system has created a political environment in Antarctica that today is largely characterized by cooperation and mutual understanding. Nonetheless, seven nations have made claims to parts of Antarctica, some overlapping, and potential disagreements remain an underlying reality.

The substantial U. S. presence in Antarctica is viewed by the Panel as a critical, perhaps the most critical, element in assuring the region’s continued political stability. In addition, working in cooperation with many nations, the U. S. plays an important role in preserving a fragile and nearly pristine ecological system which serves as an indicator of future environmental trends throughout the planet.

Because of the unique physical conditions in Antarctica, the continent also is a one-of-a-kind scientific laboratory for the investigation of phenomena which range from the microscopic to the Earth-shaping. Following are examples of the latter:

- The character and causes of the Antarctic ozone hole have served as an early warning of the threat to the planet’s ozone shield. Understanding ozone depletion and the impact of the resultant increase in surface ultraviolet radiation is crucial to predicting the future stability of Earth’s ecosystems.
- Global warming is a complex and controversial topic, but there is no controversy about the benefits to be gained through understanding and detecting whether or not we are experiencing a systematic and unprecedented warming. The polar regions are integral to this process and perhaps leading indicators of it. Ice-core records show a correlation between warming and greenhouse gas increases over hundreds of thousands of years. Recent measurements at South Pole and elsewhere show that human-caused increases in greenhouse gases are higher than any others observed over this same period of time. Further measurements at the South Pole are critical to understanding the consequences of this change.

- West Antarctica, with its ice cover, is separated from East Antarctica and its massive ice sheet by the Transantarctic Mountains. Geophysics conducted in recent years in West Antarctica has shown that the West Antarctic Ice Sheet disappeared and re-grew after it had initially formed. Understanding the history and dynamics of this phenomenon will help us know the potential for ice sheet collapse and associated sea-level rise. Should such an event occur, the resultant total rise in sea level would be approximately 20 ft. Even an order of magnitude smaller rise, at the rate believed possible by glaciologists, would drastically impact the coasts of the world.
- The South Pole is the site of the cleanest air that can be found in the world today. Measurements of atmospheric gases and aerosols there are critical to understand the chemistry of the clean atmosphere and to unambiguously detect global human influences (e.g., trends in key greenhouse gases such as methane and carbon dioxide).
- Certain parts of Antarctica are uniquely suited to the recovery of meteorites, some of whose origin can be traced to the planet Mars. Recent discoveries have suggested the possibility that primitive forms of life once existed on Mars. The implications of such a discovery, if confirmed, are profound.

Data collected to understand many of these and related phenomena show fluctuations caused by extraneous influences over various time scales (seasonal, annual, decadal, etc.). However, conclusions drawn from these studies are valid only with continuous and regular sampling to build statistical confidence. Many Antarctic measurements have been made for decades, and the continuity of this scientific record is vital.

In carrying out its Antarctic program, the U. S. maintains year-round facilities at three locations on the continent, operates two ice-capable research vessels, and supports temporary field sites, some consisting of no more than one or two tents or a robotic instrument capsule. U. S. activities in Antarctica are currently budgeted and managed by the National Science Foundation (NSF) as principal agent for the U. S. Government.

Changing circumstances, particularly federal funding pressures, have resulted in a major ongoing realignment of support functions in the Antarctic, including the withdrawal of the U. S. Navy from its historic key roles in early exploration and, since the 1950s, research support. As the Navy withdraws, the Department of Defense is shifting heavy-lift (LC-130) air transport functions to the Air National Guard, and the NSF is transferring many other functions to civilian contractors. As a result, this is a particularly significant

period, not only in terms of the need for intense management attention, but also as an opportunity to search for new means of reducing costs and re-inventing ways of conducting Antarctic activities.

A consequence of the NSF's traditional focus on the conduct of science, together with the character of the federal budgeting process — which, unlike commercial practice, does not ordinarily include a depreciation account to provide for the renewal of fixed assets — is that aging U. S. facilities in Antarctica are costly to maintain and, in some cases, of arguable safety. The Panel believes that the U. S. would not send a ship to sea or a spacecraft to orbit in the condition of many of the facilities in Antarctica — and especially those at the South Pole. The efforts of the individuals assigned responsibility for operating these facilities are heroic — nonetheless, steps need to be taken without delay to remedy the existing conditions.

The cost of constructing a replacement South Pole station has been recently estimated to be in the range of \$150M-\$200M and would take about eight years to budget and build. The Panel believes the station design which has been under consideration should be reduced in size and cost and that significant additional savings must be generated in the Antarctic program to offset a substantial fraction of the cost of a replacement facility.

The Panel has offered a series of 12 specific recommendations, each of which is discussed in this report and all of which are aggregated in Appendix IV. Overall conclusions of the Panel are as follows:

- The geopolitical importance heretofore assigned to a permanent U. S. presence in Antarctica, particularly at the South Pole, appears fully warranted. This consideration, *in itself*, justifies a year-round presence at several locations, including a moderate-sized facility at the Pole, along with necessary supporting infrastructure.
- The research being performed in Antarctica is comparable in its high quality and relevance to that being supported elsewhere by the NSF. The research utilizes the unique environment of Antarctica and addresses significant scientific issues with important human consequences, including evolution of the ozone hole, search for possible traces of life from Mars, stability of the ice sheet and its impact on sea level, and numerous other matters.
- The Antarctic program is well managed, and the competence and commitment of the individuals with whom the Panel met were impressive. The ongoing transfer of management and support responsibilities — from the Navy to the Air National Guard and from the Navy to the NSF and its contractors — demands an intense level of diligence.

- Impressive cost-reduction actions have been taken in recent years and further opportunities exist for additional savings. Among the latter are: further privatizing support operations in Antarctica, eventually under a single prime managing contractor; making total program cost (explicitly including support costs) a factor in selecting which research proposals are to be approved; placing head-count limits on the number of people traveling to Antarctica; discouraging multiple trips in a single season except under extraordinary circumstances; improving telecommunications capability to permit more science to be performed remotely; and so forth.
- Corrective actions that recently have been implemented have resolved or mitigated many of the previously documented waste recovery concerns at McMurdo Station, although additional long-term work remains to be accomplished.
- Further life-extension efforts devoted to the existing South Pole facility are neither cost effective nor conducive to the effective operation of a remote station.
- Communications to and from Antarctica, and especially the South Pole, although much improved in recent years, are dated and tenuous and require improvement to meet the standards of a modern research facility — including communications support of robotic operations as well as logistics management.
- Joint research projects with other nations and international partnering in providing transportation are flourishing and deserve to be encouraged in order to reduce costs where possible and to strengthen cooperation among nations. Joint ownership of core facilities, however, does not appear to be in the best interest of the U. S. role in promoting political stability.
- The quality of many U. S. facilities in Antarctica, and particularly at the South Pole, is not in keeping with the standard reasonably expected of a nation of America's stature and, in several respects, the facilities are becoming increasingly unsafe. Funds specifically appropriated in the FY97 budget to rectify the most extreme safety, health and environmental concerns at the South Pole are very important, but do not address the underlying problems of an aging, three-station system in a life-threatening environment.
- The Panel recommends that the NSF Office of Polar Programs (OPP) reduce the number of field projects in Antarctica during the South Pole facility reconstruction phase and encourage related science in the U. S. This is the most equitable way to help fund the replacement and should have the least impact on Antarctic science.

The Panel's principal conclusion is that the South Pole Station needs to be replaced soon for economic, safety and operational reasons and that modest upgrades are needed at Palmer and McMurdo Stations. The Panel understands that urgent safety shortcomings at South Pole Station will be resolved with the application of \$25M funded in FY97. Other renovations (a minimum of \$15M at Palmer and McMurdo Stations) and replacement of South Pole Station should be funded by a downsizing of the previously proposed new South Pole Station design, reducing the cost to \$125M excluding \$5M of interim expenses to keep the existing station functional until replacement; a cumulative reallocation of

\$20M from science grants and science support over FY98-FY02; and the generation of savings of at least \$30M through cost reduction actions already underway, augmented by the recommendations contained in Section 7. Although this represents a considerable reduction in new funding needs relative to previous estimates, it still produces a cumulative shortfall of \$95M over the five-year period during which the replacement South Pole Station is to be funded. It is the conclusion of the Panel that these residual funds are not to be found within the resources of the USAP without severely undermining the viability of the science program and degrading health and safety conditions.