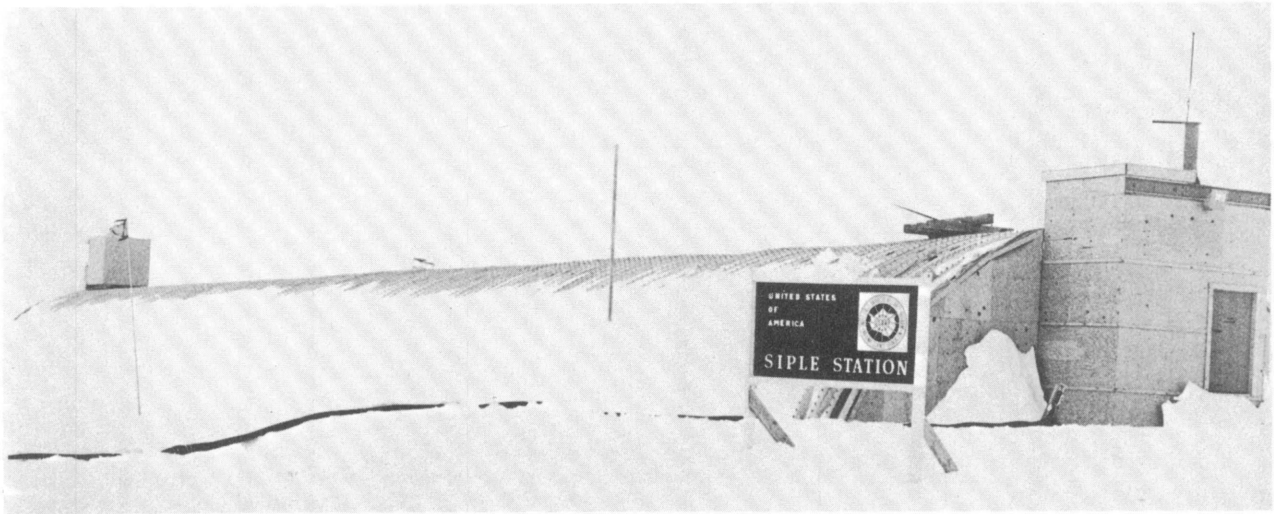
antarctic journal OF THE UNITED STATES

March 1979 National Science Foundation Volume XIV—Number 1



NSF photo

New Siple Station ready for winter

Eight men will spend the coming austral winter in a new facility at Siple Station in Ellsworth Land. The new station is expected to function as a year-round U.S. research platform until the late 1980's when, like old Siple Station, it will have been buried beneath a crushing mass of snow and ice. The completion of the new station ahead of schedule and within budget, less than 3 years after the decision was made to replace the old station, will enable upper atmosphere research at Siple to continue without interruption.

The U.S. has maintained a station at Siple (75°55'S, 83°55'W) since 1969 because it is the single best location in the southern hemisphere for controlled very-low-frequency (VLF) wave investigations of the upper atmosphere. VLF signals generated by the Siple transmitter travel along geomagnetic lines of force through the plasmapause and return to earth in northeastern Canada where they are picked up at Siple's conjugate station in Roberval, Quebec. Scientists at both locations record what happens to the signals on their passage through the plasmapause and attempt to find patterns in the behavior of different kinds of VLF signals. Such research produces general characterizations of VLF waves, the plasmapause, the magnetosphere, and interactions between the magnetosphere and the ionosphere.

VLF probing of the magnetosphere can take place at other locations, but it is done best along the geomagnetic field lines that traverse the earth's plasmapause. It is done most efficiently if the transmitter is located well above the ground surface so there is minimal signal loss due to ground absorption. Siple Station, located on top of an ice sheet over a kilometer thick and at the optimum geomagnetic latitude, is therefore ideal for VLF research.

For this reason the United States maintains a station at Siple in spite of its 2400-kilometer distance from McMurdo and local weather conditions that make transportation to and from Siple unpredictable. Airplanes which leave McMurdo for Siple in good weather are often frustrated by the rapid onset of low ceilings or blowing snow, either of which can limit visibility and force planes to return without landing.

Blowing snow is also responsible for the prime difficulty in maintaining a station at Siple. Although annual snowfall is only about 1.5 meters, Siple's nearly constant winds move massive volumes of snow across the surface. Anything which protrudes above the surface obstructs the wind and creates a downwind eddy. A snow drift on the surface is formed and backs up toward the source of the obstruction. Because the transiting storm systems cause great variation in the wind direction, such snow drifts can cover an object 2 to 3 meters high in one season. Once snow drifting begins, it does not stop until the surface is again level around and over the obstruction. This drifting process explains why old Siple Station, completed in 1972, is now about 12 meters beneath the surface.

The snow that covered old Siple and that will eventually cover the new station is not in itself a matter of concern. The arch is strong enough to withstand a great deal more weight than the snow can provide. However, penetrations of the arch, necessary for exhaust and ventilation shafts, weaken the structure and allow heat to escape into the snow above. As the snow melts, its density and weight increase substantially and the resulting pressure attacks the arch at its weakest points, that is, where penetrations have been made.

The replacement station, designed in 1976 by Holmes & Narver, Inc., takes into account the lessons learned at old Siple. The arch is made of 12 gage corrugated steel. It is 13.5 meters wide and 80 meters long. Only two shafts penetrate the arch: an exhaust/fresh air return vent and a snow chute leading to the snow melter. Each of the penetrations is fitted with a specially designed collar that restores much of the strength lost by cutting through the arch. It should be about 10 years—double the life of the first Siple Station—before the new arch deteriorates under pressure from snow and ice above.

The new arch is 14 meters longer than the arch over old Siple. The buildings in the old station will not be moved into the replacement facility. Instead, the new station is composed of 24 building modules which were shipped disassembled from the U.S. Twenty-one of the modules are 2.4 meters by 7.3 meters; three of them are 2.4 meters by 8.5 meters. They provide living quarters for eight station personnel, space for scientific equipment, a power plant which houses three new electric generators, a communications room, a dispensary, a common dining area, a recreation room, and showers and toilets. The power plant is separate from the science and living quarters to minimize noise and electrical interference with the science equipment. New Siple is by no means spacious, but it is less cramped and much more comfortable than the old station.

UNITED STATES ANTARCTIC RESEARCH PROGRAM — USARP — NATIONAL SCIENCE FOUNDATION

Editor: Richard P. Muldoon

Antarctic Journal of the United States, established in 1966, reports on U.S. activities in Antarctica and related activities elsewhere, and on trends in the U.S. Antarctic Program. It is published quarterly (March, June, September, and December) with a fifth annual review issue in October, by the Division of Polar Programs, National Science Foundation, Washington, D.C. 20550. Telephone: 202/632-4076.

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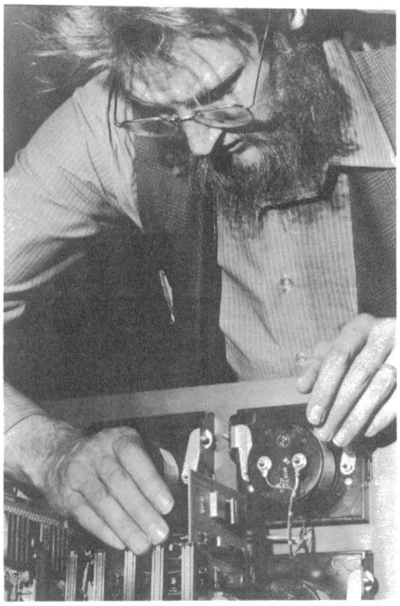
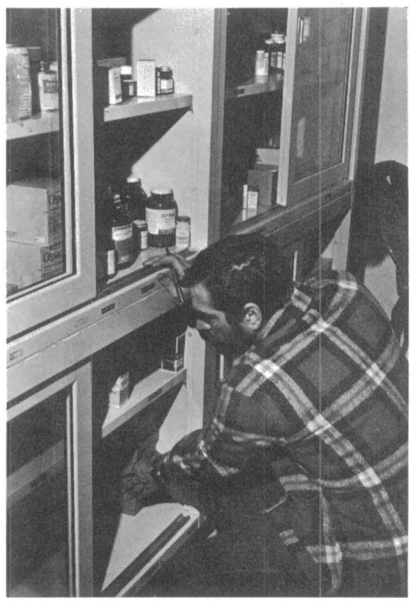
The director of the National Science Foundation has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the director of the Office of Management and Budget through 30 September 1979.

At left, a Stanford University researcher, Evans Paschal, inserts a plug-in circuit board in the Jupiter transmitter at Siple. At right, the winter paramedic, Don Bihler, stores supplies in the new dispensary.





U.S. Navy photos by Charles R. Hitchcock

Two of the diesel generators will be alternated to supply power for the station; the third will power only scientific equipment. Waste heat from the engines, collected by fancoil units using a glycol-water mixture, will be used to heat the station and to melt snow for a fresh water supply. Heat exchangers mounted on the engine exhaust stacks will provide additional heat for the station and also limit heat escape through the ventilation shaft into the snow above. Fuel for the diesels will be stored in two 25,000 gallon bladders that will remain in old Siple Station and in an additional bladder of the same capacity in the new station.

Extra diesel fuel will be stored in drums near the existing summer construction camp, which will be restocked for emergency use should anything go wrong at the station this winter. If necessary, ski-equipped LC-130 airplanes could fly to Siple in winter, but continual darkness, unprepared landing surfaces at Siple and McMurdo, characteristically poor communications during winter, the lack of operating ground navigational equipment, and temperatures too low for normal aircraft operations would make such a rescue flight itself dangerous. For these reasons the station is designed to be self-supporting during both normal and emergency conditions.

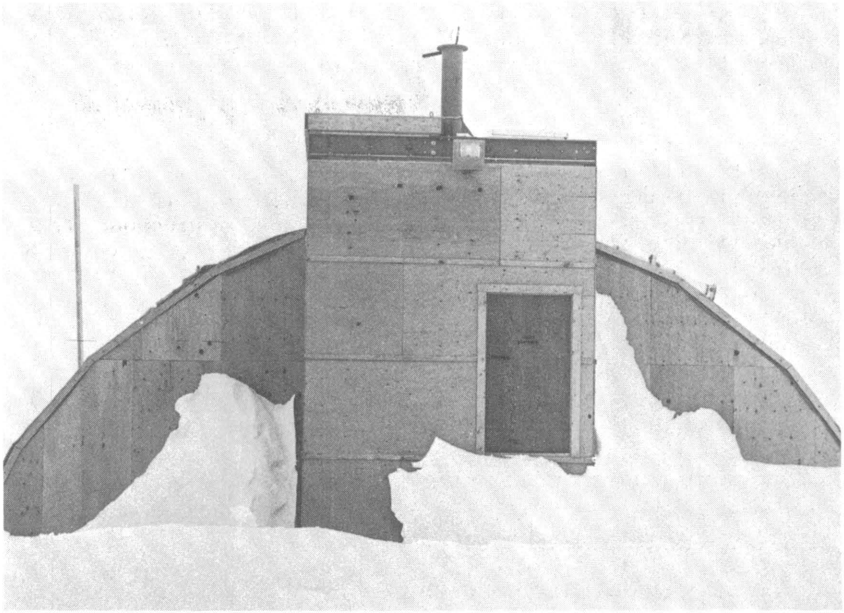
Science personnel this winter include the station science leader and two other researchers. The Navy has supplied a paramedic. Holmes & Narver, Inc., has provided a station manager, a facilities engineer, a communications technician, and a general maintenance mechanic. They will be isolated at Siple from February through November. In addition to conducting the science experiments planned for the station, the crew will put finishing touches on the interior.

Primary science will benefit from a new Jupiter VLF transmitter which is more powerful and more flexible than the Zeus transmitter used at old Siple. The Jupiter, almost unlimited in bandwidth and modulation range, will allow the researchers to program a wider variety of VLF signals with greater signal strength.

This winter Stanford University researchers will use the Jupiter transmitter to investigate wave-particle interactions in the plasmapause and to study wave-produced precipitation. Lockheed Palo Alto Research Laboratories scientists will use a six-channel meridian scanning photometer to study artificial aurora produced by VLF wave induced particle precipitation. Also this winter, an experiment designed by investigators at the University of Minnesota and the University of New Hampshire will examine the effect of increased solar activity on the shape and location of the plasmapause. The investigators will look for simultaneous occurrences of auroral light and ultra-low-frequency (ULF) pulsations in an attempt to compare ULF waves and interacting particles.

Equipment installed for a Bell Telephone Laboratories experiment will record changes in the earth's magnetic field that are produced by magnetic storms and by ULF waves propagating in the magnetosphere. Finally, an experiment on behalf of the University of Maryland and the Bell Telephone Laboratories will involve riometer measurement of the ionospheric absorption of extraterrestrial radio noise.

Stanford University serves as the science coordinator for all research conducted at Siple Station.



NSF photo

Drifting snow eventually will make this door invaluable. Its threshhold is about 4 meters above the current entrance to new Siple Station.

Siple dedication ceremony

On 14 January 1979, officials from the U.S. Antarctic Research Program dedicated the new research facility at Siple Station in Ellsworth Land. The ceremony was held in a snowstorm with winds up to 15 meters per second and temperatures around -15°C.

After an invocation by Father John Curnow of Christchurch, New Zealand, John F. Katsufrakis, the Siple science coordinator from Stanford University, spoke of the science projects that would be conducted at the new station and unfolded a new U.S. flag. Edward P. Todd, Director of the Division of Polar Programs at the National Science Foundation, dedicated the station for the United States and raised the new flag above the station. Also present were Captain Darrel E. Westbrook, Jr., USN, Commander of the U.S. Naval Support Force, Antarctica, and Earl P. Gilmore of Holmes & Narver, Inc.

The new station and its predecessor were named in honor of Paul Siple, who first visited Antarctica as an Eagle Scout 50 years ago with Richard E. Byrd. Dr. Siple returned often to Antarctica as both scientist and explorer. He was the first winter scientific leader at South Pole Station in 1956.

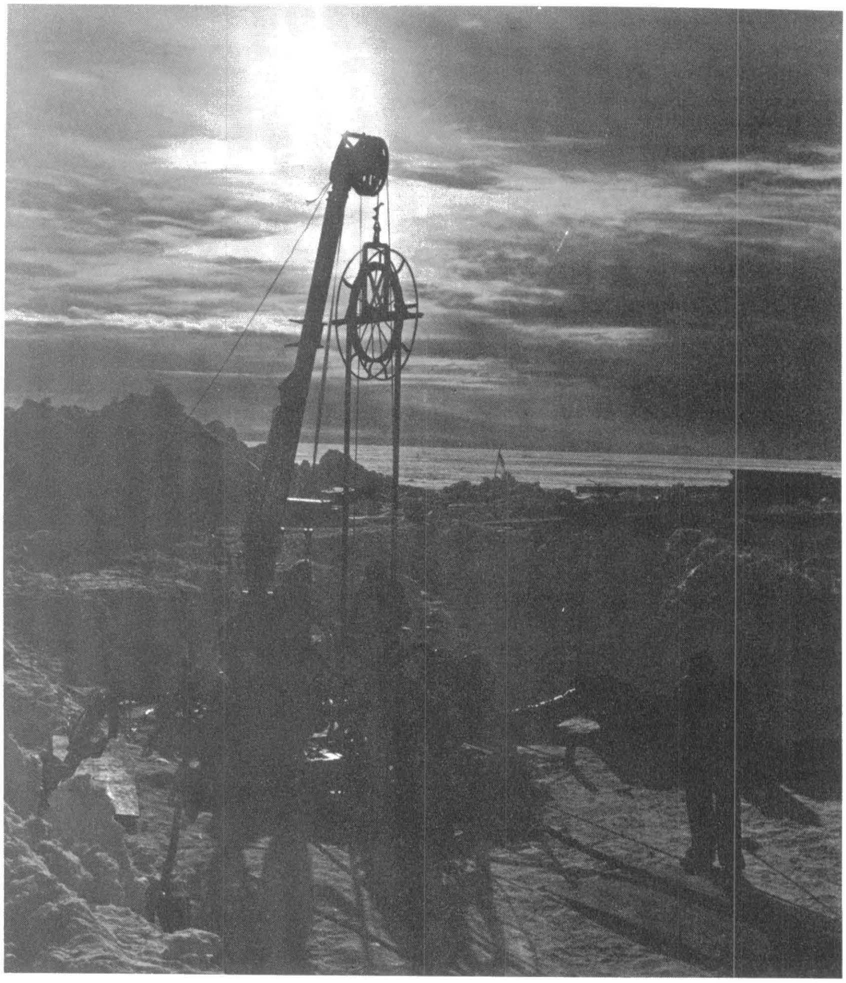
Drillers put three holes through Ross Ice Shelf

In the final season of the Ross Ice Shelf Project, technicians using the Browning hot water drill melted three holes through the ice shelf at site J-9 (82°22.5'S, 168°37.5'W), 480 kilometers south of the shelf's edge. The first hole went through the shelf on 29 November 1978 through 412 meters of ice. The water column beneath the shelf was 234.5 meters deep. This hole and the second, completed on 4 December, were used to lower instruments to the base of the shelf so they could be locked into the ice as the hole refroze. The third hole, drilled on 7 December, was the main access hole that allowed extensive sampling of the water column, bottom sediments, and life beneath the shelf.

The first hole was generally round and uniform with a few gentle bends. It measured 76 centimeters in diameter to 325 meters, 71 centimeters at 350 meters, and 51 centimeters at 400 meters. A television camera lowered into the hole showed a change in ice texture at about 400 meters. At 410 meters there were cracks and channels in the ice.

After the hole was reamed, another TV lowering showed a distinct change in the ice as the camera went down the hole. Above 300 meters, for example, the ice was light in color with long wave length ripple marks; below 300 meters, the ice was darker with shorter wave length marks. On the very bottom of the ice shelf there were many small, smooth ripples. Equipment designed to measure the mass balance and heat flow of seawater beneath the shelf was lowered into the water. It was locked into position beneath the shelf as the water in the hole refroze. A tape recording system installed on the surface of the shelf will record data throughout the coming winter.

The second hole was drilled on 4 December. This hole was everywhere greater than 76 centimeters in diameter except at the water-ice boundary where it was 51 centimeters wide. Ultrasonic instruments were lowered 2 meters below the water-ice boundary where, frozen in place by the closing hole, they will monitor the freezing and melting rates at the bottom of the ice shelf. A quartz thermometer was installed 3 meters above the water-ice boundary to provide additional data on freezing and melting processes.



U.S. Navy photo by Dave Thompson

The Browning hot water drill enabled researchers to melt three holes this season completely through the Ross Ice Shelf.

On 7 December, the main access hole through the shelf was completed. This hole was 76 centimeters or larger down to the water-ice boundary. There it was 64 centimeters wide. The hole was kept open for scientific sampling of the water and sediment beneath the shelf until 1 January 1979.

Sphincter cores, about 35 in all and up to 25 centimeters long, indicated that the bottom was somewhat rockier than at last season's sampling site. One black, fine-grained rock 5 centimeters long and smaller, similar rock particles were collected. About 40 gravity cores were taken, too, the longest of which was 125 centimeters.

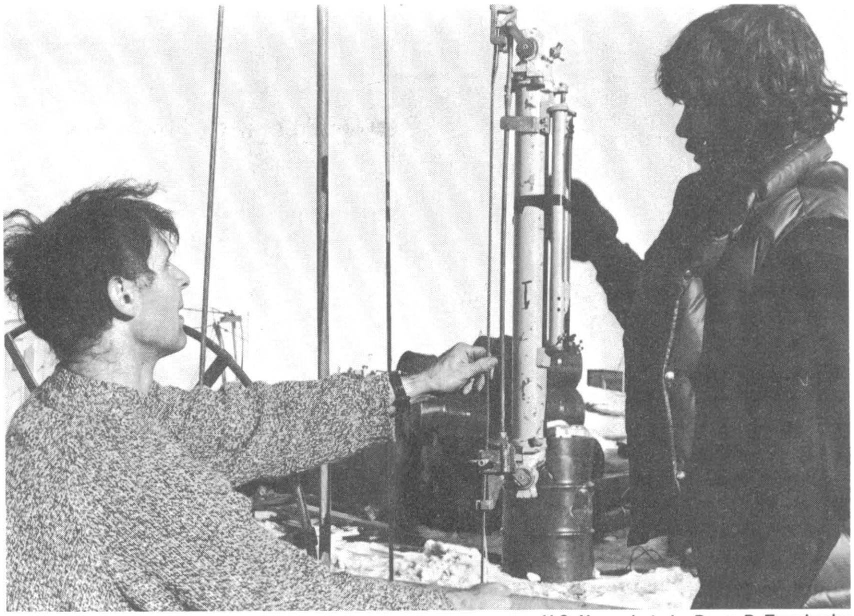
The sea bottom was covered by about 15 centimeters of sandy mud, some of which contained dead gastropods and dead foraminifera. Approximately 4,000 living amphipods of five species and several copepods were collected at the site. A decapod appeared during one television scan, but was not captured.

Sphincter cores, gravity cores, and living organisms brought up through the access hole will enable researchers to study the history of life near the sea bottom and the organisms that live there today.

The microbial population in the water column was sampled in 18 water bottle casts. Researchers at the drill site examined each water sample for oxygen, salinity, epifluorescence, pigment, particulate organic carbon, and nutrient contents. They also assayed the number of microorganisms in each sample and conducted three umbrella tows to retrieve plankton. Deep sea water was pumped to the surface from 20 different depths in the water column and similarly examined. These studies will produce a description of biotic activity in the water column and define the composition of the water itself between the sea floor and the bottom of the ice shelf.

Current meters were lowered into the water beneath the shelf before the third hole refroze. These meters measured movements of water beneath the shelf. This data, combined with data gained in open areas of the Ross Sea, will enable researchers to describe the interactions of glacial ice and sea water beneath the shelf and where the shelf meets open water.

All science projects scheduled for the drill site this season were finished by 1 January 1979. This was the last drilling season for the Ross Ice Shelf Project. All the drilling equipment and most of the camp were to be returned to McMurdo by the end of the 1978-79 field season.



U.S. Navy photo by Bruce R. Trombecky

Two researchers, Peter Bruchhausen and Tom Converse, inspect a water sampling bottle before it is lowered through the Ross Ice Shelf access hole.

Core obtained through Ross Ice Shelf

Soviet drillers working with the U.S. Ross Ice Shelf Project used two thermal drills to obtain 381 meters of ice core completely through the Ross Ice Shelf at site J-9. The thermal drills operated by melting a ring around the ice core, which was then captured and raised to the surface in 10 meter segments. The core includes 6 meters of briny ice from the bottom of the shelf.

A distinct boundary between fresh and briny ice appears at 410 meters below the ice surface. The 6 meters of briny ice core are mottled with grey inclusions which may be brine pockets. Widely scattered inclusions of opaque material, probably of marine origin, also appear. There are distinct bands or layers of ice up to 1 centimeter thick throughout the briny ice. Their orientation suggests that they are alined with the main current direction beneath the shelf.

The very bottom of the core is sharply defined. The bottom few centimeters show a columnar structure or ice fabric made up of protruding ice crystals each about 5 centimeters in diameter. These protruding crystals give a waffle-iron appearance to the end of the core.

It took the Soviet team only 12 days to penetrate the 416-meter thick Ross Ice Shelf. The total weight of the ice core is 4,000 kilograms. The cores are packed in 370 tubes. Core cutting will be performed at the core storage facility at the Department of Geology, State University of New York at Buffalo. Igor Zotikov, the Soviet glaciologist who headed the coring team, is spending several months working with colleagues in the United States before returning to the Soviet Union.

About 4,000 of these amphipods were collected through the main Ross Ice Shelf access hole in December.

U.S. Navy photo by Bruce R. Trombecky

Airborne research

All air sampling, aerial photography, airborne magnetometry, and radio echo sounding flights scheduled for the 1978-79 U.S. Antarctic Research Program were completed by the end of December 1978. The research airplane, an LC-130 Hercules modified to accept a number of instrument packages, allowed scientists to obtain data from specific altitudes over many locations in Antarctica.

Air sampling experiments designed by eight investigators examined storm fronts, transport paths, aerosols, ice crystals, and the concentration and distribution of trace gases in the atmosphere. The investigators obtained:

- vertical profiles of continental and maritime air masses;
- vertical and latitudinal atmospheric tritium samples;
- data on particle concentrations in the upper troposphere and on the transport of particulate matter to the Polar Plateau;
- air samples near the surface of the Ross Sea;
- cloud physics observations over the Ross Sea and the Ross Ice Shelf;
- cloud and ice crystal photography over the interior and on descents to South Pole Station;
- tracking data on the Mt. Erebus volcanic plume for about 65 kilometers downwind on a clear, stable day.

The only disappointment was the disappearance of a banded structure in a barometric pressure trough over the Ross Sea while the airplane was heading toward it.

Aerial photography missions were designed to supplement studies of the Byrd Glacier and to map areas scheduled for future projects, particularly the Darwin Glacier and the Heritage and Sentinel Ranges in the Ellsworth Mountains.

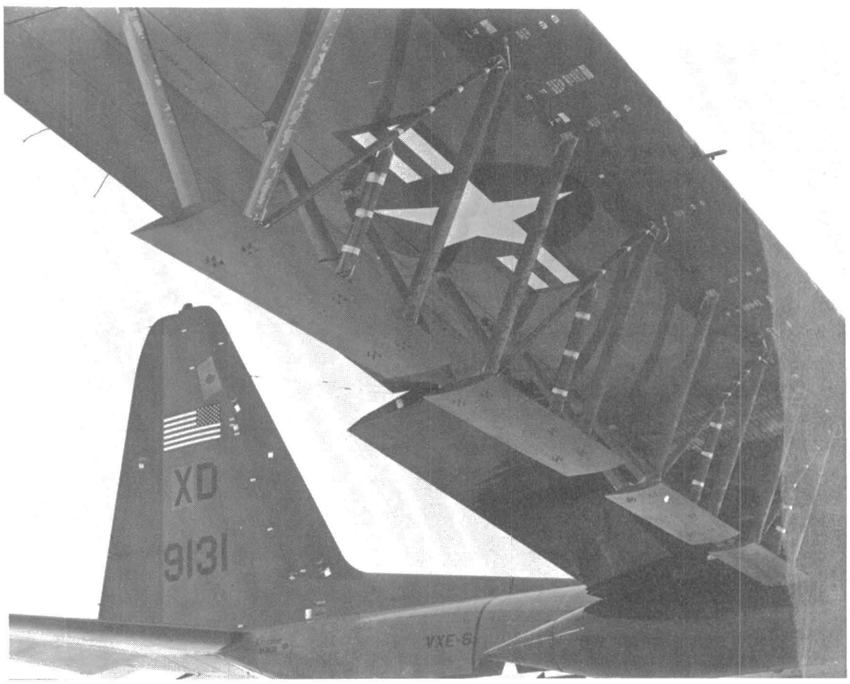
Byrd Glacier was photographed after field parties had placed markers on its surface. A second photograph of the glacier taken exactly five weeks after the first will record the movement of the markers. The relative movements of the markers, measured by aerial photogrammetric surveys and ground surveys, will enable researchers to determine the strain rate for the Byrd Glacier-Ross Ice Shelf dynamic system. Accurate measurement depends on determining within 10 meters the relative movements of two features that were initially 1 kilometer apart.

Aeromagnetic surveys and radio echo soundings were flown over the Dufek Massif, the Ross Sea continental shelf, the dome C area, and over much of Ellsworth Land and Marie Byrd Land.

The aeromagnetic survey of the Dufek Massif was part of an overall effort to evaluate the geology of this basic layered intrusion. The survey indicated that the Dufek Massif is much longer than was previously supposed. It is still only the second largest layered intrusion in the world, but the new survey may increase its significance as a research site.

Radio echo sounding of the dome C area provided data on ice thickness and internal layering that will support ground based research. Other radio echo soundings, part of the International Antarctic Glaciological Project, contributed to the development of a 100-kilometer grid network that eventually will cover all of Antarctica.

This antenna array attached to the research airplane allowed scientists to determine the thickness of the ice sheet.



U.S. Navy photo by Jerry Moore

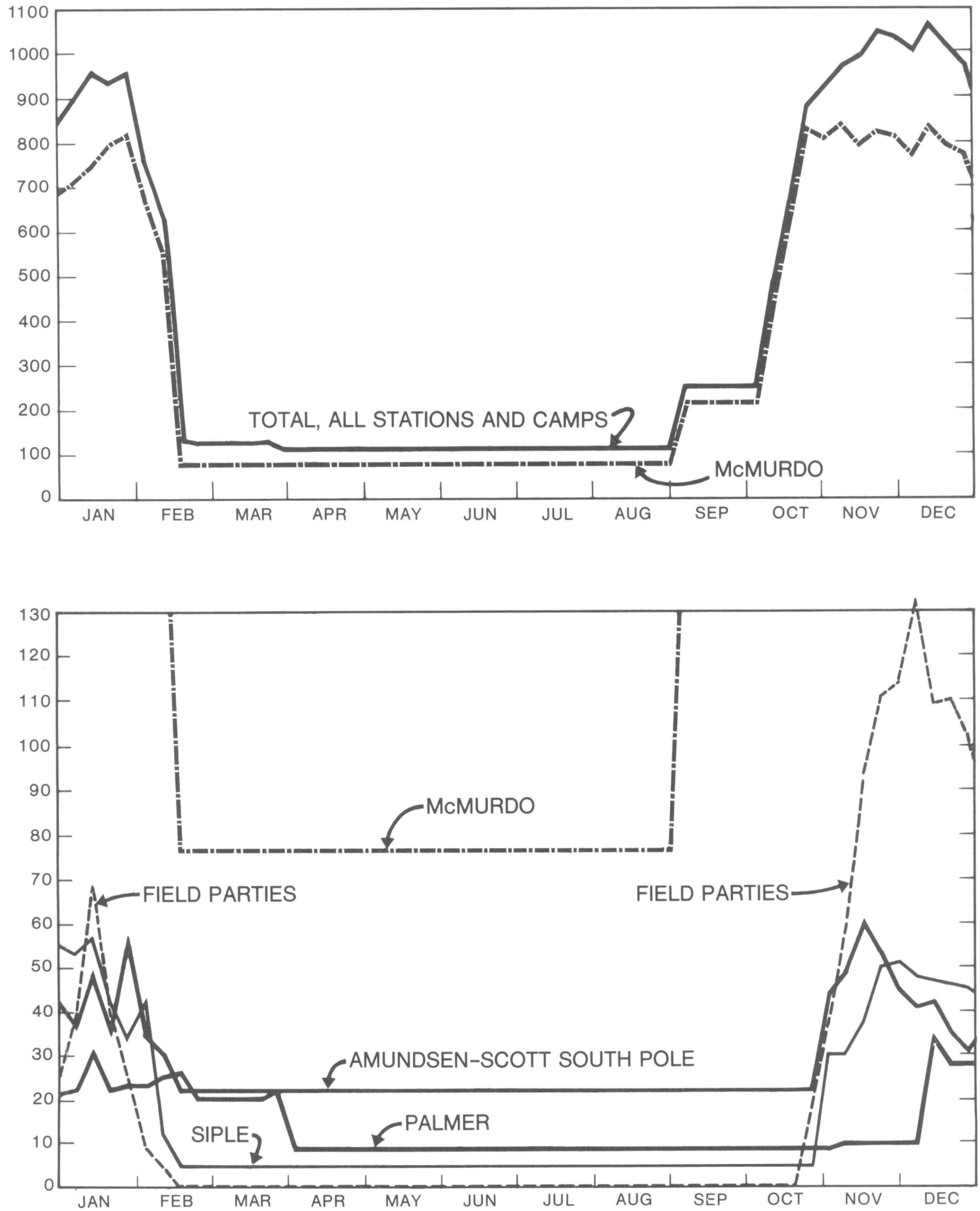
U.S. antarctic population, 1978

In 1978 the U.S. population in Antarctica varied from 112 to 1,064 (see graphs). As the year began, all four stations were full and field parties occupied temporary camps across the continent. As projects were completed, researchers flew home and the population declined.

By mid-February only the winter parties were left at Siple (5 people) and at Amundsen-Scott South Pole (22 people). Within a few days McMurdo reached its winter level of 76. At the end of March the last ship left Palmer in the hands of its winter crew of 9.

Early in September planes from California landed at McMurdo, ending the station's 6½ month isolation and raising its population to 217. In October new summer workers arrived at McMurdo, relieved the South Pole and Siple crews, and established new field camps. Palmer was relieved by ship in November.

Not included in the graphs are U.S. ship complements. In January the ships added approximately 500 people. The numbers and trends in 1978 were typical of recent years in the U.S. program.



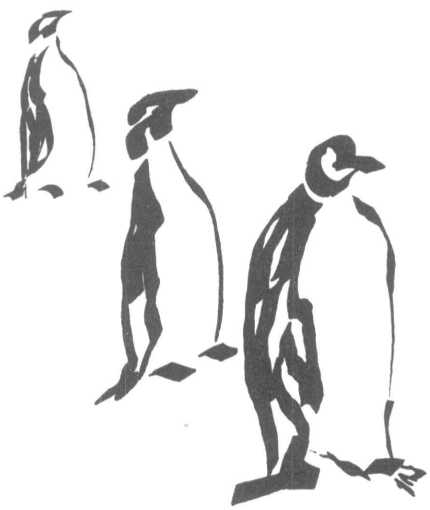
U.S. population in Antarctica, 1978

U.S. Navy photo by Howard Weinger

Scott's hut at Cape Evans, Ross Island, was built for the British Antarctic Expedition, 1910-13, when Scott and his party were unable to reach Hut Point because of ice conditions. The hut at Cape Evans stands today as an historic monument to the exploration of Antarctica.

New temperature high for South Pole

A 5-day snowstorm that began on Christmas Eve brought a record high temperature to South Pole Station. On 27 December 1978, the temperature reached -13.6°C. Barometric pressure that day, also a record high for South Pole, reached 705.7 millibars. The storm was caused by a very strong flow at all levels of warm, moist, maritime air from the Weddell Sea.



1979 orientation dates set

The U.S. Antarctic Research Program 1979 orientation session will take place 16-19 September 1979 at the Sheraton National Motor Hotel in Arlington, Virginia. All those participating in the 1979-80 antarctic field season should plan to attend the conference, which is not open to the public.

The orientation session is designed to place the work of participating scientists and support staff in the national and international contexts of antarctic research as well as to instruct participants in cold weather survival techniques and to acquaint them in advance with problems that might occur in the field. The conference also allows field invetigators to make final logistic arrangements for their programs. A separate portion of the conference is devoted to psychological orientation for winter personnel.

Transportation costs to the orientation conference are included in grant or contract budgets. Lodging and meals are supplied by the National Science Foundation.

RISP featured in *Science*

The 2 February 1979 issue of *Science* magazine featured 10 articles by researchers involved in the Ross Ice Shelf Project (RISP) and one report on meteorites found in the Allan Hills.

The RISP reports cover the drilling of the access hole in 1976, sediment studies, investigations of water temperature, circulation, and freezing, and studies of various organisms found beneath the shelf.

Science is published weekly by the American Association for the Advancement of Science. Back issues are available by mail for $3.00 from *Science,* 1515 Massachusetts Avenue, Washington, D.C. 20005.

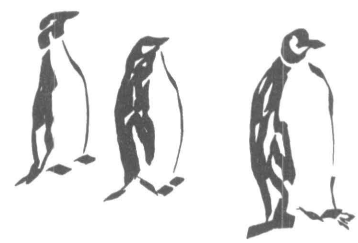
Antarctic conservation draft regulations published

Pursuant to the Antarctic Conservation Act of 1978 (Public Law 95-541) the Foundation has proposed regulations to conserve and protect animals and plants native to Antarctica.

The regulations would apply to all U.S. citizens in Antarctica and to everyone importing into or exporting from the United States designated antarctic animals and certain antarctic plants or parts of them.

The purpose of the regulations is to protect antarctic ecological systems in accordance with internationally established measures. Civil and criminal penalties for noncompliance are provided in the Act.

The proposed regulations were published in the March 6 *Federal Register,* pages 12214-12220.



Royal Australian Air Force photo

On 1 December 1978, a Royal Australian Air Force C-130 completed the first Australian Hercules landing in Antarctica. The airplane took off from Christchurch, New Zealand and landed on the sea ice runway at McMurdo Station, covering almost 4000 kilometers in 6 hours and 15 minutes. The Hercules carried 10 passengers and 11,000 kilograms of cargo in support of research teams working in Antarctica. It was the first of four Australian flights scheduled this season.

1980 funds requested for research, support

In its budget request for the 1980 fiscal year (1 October 1979 to 30 September 1980) the National Science Foundation has specified $55 million for support of the U.S. Antarctic Program. Of this amount, $8 million is for research (see box) and $47 million is for operational support.

The request for research funds substantially exceeds the 1979 level of $6.5 million. Much of the planned increase is for study of the marine ecosystem in the oceans surrounding Antarctica. Recent interest in this ecosystem has centered on krill (*Euphausia superba*), a crustacean that swarms in great numbers and could become an important source of food for people. Areas for increased emphasis include study of primary productivity; the life cycle, swarming habits, and distribution of krill; and other components of the ecosystem.

Operational support will include maintenance of four year-round stations and other field facilities; operation of ships, icebreakers, and aircraft; and a major overhaul in the United States of the ice-strengthened research ship *Hero*.

The Foundation's requested 1980 budget for $1.006 billion is 8.4 percent above the 1979 fiscal level. Richard C. Atkinson, Director of the Foundation, said the top Foundation priority is to increase support for basic research in the sciences and engineering to ensure the Nation's scientific strength.

Congressional decisions on the request are expected before the end of the current fiscal year.

Proposals due 1 June

The National Science Foundation envisions the availability of about $8 million in fiscal 1980 for research in Antarctica and its environs, including data reduction or related research at institutions in the United States.

Proposals for scientific research projects that are received by 1 June 1979 will be considered for performance periods as follows:

- for research *in Antarctica* during the 1980-1981 austral summer season (September 1980 through March 1981) and extending through the antarctic winter of 1981 if appropriate.
- for research or data analysis *in the United States* commencing approximately January 1980.

In some cases, an additional year of lead time is required if projects require substantial preparation of facilities, extensive vehicle use, transportation of large amounts of cargo or equipment, etc. Researchers may have to allow time for the procurement of supplies and their transport in the annual cargo ship one year in advance of the season in which the fieldwork will be accomplished.

Scientists wishing to perform antarctic research should investigate eligibility requirements and submit proposals in collaboration with their institutions as specified in the Foundation's booklet *Grants for Scientific Research* (NSF 78-41 or NSF 78-41A). A copy of this booklet, a description of antarctic research opportunities, and other necessary forms and instructions should be obtained from the Division of Polar Programs (telephone 202-632-4076) before submitting proposals.

Foundation awards of funds for antarctic projects

1 October to 31 December 1978

Following is a list of National Science Foundation antarctic awards made from 1 October to 31 December 1978. Each item contains the name of the principal investigator or the project manager, his or her institution, a shortened title of the project, the award number, its duration, and the amount awarded. If an investigator received a joint award from more than one Foundation program, the antarctic program funds are listed first, and the total amount of the award is listed in parentheses. Amounts followed by an asterisk are funding increments. International Southern Ocean Studies awards were made by the Division of Ocean Sciences. All other awards were made by the Division of Polar Programs.

Support and services

Johnson, James R. Holmes & Narver, Inc., Orange, California. Operation of Palmer Station and research ship *Hero*. DPP 74-03237. 7 months. $1,500,000.

Johnson, James R. Holmes & Narver, Inc., Orange, California. Station operation and other support. DPP 73-07187. 8 months. $4,000,000.

Spilhaus, A. F. American Geophysical Union, Washington, D.C. Publication of *Antarctic Research Series*. DPP 77-21859. 12 months. $36,000.

Westbrook, Darrel E. Department of Defense, U.S. Navy, Washington, D.C. Logistics and support. DPP 76-10886. 9 months. $25,000,000.

Glaciology

Clough, John W. University of Nebraska, Lincoln, Nebraska. Management of the Ross Ice Shelf Project. DPP 72-20410. 12 months. $341,306.

King, Elbert A. University of Houston, Houston, Texas. Preliminary investigation of cometary dust. DPP 78-20410. 12 months. $28,937.

Atmospheric science

Cahill, Laurence J. University of Minnesota, Minneapolis, Minnesota. Micropulsation research at Siple Station and Roberval, Quebec. DPP 77-21924. 12 months. $29,706 ($69,706).

Helliwell, Robert A. Stanford University, Stanford, California. Very-low-frequency probing of the magnetosphere from Palmer Station. DPP 76-82042. 12 months. $61,800.

Pomerantz, Martin A. Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania. Cosmic ray intensity variations. DPP 76-23429. 12 months. $114,140.

Polar biology and medicine

Landrum, Betty J. Smithsonian Institute, Washington, D.C. Cooperative systematics and analysis of polar biological materials. DPP 76-23979. 12 months. $99,927.

McWhinnie, Mary A. DePaul University, Chicago, Illinois. Biological investigations of krill *(Euphausia superba)*. DPP 76-23437. 12 months. $84,000.

Parmelee, David F. University of Minnesota, Minneapolis, Minnesota. Ecological and behavioral adaptations to environments at Palmer Station. DPP 77-22096. 12 months. $66,667.

Siniff, Donald B. University of Minnesota, Minneapolis, Minnesota. Role of the leopard seal in marine ecosystems. DPP 77-21946. 12 months. $70,414.

Meteorology

Ostlund, H. Gote. University of Miami, Miami, Florida. Tritium. DPP 76-23433. 12 months. $19,200.

Schwerdtfeger, Werner. University of Wisconsin, Madison, Wisconsin. Meteorology. DPP 77-04506. 2 months. $50,401.

Ocean sciences

Anderson, John B. Rice University, Houston, Texas. Marine geologic study of the eastern Weddell Sea and Bransfield Strait. DPP 77-26407. 12 months. $24,430.

Gordon, Arnold L. Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York. Physical oceanography of the Ross Sea. DPP 77-22209 12 months. $83,000.

Gordon, Arnold L. Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York. Processing and analysis of *Islas Orcadas* hydrographic circumpolar data. DPP 78-24832. 12 months. $81,710.

Johnson, David A. Woods Hole Oceanographic Institution, Woods Hole, Massachusetts. Quaternary thermohaline circulation in the southern ocean. DPP 78-21105. 12 months. $43,900.

Kellogg, Thomas B. University of Maine, Orono, Maine. Quantitative paleoclimatic analysis of Ross Sea continental shelf sediments. DPP 77-21083. 12 months. $43,884.

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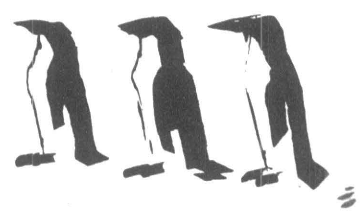

Monthly climate summary

Feature	November 1978				December 1978				January 1979			
	McMurdo (date)	Palmer (date)	Siple	South Pole (date)	McMurdo (date)	Palmer (date)	Siple	South Pole (date)	McMurdo (date)	Palmer (date)	Siple	South Pole (date)
Average temperature (°C)	-10.5	-1.9	-15.9	-38.8	-4.7	1	-13.4	-28.2	-3.7	2.0	-11.9	-27.5
Temperature maximum (°C)	0.0 (15)	3.0 (13,16,27)	5.0 (24)	-31.6 (27)	9.6 (29)	5 (25)	6.6 (18)	-13.6 (27)	4.5 (8)	8.0 (20)	-0.5 (19)	-19.4 (1)
Temperature minimum (°C)	-18.9 (6)	-10.0 (2)	-36.0 (2)	-49.3 (2)	-14.4 (5)	-5 (1)	-25.0 (1)	-38.9 (3)	-11.1 (27)	-3.0 (10)	-23.9 (31)	-36.1 (30,31)
Average station pressure (mb)	985.4	992.2	862.5	683.8	987.2	980.8	864.7	687.8	986.5	992.7	865.1	688.4
Pressure maximum (mb)	999.2 (1)	1005.1 (4)	878.3 (5)	691.8 (3)	995.6 (10)	999.9 (1)	878.4 (29)	705.7 (27)	996.9 (20)	1009.8 (18)	874.1 (12)	688.4 (1)
Pressure minimum (mb)	970.4 (7)	971.7 (22)	850.9 (13)	675.8 (22)	976.8 (20)	961.0 (10)	851.3 (11)	676.4 (5)	977.1 (23)	973.2 (23)	851.6 (23)	681.1 (31)
Snowfall (mm)	7.6		487.7	Trace	35.6		175.3	Trace	66.0		203.2	Trace
Prevailing wind direction	070°	220°	160°	050°	090°	220°	225°	020°	070°	050°	160°	045°
Average wind speed (m/sec)	5.1	4.2	4.7	4.2	5.2		4.9	3.9	4.5	4.0	5.1	3.7
Fastest wind speed (m/sec)	135° (26)	21.0 360° (16)	13.0 090° (27)	12.9 340° (13)	27.7 220° (29)	21.0 020° (16)	19.2 225° (11)	14.9 010° (28)	18.5 090° (4)	18.0 030° (20)	17.9 135° (20)	9.8 340° (24)
Average sky cover	6.0/10	7.3/10	7.3/10	3.8/8	5.2/10	9.0/10	6.4/10	4.3/8	6.8/10	8.0/10	7.4/10	5.2/10
Number clear days	7	2	5	12	9	0.6	6	7	4	1.7	5	11
Number partly cloudy days	10	11	7	9	14	9.0	9	14	12	11.0	6	9
Number cloudy days	13	17	18	9	8	27.3	16	10	15	22.3	20	11
Number days with visibility less than 0.4 km	0	0	4.3	1	2	0	3.9	5	0.2	0	5.8	0

Prepared from information received by teletype from the stations. Locations: McMurdo 77°51′S. 166°40′E. Palmer 64°46′S. 64°03′W. Siple 75°55′S. 83°55′W. Amundsen-Scott South Pole 90°S. For prior data and daily logs contact National Climatic Center, Asheville, North Carolina 28801.

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