

CHAPTER 1: The United States in Antarctica



U.S. Navy pilot LCDR Gus Shinn starts up the Que Sera Sera before taking off for the South Pole from the Naval Air Facility McMurdo on 31 October 1956. This aircraft was the first to land at the South Pole. The Naval Air Facility was re-named McMurdo Station in 1961. Photo by U.S. Navy.

The U.S. role in Antarctica derives from American expeditions to the region and diplomatic initiatives that have taken place since the earliest expeditions by American whalers. This history led to a continuous U.S. presence in the region since the 1950s and to a consistent U.S. policy toward Antarctica that has been reaffirmed repeatedly over the decades, most recently by high-level reviews in 1994, 1996, and 1997. Current federal policy is geared toward continuing a strong U.S. capability to support Antarctic scientific research into the foreseeable future.

BACKGROUND

Antarctic Exploration and the Antarctic Treaty

Beginning in the late 18th Century and continuing well into the early part of the 20th, Antarctica was the focus of numerous international scientific and geographic expeditions. Information on this fascinating history can be found in a variety of books and other publications, including the NSF booklet “Science on the Ice: The United States Antarctic Program.”

In 1956–57 the U.S. Navy, during Operation Deep Freeze I, and in conjunction with research teams from the National Science Foundation (NSF), established bases in Antarctica to prepare for the International Geophysical Year (IGY, 1957–58). The IGY was an intensive, multi-national, multi-disciplinary, global research effort designed to study a wide range of geophysical processes. Much of that effort took place in Antarctica and was crucial in establishing Antarctica as a continent for peace and science.

The international coordination that resulted from the IGY ultimately led to the Antarctic Treaty, which was signed in 1961. Since then, Treaty nations have agreed to several addenda, including the 1991 Environmental Protocol to the Antarctic Treaty (Protocol), which establishes rules and procedures specifically designed to protect the Antarctic environment. The Protocol was ratified and went into effect in 1998.

United States Antarctic Program (USAP)

The United States established the U.S. Antarctic Research Program (USARP) in 1959, immediately after the IGY. (The name was later changed to the U.S. Antarctic Program.) Through the USAP, NSF facilitates and manages U.S. research efforts in Antarctica. The Department of Defense supports the USAP scientific effort via the continuing Operation Deep Freeze.

Research supported by the NSF Office of Polar Programs (OPP) and by other U.S. federal agencies aims to expand fundamental knowledge of the Antarctic region, elicit the connection between Antarctica and the rest of the Earth, and leverage Antarctica as a unique research platform. U.S. research has greatly improved our understanding of Antarctica, Antarctica's role in global environmental change, and the universe beyond planet Earth. This research and the extensive logistic reach of the USAP has placed the United States in a position of scientific and diplomatic leadership in Antarctica.

Programs to integrate research and education are an important and unique element of the USAP. NSF also supports an Artists and Writers Program that facilitates works of art to increase public understanding of both Antarctica and Antarctic research.

The Antarctic Treaty and U.S. Antarctic Policy



The ceremonial pole at Amundsen-Scott South Pole Station is surrounded by the flags of the original 12 signatory nations to the Antarctic Treaty. Photo by Deven Stross

The Antarctic Treaty entered into force in 1961, and its original 12 signatory nations included those that were active in Antarctica during the IGY. The treaty is a remarkable achievement whose primary success has been to reserve the area south of 60 degrees south latitude as a zone of peace. It prohibits measures of a military nature, including fortifications, and it prohibits nuclear explosions and the disposal of radioactive waste. It gives treaty parties the right to inspect all areas of Antarctica, including the stations, installations, equipment, ships, and airplanes of other member states to ensure continuing adherence to the treaty.

More than 50 nations are now signatories of the Antarctic Treaty. In addition to diplomatic interchanges carried out under the Antarctic Treaty by the U.S. Department of State and its counterparts in other nations, leaders of the various national Antarctic programs directly coordinate and exchange logistical and operational plans via the Council of Managers of National Antarctic Programs (COMNAP).

The Antarctic Treaty establishes Antarctica as a continent for science and international cooperation. It also provides for the annual exchange of plans, personnel, scientific observations, and results. The United States, a leader in both the establishment of the treaty and in its continued operation, cooperates extensively with other treaty nations in scientific research and operational support.

The Antarctic Treaty consultative parties established a secretariat in Buenos Aires, Argentina to support Antarctic Treaty activities. Besides assisting with preparation for annual meetings, the Secretariat is also responsible for information related to the Treaty System and the Protocol. Its website, www.ats.aq, includes a database that describes operations and scientific activities for each nation in Antarctica and provides information about treaty-related activities.

U.S. Antarctic Policy is based on four core principles:

1. Non-recognition of territorial claims
2. Retention of the right to participate in any future uses of the region
3. Use of Antarctica for peaceful purposes only
4. Free access for scientific investigation and other peaceful pursuits

USAP STRUCTURE

National Science Foundation

NSF has overall management responsibility for U.S. activities in Antarctica, which includes:

- preparing an annual budget and operational plans for consideration by the executive branch and for review and appropriation by Congress;
- obtaining advice from the scientific community, as needed, to develop scientific goals for NSF-supported research in Antarctica;
- evaluating and supporting proposals for research and education from U.S. universities, other research institutions, and federal agencies;
- detailed planning of logistics and transmitting logistics requirements, along with necessary funds, to elements of the Department of Defense and the United States Coast Guard;
- managing facilities, including the planning, design, engineering, construction, and maintenance of Antarctic infrastructure;
- developing a government support contract and managing a contractor charged with operating Antarctic stations and research vessels and providing related services, including construction;
- developing and implementing a comprehensive safety, environmental, and health program for U.S. activities in Antarctica;
- arranging cooperative scientific and logistics programs with other Antarctic Treaty nations;
- designating a senior U.S. representative in Antarctica and ensuring on-site management of field programs in Antarctica; and
- serving as a clearinghouse and source of information regarding Antarctic records, files, documents, and maps maintained within agencies and nongovernmental organizations.

OPP has day-to-day responsibility for these functions (see www.nsf.gov/geo/opp/about.jsp). The OPP address is 2415 Eisenhower Avenue, Suite W7100, Alexandria, VA 22314. Phone: 703-292-8030 Fax: 703-292-9081.

Support Contractors

Leidos is currently the prime contractor supporting the USAP. Leidos manages a team that includes partner companies performing specific support functions. Together, the companies comprising the support contractor are known collectively as the Antarctic Support Contract (ASC).

Antarctic Support Contract (ASC)

Leidos	ASC program management, science planning
Best Recycling	Waste management
Damco	U.S. and international cargo, Punta Arenas operations
Gana-A' Yoo (GSC)	Lodging, food/beverage, recreation, retail, post office
GHG Corporation	IT and communications
PAE	Infrastructure, operations, transportation, and logistics
PAE New Zealand	Christchurch operations
University of Texas Medical Branch	Medical qualification, clinic staff, and telemedicine
Parsons	Design, engineering, and construction management

The scope of work ASC is responsible for includes:

- supporting funded science projects and operating research facilities;
- purchasing, shipping, warehousing, and issuing equipment and supplies;
- designing, procuring, and constructing facilities;
- operating and maintaining Antarctic stations, research vessels, and field camps;

- arranging medical clearance and travel for participants;
- managing transportation of passengers and cargo;
- providing marine terminal operations; and
- ensuring compliance with safety, health, and environmental requirements.

ASC can be reached at 800-688-8606, fax 303-790-9130. The address is 7400 S. Tucson Way, Centennial, CO 80112-3938.

Other organizations are also contracted by the NSF, ASC, and the Department of Defense (DoD) to perform specific tasks, such as providing helicopter and fixed-wing aircraft support.

Department of Defense

The DoD provides logistical support to the USAP, with costs reimbursed by NSF, as directed by Presidential Decision Memorandum 6646 and in accordance with the NSF-DoD Memorandum of Agreement. This support includes:

- shipborne cargo transport between the U.S. west coast and McMurdo Station (Military Sealift Command);
- shipborne fuel delivery to McMurdo Station (Military Sealift Command);
- airlift (C-17) between Christchurch, New Zealand and McMurdo (Air Mobility Command);
- LC-130 Hercules (ski-equipped) airlift in Antarctica and between Antarctica and New Zealand (109th Air Wing, Air National Guard);
- stevedore services (Navy Cargo Handling and Port Group);
- weather forecasting, air traffic control, ground-navigation-aid electronics maintenance, RF spectrum management, and DoD messaging (SPAWAR Office of Polar Programs);
- information Security/Information Assurance management and government oversight support (SPAWAR Office of Polar Programs); and
- electronic systems engineering, including design, procurement, and installation (SPAWAR Office of Polar Programs).

The Commander, Joint Task Force - Support Forces Antarctica (CJTf-SFA) is responsible for DoD forces deployed in support of Operation Deep Freeze. This person is normally stationed at Hickam AFB, Hawaii.

The Deputy Commander JTF-SFA (DCJTF) executes the DoD mission and manages DoD assets on behalf of CJTF-SFA. This individual is present in either New Zealand, Antarctica, or Hawaii. The commander of the 13th Air Expeditionary Group (13 AEG/CC) commands all DoD aviation operations and is normally present at McMurdo. At different times, the DCJTF will act as the 13 AEG/CC.

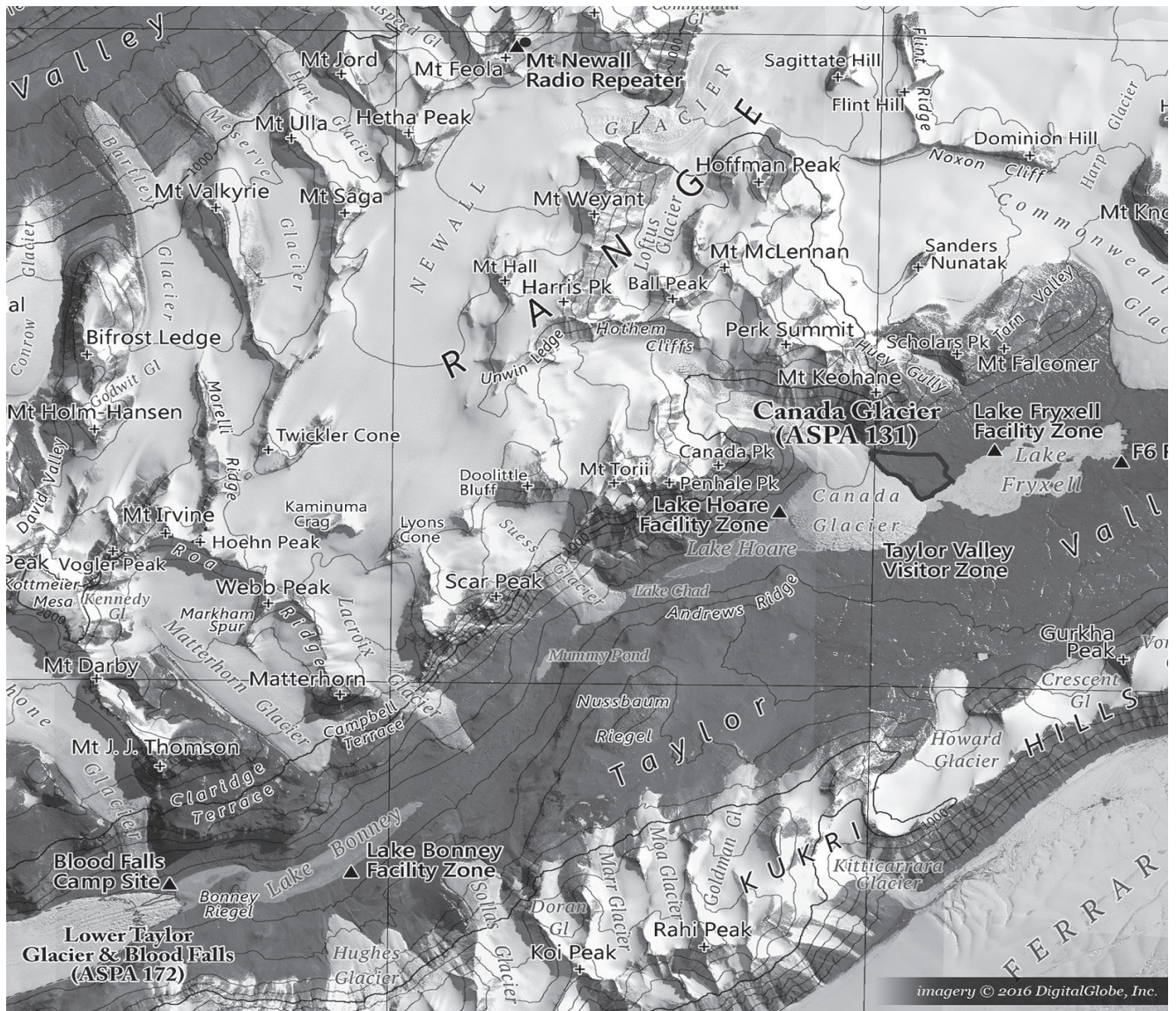
Department of Homeland Security

The Department of Homeland Security (United States Coast Guard) provides icebreaker services, reimbursed by NSF. These services include:

- breaking a channel through the fast ice of McMurdo Sound in advance of the annual fuel and resupply ships;
- escorting supply ships into and out of McMurdo Station;
- refueling Marble Point; and
- providing other assistance, including science project support, as required.

Department of the Interior

The Department of the Interior's Aviation Management Division (DOI/AMD) provides procurement assistance, contract administration, and inspection for commercial aircraft providers contracted to the USAP. The U.S. Geological Survey (USGS) holds geodetic data that support mapping in Antarctica and administers Antarctic place-name decisions.



The Polar Geospatial Center (PGC) provides mapping, high-resolution satellite imagery, and geospatial support to the USAP. This is a map of the McMurdo Dry Valleys. Map by www.pgc.umn.edu.

Department of State

The Department of State is responsible for formulating foreign policy and providing foreign policy direction in regard to developing and implementing an integrated U.S. policy for Antarctica. This includes conducting foreign relations regarding Antarctica and adjudicating legal matters related to interpreting and implementing the Antarctic Treaty. The Department of State leads the U.S. delegation to the annual Antarctic Treaty Consultative Meeting, where the international community discusses a range of issues pertaining to Antarctica. The State Department is also responsible for informing other treaty parties of non-governmental expeditions to Antarctica that are organized in or proceed from the United States and determines, in consultation with the Environmental Protection Agency and NSF, whether expedition organizers are subject to U.S. environmental regulations.

International Cooperation

International cooperation between Antarctic Treaty nations in support of science is common. National Antarctic programs also cooperate with one another on logistics and operations when there are mutual benefits. Some past and current examples are exchanges of personnel among projects and stations, cooperative planning and execution of large-scale science projects, and the exchange or shared use of logistics assets, such as ships and airplanes.

The Scientific Committee on Antarctic Research (SCAR; www.scar.org) is a part of the International Council of Scientific Unions (ICSU). SCAR is a non-governmental body established to further the coordination of scientific activity in Antarctica, with a view to developing scientific programs of circumpolar scope and significance. SCAR organizes symposia, prepares annual reports to ensure the regular exchange of information about scientific programs, develops long-range scientific goals, and responds to special requests for scientific advice from the Antarctic Treaty organization. Members of the Polar Research Board, National Academies of Science (www.dels.nas.edu/prb) represent the United States on SCAR.

SCIENCE PROPOSALS AND GRANTS

OPP's mission is to promote and support excellence in scientific research and education in and about the polar regions, in accord with national policies. In its administration of the USAP, OPP's Antarctic Sciences Section receives proposals from scientists who wish to conduct research in Antarctica. Each proposal is peer-reviewed to provide detailed scientific advice to Antarctic Science program directors, who determine which research proposals are most deserving of support.

The NSF website (www.nsf.gov) provides additional information about NSF goals, strategic plans, budgets, and activities. The "Awards" tab has a searchable database of grants, including abstracts and award amounts. The "Polar Programs" section describes research facilities in polar regions, including USAP facilities, as well as Antarctic and Arctic research areas supported by NSF.

ANTARCTIC DATA REPOSITORIES

The American Geological Institute maintains the world's most complete Antarctic bibliography at www.coldregions.org. (NOTE: The bibliographies were last updated on September 30, 2011, except for limited additions regarding permafrost-related publications.) The U.S. Antarctic Data Coordination Center (www.usap-dc.org) collects descriptions of data sets compiled by USAP participants and enters them into the international Antarctic Master Directory. The Polar Geospatial Center (www.pgc.umn.edu) develops highly detailed Antarctic geospatial digital maps and aerial photographs and makes them available for scientists and the public. Topographic maps and aerial photographs of Antarctica are also available from the USGS at www.usgs.gov/products. In addition, the USGS has a searchable database of Antarctic place names, maps, and photographs at usarc.usgs.gov. With funding from NSF, the USGS, NASA, and the British Antarctic Survey have collaborated to provide the Landsat Image Mosaic of Antarctica (LIMA) at lima.usgs.gov.

USAP STATIONS AND SHIPS

The U.S. Antarctic Program has three permanent, year-round research stations and two research vessels. Additional temporary field stations are constructed and operated during the austral summer.

McMurdo Station

McMurdo Station (77°51' S, 166°40' E), the largest U.S. station in Antarctica, is situated on barren volcanic hills at the southern tip of Ross Island, about 3,827 km (2,378 mi) south of Christchurch, New Zealand and 1,350 km (839 mi) north of the South Pole. The station sits on the eastern shore of McMurdo Sound, the southernmost body of (occasionally) open water in the world. Mount Erebus, a 3,794-meter high (12,447 ft) active volcano, towers over Ross Island. On the west side of the Sound, the Royal Society Range and Mount Discovery, an extinct volcano, provide spectacular vistas. The mean annual temperature is -18°C (0°F). Temperatures may reach 8°C (46°F) in summer and -50°C (-58°F) in winter. The average wind speed is 12 knots, but winds have exceeded 100 knots.

McMurdo Sound is a historic area. In 1841, James Clark Ross brought his ships HMS Erebus and HMS Terror into the Sound, farther south than anyone had ever gone, before sailing eastward along a great wall of ice. He and his crew were the first humans to see the island and the ice shelf that both now bear his name. In 1902, Robert F. Scott wintered the HMS Discovery in Winter Quarters Bay, adjacent to the station. Both of Scott's (1901-1904 and 1910-1913) and Ernest Shackleton's (1907-1909 and 1914-1916) expeditions used the area as a base to deploy sledging parties for both scientific exploration and attempts to reach the South Pole. The huts these expeditions built still stand today at Hut Point, Cape Evans, and Cape Royds.

The original station was constructed in 1955-1956. With many additions and modernizations over the years, today's station is the primary logistics facility for airborne and overland resupply of inland stations and field science projects. The station is also the waste management center for much of the USAP.

McMurdo has two airfields. Phoenix Airfield, located about 18 km (11 mi) from McMurdo on the McMurdo Ice Shelf, accommodates wheeled aircraft. Williams Field Skiway, located about 15 km (9 mi) from McMurdo is for ski-equipped aircraft only. McMurdo also has a heliport to support helicopter operations.

Approximately 90% of USAP participants reside in or pass through McMurdo Station. The austral winter population ranges from 150 to 200, with the summer population varying between 800 and 1,000. The station has routine weekly flights to and from New Zealand during the austral summer (October - February), a period called "Mainbody," with less frequent flights during the winter months (March - September).

The Albert P. Crary Science and Engineering Center (Crary Lab) serves as the primary laboratory and research facility. The Crary lab is a state-of-the-art facility that supports scientists across a wide range of disciplines, including biology, geology, physics, chemistry, and system sciences. The facility is named in honor of the geophysicist and glaciologist Albert Paddock Crary (1911-1987), the first person to reach both the North and South Poles.

The lab has more than 4,320 m² (46,500 ft²) of working space and provides researchers with general use consumables, glassware, equipment, instrumentation, chemicals, cryogenics, cold storage units, laboratory materials, and general laboratory personal protective equipment (PPE). Specialized gear and specialized PPE must be brought to McMurdo by deploying science teams.

Phase I, South Side of the lab provides users with a library, shared-use computers, conference rooms, administrative and staff offices, shared equipment rooms, a cargo receiving area, and equipment/material storage areas. Phase I, North Side contains laboratories for biology and chemistry work; microscope rooms with light, petrographic, and fluorescent scopes; office spaces; environmental and walk-in freezer rooms; and a staging area equipped with a carpentry workbench. Phase II (both South and North Sides) contains laboratory space for physics, geology, glaciology, and engineering work, rock sectioning rooms, staging areas, cold rooms for ice core work, office spaces, and the information technology (IT) office. Phase III contains aquarium tanks, a flow-through seawater system, and wet laboratories designed to support live animal work and pre-deployment testing of marine equipment and submersible robotics.

The Crary Lab is managed by ASC, with direction from NSF. The lab staff is composed of facilities engineers, IT support personnel, materials and supply specialists, lab supervisors, a cryogen and chemical specialist, a research associate, and an instrument technician. These personnel assist the hundreds of scientists who move through the station each year. They also allocate and distribute resources and ensure scientific operations comply with safety, environmental, and health requirements. All scientists are expected to arrive at McMurdo trained in their respective disciplines or accompanied by a team member who can provide guidance.

Scientific posters and displays are found throughout the lab, and the McMurdo community is encouraged to visit the facility to learn more about USAP research. During the austral summer, the laboratory staff provides Sunday tours. Science lectures are presented by visiting researchers twice a week, and occasionally for night shift workers. Special events and tours are often held throughout the season to further encourage community and scientific interaction.

The Movement Control Center (MCC) provides terminal operations for all continental cargo and passenger movements. MCC personnel coordinate passenger manifesting and transportation to and from the McMurdo area airfields, support cargo pallet building, and assist with airplane load planning. MCC personnel are also responsible for loading and unloading fixed-wing aircraft, as well as for operating the McMurdo-area shuttle vans.

Amundsen-Scott South Pole Station

South Pole Station is located at the geographic South Pole, on the polar plateau, at an elevation of 2,835 m (9,300 ft) above sea level. The station sits on an ice sheet that is 2,700 m (8,858 ft) thick and drifts with the ice at about 10 m (33 ft) a year toward the Weddell Sea.

The mean annual temperature is -49°C (-56°F). Average monthly temperatures range from -28°C (-18°F) in the summer to -60°C (-76°F) in winter. The record high of -12.3°C (9.9°F) was recorded in December 2011, and the record low of -82.8°C (-117°F) was recorded in June 1982. The site has very low humidity, and precipitation is only about 20 cm of snow (8 cm water equivalent) per year. Drifting is the primary cause of snow accumulation around buildings. Average wind speed is 10.8 knots.

The original station was built in 1956-1957 and is buried beneath the snow. The second station, located under a geodesic dome, was completed in 1975. The Dome was dismantled in 2009-10 and removed from the continent. The current station was dedicated on January 12, 2008. The winter population is around 45, and the summer population averages 150.

Most USAP personnel reach the South Pole from McMurdo Station via LC-130 ski-equipped aircraft, whereas most cargo and fuel are transported via surface traverse from McMurdo Station. The short austral summer, when most activity occurs, is from late October through mid-February. The station is isolated for the rest of the year.

Research at the South Pole includes astronomy, astrophysics, aeronomy, auroral and geospace studies, meteorology, geomagnetism, seismology, earth-tide measurements, and glaciology.

Palmer Station

Palmer Station, in the Antarctic Peninsula region, is named after Nathaniel B. Palmer, the American sealer who pioneered exploration of the Peninsula in 1820. The station is located on Anvers Island at $64^{\circ}46'$ S, $64^{\circ}03'$ W and consists of two major buildings and several small ones. There is no airfield for either helicopters or fixed-winged aircraft.

The climate is milder than that of the other U.S. Antarctic stations. Temperatures in the summer range from just below freezing to above 4°C (40°F). Winter temperatures range from 0°C (32°F) to -10°C (14°F). Palmer Station is often windy and wet, with both snow and rain. The water equivalent in snow and rain averages 81 cm (32 in) per year. Wildlife is abundant near the station, which makes it superbly located for ecosystem research. As with elsewhere in Antarctica, all interactions with wildlife are strictly governed by the Antarctic Conservation Act.

Station population is about 44 in the summer and 20 or more in winter. Unlike South Pole and McMurdo Stations, Palmer usually receives transportation year-round and does not generally have a period of winter isolation.

The science laboratories consist of 10 laboratory bays, an aquarium system with seawater circulating through a series of indoor and outdoor tanks, and two environmentally controlled cold rooms. There is also a separate Terra lab that hosts atmospheric, meteorological, and geological experiments. Long-term climatologic and seawater data are available at amrc.ssec.wisc.edu.

Research Vessels

The *RVIB Nathaniel B. Palmer* (NBP) is 94 m (308 ft) long and is able to break three feet of ice at a continuous forward speed of three knots. The NBP is a modern, multi-disciplinary research vessel containing six laboratories with a combined space of 353.5 m^2 ($3,800\text{ ft}^2$). It can accommodate 39 scientists and ASC personnel and operates throughout the Southern Ocean.

The *ASRV Laurence M. Gould* (LMG) is 70 m (230 ft) long and is capable of breaking one foot of first-year ice while maintaining continuous forward progress. The LMG has berthing space to accommodate 28 scientists and ASC personnel. There are an additional nine bunks for passengers transiting to Palmer Station. The LMG transports personnel and cargo to and from Palmer Station and supports research in the Antarctic Peninsula region.

FACILITY ADMINISTRATION

NSF Representative in Antarctica. Each austral summer, the OPP director designates an OPP staff member as senior U.S. representative in Antarctica (NSFREP), with an office in the Chalet at McMurdo Station. The NSFREP ensures that U.S. policy and directives for the USAP are implemented, represents the U.S. as it interacts with foreign nations in Antarctica, ensures that U.S.-sponsored Antarctic activities are carried out in a manner consistent with

the Antarctic Treaty, and takes appropriate action in personnel matters not subject to military or other authority. The NSFREP is NSF's principal representative for implementing planned field operations, and the position coordinates and establishes on-site priorities for field support of USAP activities.

NSF Science Representative in Antarctica. The NSF science representative (SCIREP) is NSF's principal representative for Antarctic science activities. The SCIREP interacts with investigators and the NSFREP to set science-support priorities, gives on-site direction to the ASC laboratory services manager on science matters, and serves as the NSF science spokesperson. The position is occupied by different NSF Antarctic Science program directors over the course of the austral summer. At McMurdo Station, the SCIREP has an office in the Crary Lab.

NSF McMurdo Station Manager. The NSF McMurdo Station manager is a year-round position whose function is to oversee the operation of station facilities and serve as deputy marshal. The station manager interacts with all organizations represented at McMurdo and also manages emergency situations. In the winter, the NSF station manager is the ranking U.S. government official at McMurdo.

Commander, Joint Task Force - Support Forces Antarctica (CJTF-SFA). This individual is responsible for all DoD personnel and material assets that support the USAP. The CJTF-SFA is located at Hickam Air Force Base, Hawaii.

13th Air Expeditionary Group Commander (13 AEG/CC). The 13th AEG commander is the designated commander of all military forces deployed to the Joint Operations Area as part of JTF-SFA.

ASC Area Manager. ASC has area managers at McMurdo, South Pole, and Palmer Stations during the austral summer. These individuals, in conjunction with the senior ASC representative, oversee all contractor support activities. The area manager may be supplemented with a site manager during the austral summer, depending on the station and the scheduled workloads.

Station Science Leader. The NSF designates a science leader for South Pole and Palmer Stations. The station science leader is directly responsible to the OPP when no NSF representative is present. Researchers at each station or working out of the station are responsible to the station science leader, who coordinates science projects and arranges for the logistics needed to support them. Researchers request support from the station science leader during the winter, who consults with the station manager to arrange it. The station science leader clears official messages concerning research projects before they are dispatched.

ASC Winter Site Manager. This position is responsible for all station support activities during the austral winter, including local support for science projects.

Marine Project Coordinators (MPCs) are provided by ASC on both research vessels. MPCs coordinate and direct shipboard activities in conjunction with the ship's master. The MPC and the ship's master make all decisions regarding the safe conduct of the ship.

USAP Statistics

- Approximately 3,000 participants work at U.S. Antarctic stations and field camps each year.
- Approximately 90% of the participants travel through New Zealand.
- Participants originate from all over the U.S., with Colorado having the highest representation.
- Approximately 75% work during the austral summer and 25% during the winter.
- Approximately 33% are female and 10% are minorities.
- More than 700 scientists conduct research on more than 200 different science projects each year in Antarctica.

