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CONTENTS

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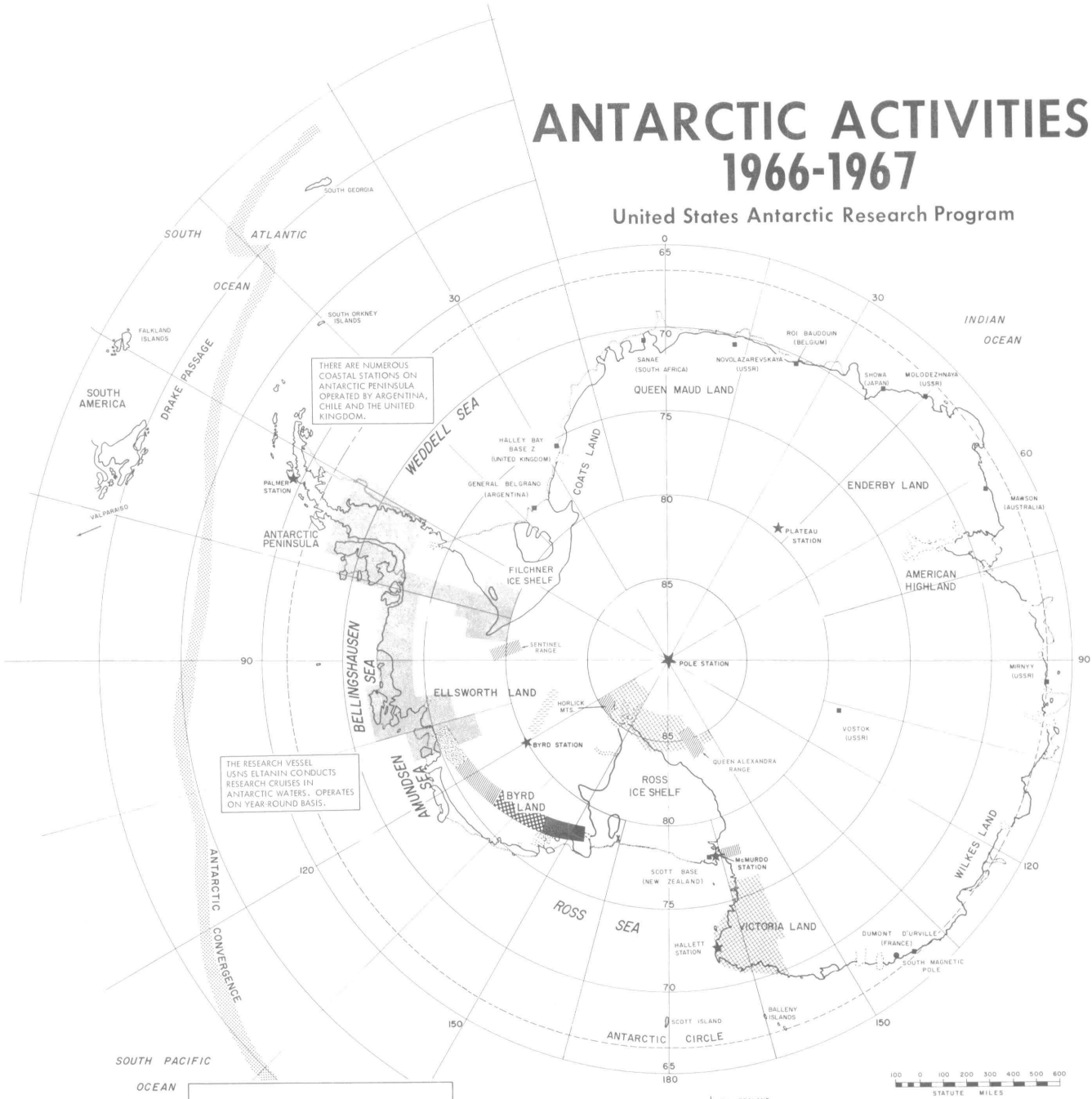
ANTARCTIC ACTIVITIES 1966-1967

United States Antarctic Research Program



LEGEND

- ★ U.S., U.S. Cooperative Stations
- ■ Foreign Stations
- Aerial Photography for Mapping
- Topographic Map Compilation
- Geological Field Parties
- Aerial Photography for Ice Movement Study
- Map Control
- Biological Field Parties
- Geophysical Investigations

STATION DESCRIPTION

	BYRD	HALLETT (U.S.-NEW ZEALAND)	McMURDO	PALMER	PLATEAU	POLE	USNS ELTANIN
LOCATION	LAT. 79° 59'S LONG. 120° 01'W	LAT. 72° 18'S LONG. 170° 18'E	LAT. 77° 51'S LONG. 166° 37'E	LAT. 64° 45'S LONG. 64° 05'W	LAT. 79° 15'S LONG. 40° 30'E	LAT. 90°S	Western Terminus-Wellington Eastern Terminus-Valparaiso
FEET ABOVE SEA LEVEL	4,971	16	102	25	11,890	9,184	-
ESTABLISHED	1957	1957	1956	1965	1966	1957	1962
TERRAIN	ON INLAND ICE	ON GLACIAL MORAINE	ON VOLCANIC ASH	ON BEDROCK	ON INLAND ICE	ON INLAND ICE	-
METHOD OF SUPPLY	AIR	AIR SEA	AIR SEA	SEA	AIR	AIR	-
NUMBER OF BUILDINGS	15	10	70	2	8	11	-
MEAN ANNUAL TEMPERATURE (°F)	-18.6	+4.2	+0.1	+20 (estimated)	-	-56.7	-
MEAN TEMP. (°F) DEC., JAN., FEB.	+1.6	+28.2	+21.6	+30 (estimated)	-	-25.2	-
APPROXIMATE WINTER PERSONNEL (SCIENTISTS) (NAVY)	9 17	SUMMER STATION ONLY	7 260	5 4	4 4	7 13	scientists 34 (year round) MSTS crew 48 operation
AIR DISTANCE FROM McMURDO (STATUTE MILES)	885	380	-	2,360	1,350	820	-

NEW ZEALAND

Activities in December and January

At all United States stations, scientific and support activities continued at a good pace during December and January except for construction at Palmer Station and the survey of the coastal area of Byrd Land, where inclement weather and the lingering effects of the loss of a helicopter in late November impeded progress. In January, enough work still remained to be done out of Byrd Land Camp No. 1 that preseason plans to establish two additional camps during the summer were abandoned. On January 26, personnel of Camp No. 1 returned to McMurdo, the season's work having been completed in that area.

In contrast to the slow progress of activities in Byrd Land, the aerial photography program proceeded exceptionally well. By the end of January, 333,000 square miles of acceptable coverage had been obtained, mostly of Palmer Land, Ellsworth Land, and the Ross Ice Shelf. Of considerable popular interest were the successful ascents by the American Antarctic Mountaineering Expedition of Vinson Massif and Mount Tyree, the two highest mountains in Antarctica, and four other peaks in the Ellsworth Mountains (cf. page 48).

RESEARCH

McMurdo Station

Scientific facilities were renovated, a new Jamesway building was erected to house the riometers of the Douglas Aircraft Company, and a permanent gravity station was installed behind the Earth Sciences Building.

The collection of upper-atmosphere data continued. On January 28, a polar cap absorption event was recorded at the cosmic-ray laboratory of the Bartol Research Foundation and on the Douglas Aircraft Company's riometers. The event, which began at 0417, showed greatly increased absorption at 0915. It reached a maximum of 7 decibels at 2400 on the 28th and was still in progress at 2300 on the 31st, when 1.5 db. were recorded.

At the New Mexico State University's satellite tracking station, 601 passes of 6 satellites were monitored. In late December, the tracking operations were concluded and preparations were made to close the facility for the winter.

Also in December, Dr. Roland Souchez, an exchange scientist from the University of Brussels, conducted geological studies at the transition zone between the ice sheet and its outlet glaciers in the Taylor Glacier region. This study extended southward his studies in the Webb and Wright Upper Glacier regions, begun in 1965. Four main topics were investigated: the characteristics of rock shattering by frost, the process by which outlet glaciers pluck debris from the rock surface, the genesis of shear moraines, and the nature of glacial erosion of dolerite sills and rocks of the Beacon Formation.

A geological party from the University of New South Wales, Australia, spent 20 days in January mapping Arena Valley in detail. Complex structures, including overturned folds, diversely oriented blocks, and intraformational discordances, were studied within the lowest 300 meters (1,000 feet) of the Beacon sequence. Stratigraphic sections were examined in an area bounded by Mount Gran, Aztec Mountain, and Victoria and Wright Valleys.

The University of Massachusetts' geological studies of the Beacon Formation sediments of central Victoria Land terminated late in December. Information on paleocurrents and stratigraphy was collected from Allan Hills, Robison Peak, and Mounts Gran, Fleming, Boreas, Feather, and Crean.

Biologists from the Jet Propulsion Laboratory (JPL) of the California Institute of Technology and from Virginia Polytechnic Institute (VPI) jointly occupied camps in the dry valleys to conduct studies of microorganisms in soils.

JPL investigators collected about 75 soil samples above permafrost levels at 25 sites in McKelvey, Balham, Barwick, Taylor, Wright, Victoria, Arena, and Beacon Valleys and at Brown Peninsula, Marble Point, and Bull Pass. Bacteria were found to increase in number with depth of soil, the greatest number occurring just above the top of the permafrost layer. Far fewer bacteria were counted in these soils than have been counted in typical desert soils. One algae and a fungus, *Penicillium* sp., were found at the soil surface. Yeasts and bacilli (aerobes, microaerophiles, and anaerobes, including psychrophilic anaerobes) were found between the surface and hard permafrost. The samples were shipped to several institutions conducting life-detection experiments for NASA.

To supplement data obtained from the soils, measurements of solar radiation and heat energy, net thermal exchange, light intensity, humidity, temperature, evaporation rate, and wind direction and velocity were made in McKelvey Valley and at Lake Vida.

About 125 soil samples were taken by VPI biologists in Taylor, Wright, Beacon, Balham, Wheeler, Barwick, and Victoria Valleys and at Bull Pass, Bratina Island, and Marble Point. Some

samples were analyzed at the McMurdo laboratory for microbial, organic, and moisture content, while others were frozen for shipment to the Institute. In almost all of the dry-valley samples subjected to microbial-isolation media at McMurdo, bacteria were found to be present. In most of the soils, the microbial count varied from several hundred to several million per gram of soil, depending apparently upon moisture content and proximity to past or present concentrations of algae. Approximately 100 mesophilic and 75 psychrophilic bacteria and numerous yeasts and algae were isolated. Yeasts and moderately halophilic bacteria occurred in proportionately higher numbers in these soils than they do in temperate-zone soils.

The VPI study revealed that when sunlight is continuous and meltwater is present in the soils, the microbial count may be several million organisms per gram of soil. Under such conditions, the soil temperature is usually 10°C. higher than the air temperature. A high reading of 18°C. (65°F.) was recorded in the surface soil of Barwick Valley on January 12.

During December, a University of South Dakota team conducting a study of protozoans visited Cape Crozier. The feces of 60 skuas, 103 Adélie penguins, and 1 emperor penguin were examined to determine their parasite content. Numerous soil samples and several green ice samples from a meltwater pond were obtained. In Taylor Valley, water samples were collected, and a 24-hour temperature study was made with 6 thermistors at the head of a flow of glacial meltwater entering Lake Bonney. Water samples were collected also at Marble Point. At Cape Royds, lake-water samples rich in protozoans were collected. The water contained a large and interesting group of ciliates, including the red rotifer and two types of red ciliates.

Johns Hopkins University biologists implanted transmitters in free-living and captive Adélies to measure body temperatures and heart rates of the penguins. Some of these measurements were made of young Adélie chicks in their own nests and in an improvised cold chamber during brooding periods. To learn more about the role of penguin flippers and feet in thermoregulation, the group made a series of observations of the changes in temperature gradient along these extremities of emperor penguin chicks that had been moved to the station from their rookery on the sea ice.

During a series of visits to the emperor penguin rookery on the sea ice east of Cape Crozier, 141 chicks and 26 adults were banded and 160 sample weights taken to measure rates of weight increases in the chicks. The study ended with the breakup of the sea ice adjoining the seaward enclave.

Two species of Mallophaga and three species of mites were found on 45 skuas examined at Cape Royds by biologists from Texas Technological College. Ectoparasites were not found on 20 Adélie penguins examined at the same location nor on 15 Adélie chicks that had died of natural causes at Cape Crozier. Two Weddell seals examined at Scott Base carried only the louse common to the species. A laboratory study of the free-living common mite *Stereotydeus mollis* revealed that this species can survive for at least a month at room temperatures, as can the common springtail, and that it can lay eggs, although in this experiment the eggs did not hatch.

University of California (Davis) biochemists prepared one gram of dialyzed and lyophilized penguin ovomucoid that was 95 percent pure, and two grams of dialyzed and lyophilized penguin ovomucin. Of 30 penguin eggs incubated, 91 percent hatched. The chicks lived for nine days. Electrophoreses by starch gel were run to compare the lactic dehydrogenase of different organs (muscle, liver, spleen, eye, testis, and ovary) of the fishes *Trematomus bernacchii, T. borchgrevinki, T. hansoni,* and *Dissostichus mawsoni,* as well as of penguin and seal species. Thirteen specimens of *D. mawsoni,* most of them alive and averaging 50 pounds in weight, were brought to the surface on 13 occasions by a "tame" seal and collected by the biochemists. Immunoelectrophoresis and immunodiffusion were done to see if antibodies were produced in the blood of penguins injected with bovine serum albumin and chicken egg white. I^{131} and Fe^{59} were used to produce radioautograms of the samples run. Purification of aldolase and lactic dehydrogenase was done by means of column chromatography.

The Ohio State University party at Meserve Glacier resurveyed the existing velocity and ablation/accumulation markers in the upper and lower

(NSF photo)

Entrance to tunnel in the base of Meserve Glacier.

regions of the glacier. The surface-strain networks were also resurveyed and expanded. The tunnel in the glacier's base was extended to a total length of 112 meters, gauges and deformation pegs were resurveyed, and additional devices were applied to record strain. Two holes were drilled and cores obtained for ice-fabric study; the holes were measured for deformation and, with the aid of a thermistor line, temperature profiles were obtained over a period of 2½ months.

Structural measurements were made close to the base of Meserve Glacier, samples of basal debris were obtained, and meltwater was collected for salinity determinations. Calving rates were recorded which, when used with the other data, will enable a mass-balance calculation to be made for the year 1965/66-1966/67. Some auxiliary studies in glacial geology were conducted and six-hourly meteorological observations were made near the glacier.

Byrd Land Survey

The weather in Byrd Land, which improved little in December and January over that of November, continued to hamper field work conducted out of Camp No. 1. The geological team from Texas Technological College completed its survey of the Fosdick Mountains and studied parts of the Phillips and Alexandra Mountains. The Phillips Mountains and outlying nunataks were found to be similar in petrography and structure to the Ford Ranges south of the Fosdick Mountains. That portion of the Ford Ranges is believed to represent the basement complex.

In December, a geologist from Washington University (St. Louis) studying paleomagnetism collected 15 samples from 5 sites between Camp No. 1 and the Rockefeller Mountains.

Because of unfavorable weather, the U.S. Geological Survey's topographic mapping party was able to work in the field on only seven days in December and three days in January. Poor visibility made it necessary for the group to measure topographic reference points with the Electrotape or by sighting on signalling devices. Upon leaving the field, the party had occupied 41 stations and completed 990 linear miles of the planned geodetic traverse.

The flying time of geophysicists of the University of Wisconsin was limited to 45 hours in December and parts of three days in January. In December, the group completed the gravity measurements it had scheduled for the area west of Camp No. 1, and during January it established 30 stations along a line from the camp to the Flood Range and made measurements at sites along Hobbs Coast to the east of the camp. Radio soundings were made from the aircraft on one day.

During December, Ohio State University members of the Byrd Land coastal survey collected lichens and mosses in the Clark Mountains, on Saunders Mountain, and on Lichen and Skua Gull Peaks. Rock-surface and subsurface temperatures were taken at these collection sites and at locations where vegetation was not found. In January, collections were made at 30 localities between the Rockefeller Mountains and Mathewson Point. The densities of lichens, mosses, and fresh-water algae were found to be greatest in the Chester and Phillips Mountains, on Mounts Giles and Gray, and at Cape Burks and Mathewson Point. Petri plates and sticky slides were exposed daily to collect airborne biologic material. No arthropods were found. On three days of December, skuas circled the camp and sometimes landed nearby, and on several occasions groups of snow petrels flew low over the camp.

The U.S.S.R. exchange scientist, Dr. Lev Klimov, working with geologists of Texas Technological College and the University of Minnesota, studied and sampled 133 outcrops between 130°W. and 160°W. Dr. Klimov was particularly interested in old gneiss complexes, which he identified in western Byrd Land for the first time.

A geologic study made by a University of Minnesota party of the Ruppert Coast between Land and Hull Glaciers revealed the occurrence of a pre-Cenozoic complex consisting of intrusive granite and of metavolcanic material, gneisses, and other metamorphic rocks.

Beardmore Glacier Party

The Beardmore Glacier geological party established its base camp on November 16 at 84°17′S. 164°24′E. On the 20th, the University of California (Los Angeles) members of the party left for Mount Mackellar, while the Ohio State University members remained at the camp to study the Beacon rocks in the Prebble Glacier area.

By December 10, the Ohio State party had measured and described in detail 1,650 meters of stratigraphic section and had collected 150 samples for laboratory study. Fossil logs 1 meter in diameter, one of which was 20 meters long, were found. Several stumps that had been preserved in place and some fossil leaves were noted also. Weather preventing access to most of the higher areas of which studies had been planned of igneous rocks and the Kirkpatrick Basalts, the group concentrated its mapping on the more accessible Ferrar Dolerites.

During the same period, the UCLA party measured the stratigraphic section on the south side of the glacier north of Tillite Glacier. The section components and their thicknesses are Alexandra Quartzites (20 meters), Pagoda Tillite (170 meters),

a part of the Mackellar Formation (80 meters), diabase (200 meters), and sandstone and shale (a few meters). About 70 cross-bed and 90 pebble orientations measured in the Alexandra Formation indicated southwest-flowing paleocurrents.

Search For Fossil Flora

On December 26, a seven-man party of scientists from the University of California (Los Angeles), Wichita State University, and the U.S. Geological Survey was placed in the Sentinel Range to examine further the fossil flora which abounds in certain localities of these mountains. The party returned to McMurdo on January 16, and three members of the group then made a visit to the Ohio Range, beginning on January 23.

The U.S. Geological Survey paleobotanical studies in the Sentinels resulted in the collection, among other samples, of *Glossopteris* and carbonaceous material from the east ridge of Polarstar Peak and of tracks and trails from the lower part of the Polarstar Formation. A significant new observation relates to the facies similarity between the dark shales of the lower Polarstar Formation and the Discovery Ridge Formation of the Ohio Range. The correlation that may be suggested is over a distance of 600 miles.

Significant specimens found in the Ohio Range included a *Glossopteris* leaf attached to its stem and three specimens of *Glossopteris* fructifications, one of which contained five seeds. These are rare types that have unusual significance for interpretation of phylogeny.

The *Leaia* beds of the Ohio Range were sampled systematically and a sizable collection of conchostracan fossils obtained.

Palmer Station

Heavy rain and high temperatures early in December were followed by cooler weather and some snow. In early January, mild weather prevailed. Visibility was fair on 10 days in December and 8 days in January. RRS *John Biscoe* attempted to force her way into the main anchorage on December 12, but made only about 100 yards through the 25-30 centimeter thick ice. The ice was strong enough to support offloading activities. The fast ice in front of the station broke out on December 14, but the main anchorage remained frozen until the end of the month. From January 18 to 23, the harbor was blocked by a grounded iceberg.

At the end of December, Neumayer Channel and Bismarck Strait were clear, and there was some open water off Cape Monaco. The rest of the ocean visible in this area was covered with 10/10 heavy pack.

The Ohio State University resurvey of the Anvers Island ice cap was 90 percent complete by January 31, despite many exposed crevasses and extensive surface melting, which on several occasions prevented ascent of the ramp by motor toboggans. Two stations were resurveyed on the 26th, raising the total number of resurveyed stations to 58. Some accumulation stakes were serviced early in January, and more pit studies were made at certain sites. As January ended, only 30 percent of the slope survey had been completed, the remainder being turned over to the new glaciological group from the University.

Investigators of the Ohio State University gravity program established control between Palmer Station and gravity stations in the United States, Chile, and the Antarctic Peninsula. A local network was surveyed in Arthur Harbor and nearby islands.

Three biological investigations were conducted by scientists from Florida State University, Virginia Institute of Marine Science, and the University of Miami. Florida State began its study of marine productivity with observations at Norsel Point, "Site Bravo," and Litchfield, Humble, Torgersen, and Horseshoe Islands. Fishing by lines and trap, the Virginia Institute of Marine Science collected specimens at Port Lockroy and other nearby areas for use in its study of parasites of vertebrates and invertebrates. The University of Miami group, which studied the distribution of marine fungi, made two reconnaissance and collecting trips by helicopter—one along the southern coast of Anvers Island and the other to points east of the station.

Hallett Station

In a study of lichen physiology, a team from Clark University isolated the algae and fungi associated with all species of lichens collected in the Hallett area. A large part of the collection was packed for shipment to the United States.

The team recorded the relative abundance of various species of lichens to determine the effect of microclimatic conditions, such as the rate at which meltwater is released by receding snow fields, on plant distribution. Although the amount of water available to lichens from melting snow is quite limited, it appears to be sufficient to give the plants a positive metabolic balance on a yearly basis.

A representative of the Bernice P. Bishop Museum continued the study of mite life cycles and collected related micrometeorological data. *Coccorhagidia gressitti* and *Stereotydeus belli* were reared successfully from tritonymph stage through egg-laying adulthood and on to larval stage *in vitro*. All stages of all mite species present were still

being collected in the field at the end of January, indicating a continuous overlapping of generations. The peak egg-laying period occurred from December 25 to January 7.

Byrd Station

The weather was generally good in December, with 7 clear and 10 partly cloudy days. The respite extended midway into January, when snow and high winds returned to interfere with outdoor activities.

Stanford University's very-low-frequency program and the Pacific Naval Laboratory's ultra-low- and extremely-low-frequency programs were progressing well. On December 31, telemetry signals from the OGO-III satellite were recorded briefly. A new preamplifier for the parabolic dish antenna improved the gain and lowered the noise in satellite recordings. Good data on signal phases were obtained throughout December from Navy VLF and ELF transmitting stations NBA, NPG, NPM, and NSS. Continuous recordings were made of extremely-low-frequency, magnetometer, and micropulsation data.

A magnetic storm occurred on January 7 and was followed on the 13th by a Storm Sudden Commencement. A solar proton event that occurred on January 28 crippled communications but provided excellent data for the upper-atmosphere and magnetosphere programs.

ESSA's meteorological program progressed normally. The final ozonesonde flown during the season reached 11.5 mb. Hypsometer-radiosondes reached an average height of 32,848 meters. Despite some difficulty in making the pyrheliometer follow the sun, the radiation data appeared to be normal. The ozone program proceeded satisfactorily, although the values obtained were not as high as those of previous years.

Preparations for the CRREL deep-drilling project, which were completed in December, included drilling an 85-meter-deep hole for the steel casing, constructing cribbing for the drill tower, and making openings in the trench roof. Drilling was expected to begin during the first week of February.

At the long-wire antenna site, University of Washington personnel repaired several breaks in the southern leg of the 21-mile antenna. Measurements of the antenna's field strength were made from the ground and from aircraft. Construction of a second receiving channel and associated antenna equipment for *D*-region sounding was completed. By the end of January, a digital tape-recording system for the *D*-region study and other equipment ordered for this season's program had arrived. Work was proceeding on the "Thor" impulse transmitter; the first discharge was made at 251 kw on 15 kc/s.

In support of a program conducted at the French station Dumont d'Urville by Mr. John Katsufrakis of Stanford University, a Stanford colleague worked at the long-wire site making hourly synoptic transmissions at 40-100 kw on 5 to 25 kc/s from January 15 to 31. Continuous transmissions were made at 12 and 50 kw in support of field-pattern configuration flights, but the data obtained were inconclusive. On six days, transmissions were made alternately on the 10- and 21-mile dipoles to evaluate quadrature transmission feasibility and to provide information on auroral-belt interface penetration for Mr. Katsufrakis.

A team from the University of Wisconsin completely rebuilt the No. 1 generator at the substation, although it appeared that detonation problems, which were the primary cause of the original piston destruction, still exist. The rebuilding of No. 2 generator continued.

An earth-current measuring system was installed for ESSA at the long-wire site. A balanced-input amplifier was designed for the system to compensate for the difference in signals received from the long-wire antenna and standard types of earth-current probes.

In December, a small building was renovated and a ground telemetry station established in it for the program of the University of Denver to measure particle precipitation in the auroral zone by means of balloons. Ten of 11 balloons launched in January made successful flights, remaining at floating altitude for an average of 36 hours. The initial launch was made on January 8 into the recovery phase of the January 7 gradual-commencement geomagnetic storm. Excellent observations were made of energetic-particle effects following the Storm Sudden Commencement on January 13. Full coverage, including details of onset, was obtained of the solar proton event of January 28—February 1.

The ionospheric, conjugate-point, aurora, and spectrophotometric studies conducted by the Institute for Telecommunication Sciences and Aeronomy of ESSA and the forward-scatter investigations of the Bartol Research Foundation proceeded on schedule. The aurora building was reopened on January 24 for a study to be conducted by the University of Colorado.

South Pole Station

December was a month of "warm" weather at Pole Station, the temperature reaching a high of $-18.9°C.$ ($-2°F.$) and not falling below $-33.9°C.$ ($-29°F.$).

By the end of January, 182 pieces of cargo weighing about 18,000 pounds had been received for the scientific program.

The meteorology, forward-scatter, micropulsation, riometer, seismology, and geomagnetism programs continued on schedule, as did the cosmic-ray program, which included the installation of a digital processing system for cosmic-ray data.

The cosmic-ray event reported by McMurdo and Byrd Stations on January 28 was also recorded at Pole Station, where it persisted as a polar cap absorption event for at least four days.

The summer portion of Oklahoma University's sleep study was completed, and the results were mailed to the United States.

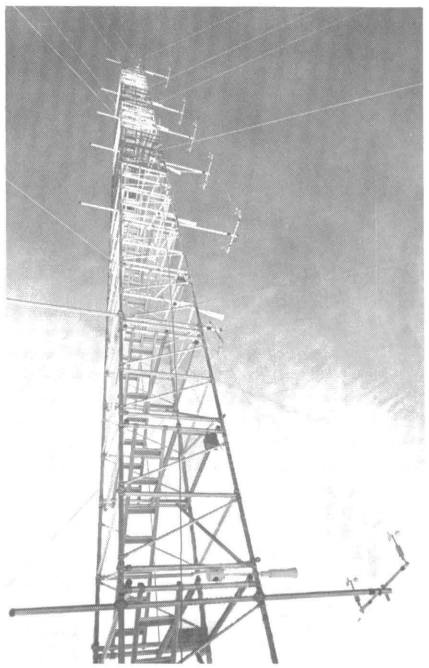
Equipment for a gravity-tide program to be conducted by the University of California (Los Angeles) was installed in a room in the seismology tunnel, where it was tested and found to be in good operating condition.

Plateau Station

By the end of January, all summer scientific studies and much of the work involved in preparing the station for winter, including readying vehicles for a resumption of the traverse in Queen Maud Land and installing and testing a new generator in the summer camp, had been completed. Although a communications blackout occurred at the end of January and early February, no unusual effects were observed on the magnetic and VLF equipment.

Early in January, Ohio State University finished its snow-pit studies, and before the end of the month had completed all stratigraphic analyses, including those of grain size, hardness, and density. Samples were taken both from the pit and from a 21-meter-long core obtained below it for analysis at Ohio State University and the Cold Regions Research and Engineering Laboratory (CRREL). A snow-accumulation network of 99 stakes, emplaced at Plateau in January 1966, was remeasured in the first half of December and again at the end of the season. Operation of the CRREL thermal drill, which began on January 13, progressed well until the 19th, when the drill froze fast at a depth of 75 meters. Although repeated applications of heat and alcohol freed the drill and permitted its removal on the 30th, all drill heaters were burned out in the process, forcing an end to the program for the season.

The very-low-frequency recording equipment of Stanford University and the VLF-phase and micropulsation recording equipment of ESSA's Institute for Telecommunication Sciences and Aeronomy functioned satisfactorily. During the latter part of the month, the Stanford VLF equipment was operated in conjunction with long-wire transmissions at Byrd. Several satellite correlation runs were made also. Micropulsation activity was very low throughout January.



Micrometeorological tower at Plateau Station.

(Photo courtesy James B. Pranke)

Forty-six series of measurements made in January as part of the U.S. Army Natick Laboratories' micrometeorological program revealed that the highest intensity of normal incidence solar radiation, which occurred on the 10th, was 1.763 cal/cm^2/min. Atmospheric turbidity was found to be highest at noon, whereas ice fog and ice crystal precipitation generally occurred during the "night." The calibration of four radiometers with respect to solar azimuth, zenith distance, and temperature resulted in 123 values with a variation of about 4 percent. Instruments that record temperature profiles at 19 levels between —10 and +32 meters and wind speed and direction at 10 levels between 0.5 and 32 meters were installed on the micrometeorological tower. The target illumination system was assembled, each unit having seven light bulbs of different colors mounted on three vertical and diagonal posts.

The Naval medical officer examined, and obtained the medical histories of, the wintering-over personnel. Interviews concerning each individual's medical history and attitudes toward the coming winter were taped. The Minnesota multiphasic personality inventory was completed by some station personnel; it will be administered again later in the year. Electrocardiograms and the Harvard step test were taken by all wintering-over personnel.

SUPPORT OPERATIONS

At the end of January, all support operations were either on schedule or very nearly so except for the construction at Palmer Station which had been delayed by the late arrival of materials. Although the icebreakers operating in the Ross Sea had experienced engineering difficulties and two of the cargo ships had suffered slight damage, the tempo of operations had not been affected. Deliveries by aircraft were ahead of schedule so that a communications blackout in late January that might otherwise have seriously retarded them was at most an annoying episode. The loss of two helicopters—one in November and the other in January—had fortunately occurred without loss of life or serious injury. Requirements for the support of scientific projects had been met and many scientists, having completed their work, were on their way home.

(U.S. Navy photo)

Early in the season, tankers such as Alatna *(right) must be escorted through the channel to McMurdo.*

Ship Operations

On December 15, USCGC *Glacier* put the finishing touches on the ship channel in McMurdo Sound by carving out a turning circle in Winter Quarters Bay, then moored to Elliott Quay. On the same day, dwindling stocks of jet fuel (JP-4) caused a curtailment of Hercules LC-130F flights. After cargo stowed on *Glacier*'s fantail had been unloaded, the ship cast off to go to the assistance of USCGC *Eastwind,* which was escorting the fuel-laden USNS *Alatna.*

The two icebreakers had commenced cutting the channel on November 23. They continued to work together until December 9, when *Eastwind* departed to meet *Alatna.* The two ships met on December 14 and were joined by *Glacier* late the following day. Because the channel was filled with brash that constantly refroze, the progress of the three ships toward McMurdo was slow. Not until the 17th did *Alatna* start unloading. With fuel once again available, full flight schedules were resumed on December 18. The short delay had not seriously affected air operations, as Air Development Squadron Six (VX-6) indicated by its announcement that the resupply of inland stations was on schedule. The announcement also pointed out that the squadron was awaiting the arrival of HMNZS *Endeavour* and USNS *Pvt. John R. Towle,* which carried additional fuel and other cargo for delivery inland.

The day after the resumption of flights, three icebreakers and two tankers were carrying out an elaborate set of maneuvers in McMurdo Sound. *Glacier* and *Eastwind* were escorting *Alatna* outbound while USCGC *Staten Island* and HMNZS *Endeavour* were inbound. *Staten Island,* the third icebreaker assigned to the Ross Sea Ship Group, had been delayed in New Zealand for repairs and did not depart Port Lyttelton until December 8. Seven days later, she met *Endeavour* to escort her through the ice. Because working a ship up the channel required two icebreakers, *Glacier* left *Alatna* and *Eastwind* on December 20 and went to the assistance of *Staten Island* which was attempting to tow the New Zealand tanker. After their rendezvous, *Glacier* broke ice while *Staten Island* continued towing. Through very close pack and in fog that reduced visibility to 100 yards, the small convoy advanced at two to two and a half knots. When the ships arrived off Hut Point, *Staten Island* shifted the tow of *Endeavour* to *Glacier* and went to the assistance of *Alatna.* (*Eastwind,* in need of engine repairs, had left *Alatna* for Winter Quarters Bay.) With the help of *Glacier, Endeavour* moored to Elliott Quay at 0500 on December 21.

Three hours later, *Glacier* rejoined *Staten Island* and *Alatna,* which were still working their way down the channel. By 1500 of the same day, the three ships had arrived in open pack and *Alatna*

was able to proceed independently. The two icebreakers returned to McMurdo Station early on December 22. While waiting for *Endeavour* to finish discharging her cargo of fuel, *Staten Island* received 18,000 gallons of fresh water from *Eastwind* and 73,000 gallons of diesel oil from *Glacier,* which was scheduled to return to New Zealand for resupply and repair. At 1400 on December 22, *Glacier* departed McMurdo Station with *Endeavour* in tow. The tow, which was soon shifted to *Staten Island,* was continued until open water was reached. *Staten Island* then returned to McMurdo Sound to rework the channel, and *Glacier* and *Endeavour* continued toward New Zealand.

Both tankers received some damage in the ice: *Alatna* to her hull, and *Endeavour* to a propeller. *Glacier* and *Staten Island* experienced mechanical difficulties, particularly with their evaporators, which was the reason for the transfer of water to the latter. *Staten Island* had originally been scheduled to depart Port Lyttelton about January 12 on a reconnaissance of the Weddell Sea, where the National Science Foundation plans oceanographic work next year, but her condition was such that a change of plan became necessary; *Eastwind* was selected to carry out this project, and *Staten Island* was assigned the task of supplying Hallett Station and carrying out an oceanographic survey in the Ross Sea. After her engines had been repaired and the Hallett cargo and oceanographic gear transferred to *Staten Island, Eastwind* departed McMurdo Station on January 1 for Wellington, where she underwent further repairs and took on fuel and supplies in preparation for her January 24 sailing.

Before departing McMurdo, *Eastwind* assisted *Staten Island* in escorting the cargo vessel *Towle* to her moorings in Winter Quarters Bay. *Towle* had arrived at Port Lyttelton on December 24 and had left for McMurdo Station the day after Christmas. To offload the cargo ships calling at McMurdo, the Navy had assigned a detachment of 40 officers and men from Cargo Handling Battalion One (CHB-1). On January 8, this unit finished unloading *Towle* and backloading whatever cargo was available for return to the United States, and the following day *Towle* departed for Port Lyttelton and home, her antarctic assignment completed.

Towle left McMurdo without escort because *Staten Island* was the only icebreaker in the Ross Sea at that time, and she was off Cape Hallett. Proceeding independently, *Towle* found from two- to four-tenths of ice coverage in the form of small floes and brash, a notable improvement in ice conditions since *Glacier* and *Staten Island* had escorted *Endeavour* from McMurdo Sound less than three weeks before.

On her way to Hallett, *Staten Island* launched a small boat to put two scientists ashore on Franklin Island to make population studies of penguins and skuas. While unloading and taking on cargo at the station, a *Staten Island* helicopter supported a USARP botanical project. On her return journey to McMurdo, the ship picked up a New Zealand geological party at Cape Washington. The geologists reported that Mount Melbourne was an active volcano, the second discovered on the Continent in a century and a quarter. The ship reembarked the ornithologists from Franklin Island and later put one of them ashore at Cape Crozier. While awaiting the arrival of *Alatna* on her second trip of the season, *Staten Island* conducted a sounding survey of the anchorage off Franklin Island and an ice survey between that point and Cape Bird.

After a brief period in the yard at Dunedin, *Alatna* took on a load of fuel at Port Lyttelton. She left New Zealand on January 6 and made the trip to McMurdo in seven days. On the 13th, she met *Staten Island* off Beaufort Island, and the two ships entered Winter Quarters Bay together. *Alatna* discharged her cargo in two days and departed McMurdo for Port Lyttelton. *Staten Island* left the next day for Wellington. Along the Victoria Land coast, she used her one operating helicopter to conduct a seal census. After disembarking passengers at Hallett Station on January 18, she proceeded to New Zealand, where she arrived a week later.

Glacier, meanwhile, had left Port Lyttelton on January 4 and was on her way to the Ross Sea to assume the duty of ready icebreaker. At Hallett Station she embarked passengers and 8.5 tons of cargo. Because the ship's medical officer needed medical treatment, scheduled scientific operations were temporarily deferred, and *Glacier* departed Hallett on January 20 for McMurdo, where she arrived the following day. After a stay of less than an hour, the ship started the return trip to Hallett. On the way, she resumed the seal census begun by *Staten Island.* On January 22, while engaged in this activity, a *Glacier* helicopter experienced a power loss under conditions of poor surface definition and crashed on an ice tongue in the vicinity of Coulman Island. Although the machine rolled over three times and the pilot was thrown through the bubble canopy on impact, he and the single passenger were not injured. They were returned to the *Glacier* by the ship's second helicopter. The seal census was continued the next day and completed in Edisto Inlet, which lies behind Cape Hallett. *Glacier* then set course for McMurdo, where she tied up on January 24.

As *Staten Island* was still undergoing repairs in Wellington, *Glacier* took over the oceanographic

survey. A party of four from the Office of the Oceanographer of the Navy arrived on board the same day the ship sailed, January 26, and commenced observations. Three days later, *Glacier* picked up a party of New Zealand scientists at Cape Bird and returned them to McMurdo. In a few hours, she left again for Hallett Station, performing oceanographic work on the way.

During January, for the first time since she began operating in the southern oceans, the research ship USNS *Eltanin* penetrated the Ross Sea. The ship, which is operated by the Military Sea Transportation Service for the National Science Foundation, departed Wellington on December 30 and arrived at McMurdo Station on January 22. After a single day, she left to continue her oceanographic investigations.

On December 1, USS *Thomas J. Gary* was serving as picket ship at approximately 60°S. 150°W. She was relieved of this duty on the 11th by USS *Mills*. After stopping at Campbell Island, where New Zealand maintains a scientific station, and later at Port Lyttelton, *Gary* arrived at Dunedin on December 15. When she departed two weeks later, she had aboard a New Zealand scientific party to be put ashore with its cargo on one of the Snares Islands, which lie just off New Zealand's South Island. Because weather conditions made a landing impossible, *Gary* left the scientists and their gear at Campbell Island and then proceeded to her station. *Mills* departed ocean station on December 30, picked up the party from Campbell Island, placed it on the Snares, and returned to Dunedin, where she arrived on January 2. Sixteen days later, *Mills* was back on ocean station, and *Gary* was once again on her way back to Dunedin. Bad weather prevented her approaching the Snares Islands to recover the scientific party, and she proceeded to Bluff, New Zealand, to participate in a local celebration. *Gary,* which was scheduled to return to Dunedin on January 23, took the opportunity to call at Snares Islands. As before, the winds were strong and the seas heavy, but a boat was put over the side. About an hour passed before the commanding officer reported that he had a party of cold and wet—but unharmed—scientists aboard. He reached Dunedin several hours later. At the end of the month, *Mills* was still on station and *Gary* in port.

Palmer Station lacks facilities for heavy aircraft operations and, therefore, depends almost entirely on ships for resupply. This season, however, the *Project Santop* Super Constellation made a successful airdrop to the station in November, and a light aircraft of the British Antarctic Survey landed there in December. The first vessel to arrive this year was USCGC *Westwind*. She departed Davisville on December 1, passed through the Panama Canal, and sailed down the west coast of South America, calling at Valparaíso and Punta Arenas, Chile. At the last port, she embarked construction, relief, and scientific personnel. Arriving at Arthur Harbor, the site of Palmer Station, on January 7, *Westwind* reported to the operational control of the Commander, U.S. Naval Support Force, Antarctica. While at the station, her helicopters and small boats supported the local scientific effort, and her crew helped transfer cargo and gave assistance to the construction party ashore.

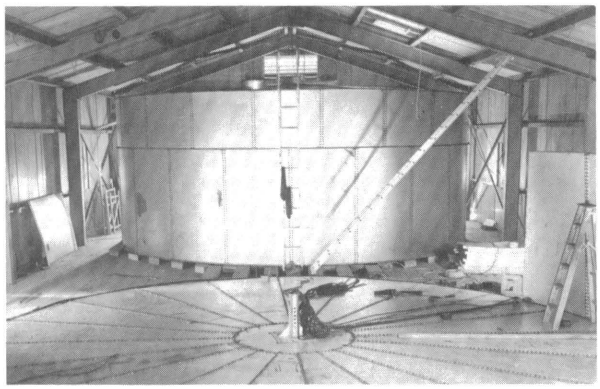
Work on the new Palmer Station was somewhat delayed by the late arrival of USNS *Wyandot*. The ship, which had been in a yard for repairs, did not leave Davisville until January 6. *Wyandot*'s schedule called for her to deliver supplies and equipment at Palmer and then to proceed directly to McMurdo Sound. She arrived at Palmer on January 28 and immediately began to unload cargo.

At the end of January, *Staten Island* was still in Wellington undergoing repairs. *Glacier* was in the Ross Sea, as was *Alatna,* which had left Port Lyttelton on January 24 on her third voyage of the season. *Alatna* was expected at McMurdo on February 1. *Eastwind* was diverted from her schedule in response to a request from the Australian Government for assistance to two charter ships, *Nella Dan* and *Thala Dan,* which were trapped in the ice off the Budd Coast. *Nella Dan* had been beset early in the month while trying to relieve Mawson Station and to land a party to construct a new Wilkes Station; although the latter effort could have been cancelled, it was essential that she reach Mawson. *Thala Dan*'s situation was less severe, but equally urgent: though mobile, she was confined and unable to relieve Wilkes Station in time for her to make two necessary trips between Australia and Dumont d'Urville. On January 27, the Commander, U. S. Naval Support Force, Antarctica, passed the Australian request to *Eastwind* and instructed her commanding officer to render whatever help was feasible before continuing on toward the Weddell Sea.

Construction

Construction Battalion Unit 201 (CBU-201), specially created last spring to operate in the Antarctic, was divided for work in two widely separated areas. The principal element of the unit, consisting of 2 officers and 100 men, was deployed through Christchurch to McMurdo. From there, detachments were sent out as needed to Byrd and Plateau. (No major construction was scheduled for South Pole and Hallett Stations.) Another detachment of 1 officer and 25 men flew from the United States to Chile. There the group boarded *Westwind,* which arrived at Palmer Station on January 7.

The unit had expected to have 78 percent of the year's construction program completed as of the end of January. By that date, 76 percent had actually been completed. At both McMurdo and Plateau Stations, work was virtually on schedule, while at Byrd it was somewhat ahead. Only at Palmer had it fallen behind, largely owing to the late arrival of *Wyandot* with construction material. In order to accomplish what had been planned, arrangements were made for the construction detachment to remain at Palmer until the end of March.



(U.S. Navy photo)

Water storage tank of 55,000-gallon capacity under construction during 1963-1964. The desalination system became fully operational in December 1966.

At McMurdo, those portions of the sewer and sewage outfall systems that were scheduled for construction this year were finished on December 6. The freshwater distribution system from the desalination plant was reactivated and extended, and the plant began supplying the station with water on December 29, using its own energy. On January 16, energy derived from the nuclear power plant was first employed to distill water on a regular basis. The plant's daily production of over 14,000 gallons is piped to much of the station. Although the new system will not make water abundant at McMurdo, it is a great improvement over the previous procedure of transporting snow to the station's snow melters.

On December 16, the Commander, Antarctic Support Activities, accepted from the Seabee unit a new warehouse for the use of VX-6. During January, the squadron moved equipment and supplies into the building. At the petroleum tank farm, a contractor, with Seabee support, was working to double the capacity of eight storage tanks. When completed, this project should help prevent early season shortages of aviation fuel, such as occurred during December of this year and last, and so make it possible to bring in the ships later in the season when ice conditions are less difficult and dangerous.

The major construction project at Byrd was the installation of a deep-penetration drill for coring the ice cap. Although the work was not completely finished, the drill was in place and operating in late January. Other work involved some extensive repairs at both the main station and the substation, located about 11 miles away. At Plateau, two Jamesway huts were erected and a ventilation system installed in the central portion of the building.[1]

The responsibility for maintaining the stations belongs to Antarctic Support Activities. In the course of repair and renovation, this organization also does some minor construction. At Byrd, Plateau, and South Pole, it was apparent that all the scheduled work would be completed by early February, and accomplishments at McMurdo were close to what had been expected. Only at Palmer did work fall seriously behind schedule. With February and March yet to go, it was expected that much of the lost time would be made up.

Air Operations

Air operations in December and January were quite successful despite the brief curtailment of LC-130 flights until *Alatna* replenished the fuel stocks. All requests for the support of scientific projects were met, and the aerial mapping program was the most successful in many years. On January 16, Air Development Squadron Six (VX-6) reported that the supply of inland stations, a first priority, was ahead of schedule. These achievements minimized the seriousness of a communications blackout that on January 29 prevented all flights to, from, or within the Continent, except for local helicopter operations. The blackout persisted through the end of the month.[2]

During the first two months of the season, heavy demands were placed on the Antarctic Air Group for the deployment of personnel and the shipment of priority cargo to Antarctica. For this movement, the Naval Support Force obtains assistance from the Air Force. This year the Twenty-Second Air Force assigned a task unit from the Naval Air Transport Wing, Pacific, one of its subordinate commands. On 19 round trips between Christchurch and Williams Field, the two C-130Es of the task unit carried 95 passengers and 227 tons of cargo southbound and 176 passengers and 53 tons of cargo northbound. The final mission terminated on December 7, and three days later the last of the unit's aircraft left New Zealand for the United States. In January, another link in the intercontinental supply chain was forged by the Royal New Zealand Air

[1] See station plan in *Antarctic Journal of the United States*, Vol. I, p. 159.

[2] This discussion treats activites prior to February 1.

(U.S. Navy photo)

First New Zealand Hercules ever to land in Antarctica (October 1965). RNZAF C-130Hs flew two missions to McMurdo in January 1967.

Force, which made two round trips to Williams Field with C-130Hs.

On the Continent itself, VX-6 supplied the inland stations, supported scientific field parties, and flew photographic missions. By the end of January, virtually all available cargo had been moved from McMurdo, and the squadron was awaiting the arrival of *Wyandot* with additional material to be carried inland. All aerial fuel deliveries were complete except those needed to top off the stations' tanks before winter sets in.

A large part of the scientific field work in the McMurdo area requires helicopter support. For this effort, VX-6 had three helicopters at the beginning of the year. Two more arrived aboard *Towle* in December. Helicopters from the icebreakers assisted ship-based scientific projects and were available to scientists when the icebreakers visited Hallett and Palmer Stations or worked near McMurdo. Although no summary of the extent of this effort is currently available, analysis of a typical week, December 4-10, shows 19 airlifts of scientific parties about McMurdo Sound. These groups, some of which were moved more than once, represented 13 projects sponsored by 12 institutions.

During the same week, an LC-130 of VX-6 placed the American Antarctic Mountaineering Expedition in the field about 25 miles from the base of the Vinson Massif, the climbers' first objective. On December 26, a group of geologists were transported to the vicinity of Polarstar Peak in the Sentinel Range. At about this same time, the Byrd Land Survey camp was resupplied, and on December 30 a reconnaissance flight determined the site for the survey's second camp. The Byrd Land Survey was hampered throughout the season by poor weather and, to a lesser extent, by the loss of one of three Army helicopters that provided field support (this machine was replaced on December 21).

For aerial photography, VX-6 has two specially equipped aircraft: an LC-130F and a C-121J. During the current season, the LC-130F operated from Byrd and McMurdo. On October 24, the C-121J flew to Chabunco Airport outside Punta Arenas, Chile, to carry out *Project Santop,* the photographing of Palmer Land, the base of the Antarctic Peninsula. Harmonious relationships were established with the local authorities, and the Chilean Air Force appointed a liaison officer who accompanied the crew on most of the photographic flights. Bad weather and difficulties with the aircraft caused delays during the first month. As a result, it was decided to continue the project beyond the original termination date of December 4 to December 28. The wisdom of this decision became apparent in late December when two of the most successful flights of the entire operation occurred. A total of 93,000 square miles of acceptable photography was obtained, amounting to 72 percent of the scheduled amount. Under the adverse conditions experienced, this amount was considered sufficient to conclude the project.

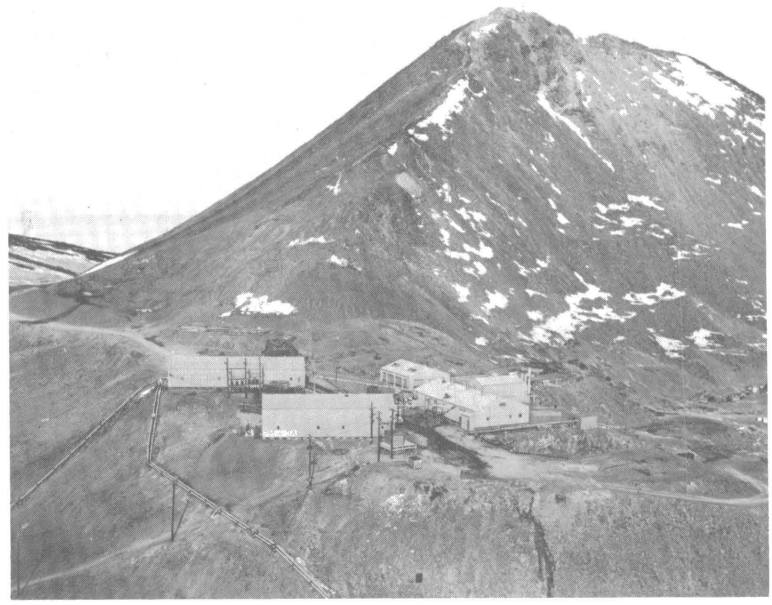
In most other areas, a greater proportion of photomapping coverage was completed. Including the film taken in Palmer Land, 90 rolls of film had been processed by February 1, and photographs of 333,000 square miles had been assessed suitable for map construction. These figures represent 75 percent of the year's overall goal. Some exposed film had not yet been processed.

During the latter part of January, field parties were being recovered. The geological group from Polarstar Peak was brought back to McMurdo on January 16. The next day, the mountain climbers, who had scaled six peaks in the Sentinel Range, were flown to the station. Ten days later, VX-6 completed the evacuation of the Byrd Land survey team.

The success of air operations during *Deep Freeze* 67 is in large part attributable to the skill and experience of the officers and men of VX-6. Other contributing factors were favorable weather in most areas during much of the season and the fact that the runway on the annual ice did not deteriorate as early as it did last year. Although significant thinning of the ice was reported on December 29, it proved possible to keep the runway useable until January 26, 14 days longer than last year.

Five Years of Nuclear Power at McMurdo Station

W. G. SHAFER
Lieutenant Commander, CEC, USN
Naval Nuclear Power Unit
Fort Belvoir, Virginia



The nuclear power plant at McMurdo Station. The reactor is in the building forming leg of "T" on right side of the plant complex. Building farthest to the left houses desalination facility. The freshwater distribution pipe is at left, and the seawater intake pipe is in the foreground.

(U.S. Navy photo)

On December 12, 1961, a special cargo was unloaded from USNS *Arneb,* sledged over the ice of McMurdo Sound, and hauled up the slopes of Observation Hill to waiting building shells. Within 81 days, that cargo had been assembled into the first—and still the only—nuclear power plant in Antarctica. During the five years that have passed since the plant first achieved criticality on March 3, 1962, it has established a remarkable record. Before 1967 it held the record for the longest continuous power run by a military-operated nuclear plant, and it was the first U.S. nuclear shore facility to provide energy for the production of fresh water from seawater.

The Navy's responsibility for shore-based nuclear power generation and the story of the McMurdo reactor began on July 6, 1960, when the Secretary of the Navy established the U.S. Naval Nuclear Power Unit (NNPU) at Fort Belvoir, Virginia, under the Bureau of Yards and Docks (now the Naval Facilities Engineering Command). NNPU has responsibility for the design, procurement, construction, operation, and maintenance of nuclear shore systems and for the training of personnel to support them.

Authorization

In August 1960, Congress authorized the design and construction of a nuclear power plant to be installed at McMurdo Station. Also during that month, the U.S. Atomic Energy Commission (AEC), which supervises all nuclear-power research and development, contracted with the Martin Marietta Corporation of Baltimore, Maryland, to design and fabricate the PM-3A (a portable, medium-output reactor that is the third of its general type and the first of that type designed for field use). The contract specified also that the contractor would supervise the installation and initial testing and operation of the plant.

The decision to provide nuclear power to McMurdo Station stemmed primarily from the large fuel demands of the station and the burdensome logistics involved in accommodating those demands during the Continent's short season of accessibility. Aircraft, diesel generators, space-heating units, and many kinds of land vehicles consumed fuel in amounts constituting more than half of all freight delivered to Antarctica. It was realized also that an increased supply of electricity would, by permitting use of electrical instead of oil-fired heating units, make living more comfortable and efficient while reducing the fire hazard. Furthermore, valuable experience would be gained in installing and operating a nuclear power plant in an isolated and rigorous environment.

Design and Installation

Portability was central to the PM-3A concept. McMurdo Station is accessible in summer by ship, but the designers envisioned future use of nuclear power at inland stations, such as Byrd and Pole, and so developed the PM-3A as the prototype of a power plant that could be delivered in modules by the LC-130 aircraft. Considerations of reliability and adaptability to prefabrication led to the selection of a pressurized-water system. In this system, water is pumped under pressure from the core of the reactor,

where it is heated, to a vessel in which it gives up heat to produce steam. The water is then returned to the core for reheating, and the cycle is repeated.

The basic process in a nuclear reactor such as the PM-3A is the fissioning of uranium 235. Fissioning occurs when an atom of U^{235} captures a thermal neutron (a neutron of low energy that is in equilibrium with surrounding molecules). The neutron excites the U^{235} nucleus, causing it to split into two fragments and to produce heat. The friction created by the slowing of the fission fragments is responsible for the largest portion of heat generated by the fuel elements. An average of 2.5 high-energy neutrons are released per fission. Upon reaching equilibrium again, the neutrons become available for further fissioning.

The Martin Marietta Corporation, under AEC supervision, designed and constructed the PM-3A and brought it to criticality between August 1960 and March 1962, a period of only 19 months. Between May and November 1961, the officers and enlisted men selected and trained by NNPU as the reactor's first operating crew were sent to the contractor's plant, where they received basic PM-3A instruction and took part in the pre-shipment assembly, testing, and evaluation of the PM-3A's systems. By November 1961, the PM-3A had been shipped to Davisville, Rhode Island, and loaded on board USNS *Arneb* for delivery to McMurdo Station, where construction of the buildings to house it had been started a month earlier by Seabees of Mobile Construction Battalion One.

The PM-3A was erected on a foundation of solid volcanic rock at an altitude of 300 feet on the side of Observation Hill, which overlooks the station. The first NNPU-trained operating crew and Seabees from Mobile Construction Battalion One, working under the direction of the contractor, installed the new plant during the short austral summer season of 1961-1962. On July 12, the plant delivered its first useful power to the station. Operational testing required to perfect plant design continued for 23 months. At the end of that period, management of the PM-3A was turned over to the Navy. Power production under Navy management commenced on June 10, 1964.

Training

Twenty-four-hour operation of the PM-3A and a sea-water distillation plant located next to it is performed by 2 officers and 23 enlisted men. All crew members receive one year of formal school training in nuclear power plant operation and maintenance at Fort Belvoir. They also take courses in such subjects as mathematics, physics, and engineering. During the following one to two years, they undergo on-the-job training at one of three operational pressurized-water nuclear power plants: the Air Force's PM-1, Sundance, Wyoming, or the Army's SM-1, Fort Belvoir, or SM-1A, Fort Greely, Alaska. Each man becomes qualified in one of four nuclear power plant specialties: mechanics, electricity, instrumentation, or process control.

An operating crew assigned to Antarctica serves about 13 months at the PM-3A. Toward the end of that period, in October or November, a replacement crew arrives and trains under the watchful eyes of the former crew until it has demonstrated its ability to meet all requirements, at which time it takes over operation of the plant and the former crew leaves. Most PM-3A veterans take nuclear-power program assignments at other locations; after a tour of shore duty, many return voluntarily to Antarctica for another year at the PM-3A.

NNPU, largely through its McMurdo Station Detachment, also extends important supplemental services to the antarctic community. A water-distillation plant having a capacity of 14,000 gallons per day was erected beside the PM-3A and on February 19 and 20, 1966, steam from the PM-3A was drawn off to operate the distillation equipment on a trial basis. The PM-3A thus became the first U.S. nuclear shore-based power plant to provide energy for the conversion of sea water to fresh water. During the 1966-1967 season, the distillation plant began receiving steam produced by the PM-3A on a regular basis. NNPU also provides technical support for, and field servicing of, the SNAP-7C radioisotope thermal-electric generator that powers the automatic weather-reporting device at the Brockton weather station on the Ross Ice Shelf.

Operations

PM-3A operations have contributed significantly to this Nation's advancement of the state-of-the-art for medium-size nuclear power plants. In December 1964, whole reactor-core refueling was accomplished at the McMurdo plant for the first time in an installation of this type. Improvements in PM-3A control-rod drive mechanisms have resulted in much greater reliability for the PM-3A and comparable systems. A hydrogen fire that occurred within the containment tanks of the plant in October 1962 was evaluated, and measures were taken to forestall such events in reactors of the PM-3A type. (The fire was contained, and no environmental contamination occurred.) At the present time, better methods of processing and removing radioactive wastes from Antarctica are being developed,* and further im-

* The Antarctic Treaty prohibits the disposal of radioactive wastes in Antarctica.

provements are being made in nuclear instrumentation and control-rod drive-mechanism systems.

The power output of the PM-3A has increased from 2,410,000 kwhr during the first year of operation (following the initial operational testing period) to 6,780,000 kwhr during 1966. Since July 10, 1962, when the PM-3A first supplied power to McMurdo Station, the plant has generated 25,305,200 kwhr of energy, which is equivalent to 1,775,729 gallons of diesel fuel. On October 8, 1966, the plant achieved 3390.4 hours of continuous power operation; at that time, the 141-day run was the best ever for nuclear power plants operated by military crews and was just 18 days short of the U.S. record for large commercial pressurized-water nuclear power plants. The plant's availability for power production has also been on the increase, from 35.89 percent in 1964 to 77.42 percent in 1966.

On March 3, 1967, five years had passed since the PM-3A achieved initial criticality. The realization of dependable nuclear-power support of our Nation's scientific efforts in Antarctica serves as an anniversary tribute to the men who have contributed to successful PM-3A operations.

New Publications

Three new publications of general interest to the antarctic community have recently been issued. All are volumes in continuous series supported by the National Science Foundation:

Antarctic Map Folio Series, Folio 4: The Antarctic Atmosphere; Climatology of the Troposphere and Lower Stratosphere. Plates compiled by the National Weather Records Center. Text by W. S. Weyant. Vivian C. Bushnell, Series Editor. New York, N.Y., American Geographical Society, 1966. 4 p., 8 plates. (For sale by American Geographical Society, Broadway at 156th Street, New York, N.Y. 10032 at $3.50 a copy.)

Antarctic Bibliography, Vol. II. Edited by George A. Doumani. Washington, D.C., Library of Congress, 1966. v, 523 p. (For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 at $4.25 a copy.)

Antarctic Research Series, Vol. 8: Antarctic Soils and Soil Forming Processes. Edited by J. C. F. Tedrow. Washington, D.C., American Geophysical Union, 1966. 177 p. (For sale by American Geophysical Union, Suite 506, 1145 19th Street, N.W., Washington, D.C. 20036 at $10.00 a copy.)

Parachute Descent at the South Pole

On December 23, 1966, Aviation Electrician's Mate Second Class Henry B. Thomann, Jr., jumped from a Navy C-130 Hercules while it was flying about 6,000 feet above Amundsen-Scott South Pole Station. He thus became the first Navy man to arrive at the station by parachute and the second individual to parachute into the immediate vicinity of the Pole.

The previous jump was made by T. Sgt. Richard J. Patton, USAF, during *Deep Freeze* II. On November 25, 1956, he parachuted 1,500 feet from a wheel-equipped Air Force C-124 that had just dropped parts for a disabled weasel. The four-man crew of the weasel was part of an eight-man advance construction party which had been landed five days earlier at a point presumed to be the Pole but soon discovered to be eight miles from it. (The other four Seabees and the 11 dogs which had been landed with them had proceeded to the Pole on November 22.) The stranded men repaired their vehicle and, accompanied by Sergeant Patton, rejoined their companions the same day, Patton thereby gaining the additional distinction of being the first member of the Air Force to stand at the South Pole.

Thomann, who is a licensed jumpmaster with the VX-6 pararescue team, delayed deploying his parachute for 10 seconds, during which he fell to within 2,500 feet of the surface. An unretarded descent of 3,500 feet normally takes more than 10 seconds, but in the rarified air over the 9,184-foot-high station the descent rate is higher, a factor considered by Thomann and the plane's pilot, Lt. Frank A. Orr, USN, before the jump was made. As a further adjustment to the aerial environment, Thomann breathed pure oxygen before diving from the plane's rear cargo ramp.

On the day of the jump, Pole Station recorded a surface temperature of -34.4°C. (-30°F.) and a wind speed of 17 mph. Despite the shifting winds, Thomann landed within 600 feet of the Pole.

The jump was the 500th of Thomann's 6-year parachuting career and his 15th in Antarctica, where he is currently on his third tour. Three jumps before his descent to the Pole, Thomann and Air Crew Survival Equipmentman Second Class John Cadwallader set the antarctic free-fall record of 7,200 feet over the Ross Ice Shelf. They jumped from an LH-34D Seahorse at 9,700 feet and fell for 48 seconds before opening their parachutes.

Eltanin Cruises 23-25

Cruise 23

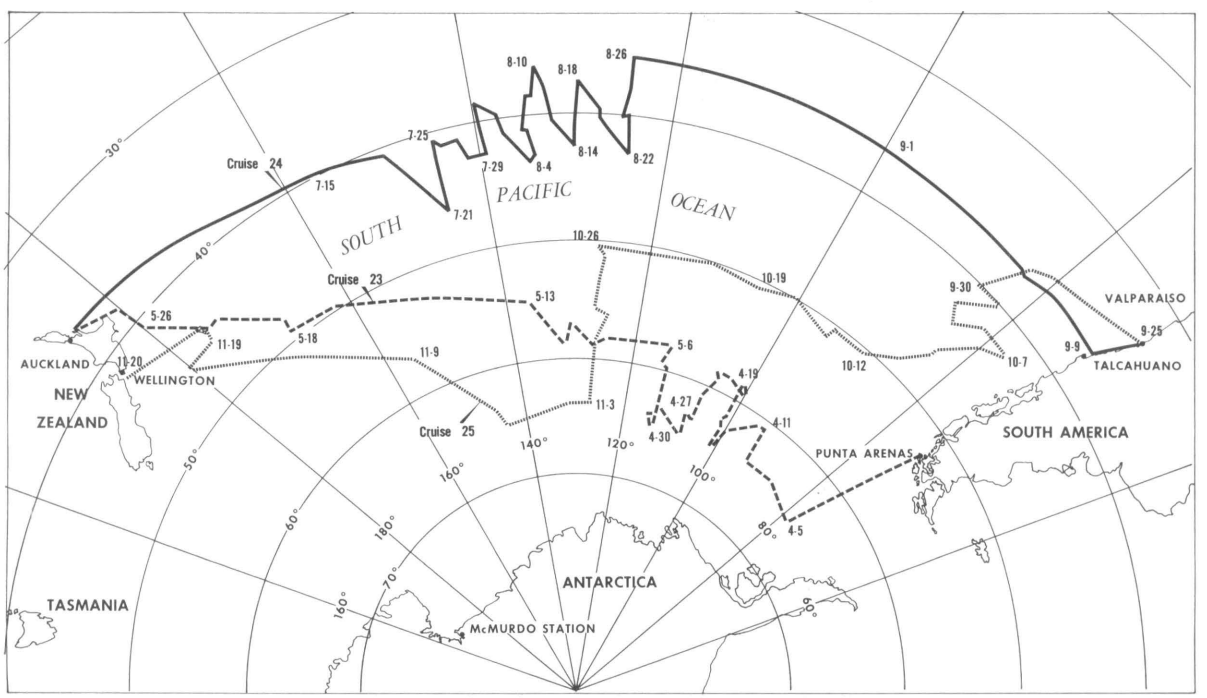
Cruise 23, *Eltanin*'s seventh transit of the South Pacific Ocean, began at Punta Arenas, Chile, on March 31 and terminated at Auckland, New Zealand, on May 30. Aboard the ship were 37 scientists and technicians, including two women and two foreign scientists. Studies were conducted in hydrography, marine geology and biology, ornithology, upper-atmosphere physics, meteorology, and magnetic and seismic profiling.

A primary purpose of the 60-day, 7,330-mile cruise was to crisscross the Antarctic Convergence between 95° and 150°W., covering generally the track of Cruise 15, in order to obtain comparative data at a different time of the year. The track was modified, however, after the fourth crossing of the Convergence, near 115°W., where a nearly direct course was set for New Zealand (cf. map). Nineteen stations were occupied during the four crossings. Another was completed at the beginning of the aborted fifth crossing, and seven stations were occupied along the Subtropical Convergence during the passage to New Zealand.

The hydrographic program, conducted by Lamont Geological Observatory of Columbia University, included sampling for trace elements, phytoplankton, and fungi for the University of Miami and obtaining Phleger cores for the University of Southern California and the Georgia Institute of Technology. At each station, two casts were made, each line carrying as many as 43 bottles. One cast sampled the water column from the surface to a depth of 1,000 meters and the other from 1,250 meters to the bottom.

The University of Southern California's biological sampling program included 18 Blake trawls, 54 Isaacs-Kidd mid-water trawls, 13 plankton hauls, 1 otter trawl, and 10 dip-net hauls. In addition, sampling was done from shore at Punta Arenas and the Chatham Islands. Echinoderms were the most numerous organisms collected from the abyssal plain; at one station, at least eight forms of holothurians were taken in a single tow at 2,500 fathoms. A greater variety of organisms was taken in shallow water near New Zealand than at comparable depths in the Straits of Magellan; numerous species of gadids and Macruridae dominated the collections obtained from both areas.

The University of Miami conducted a study of fungal populations and their relationship to the presence of bacteria, phytoplankton, and certain micronutrients upon which they depend. Collections were made at 23 stations; 506 samples of fungi and bacteria, 450 of phytoplankton, and 400 of trace elements and particulate organic matter were processed and shipped to the United States for study.



Eltanin *tracks, Cruises 23-25.*

Another University of Miami study compared the cephalopod distribution along the Antarctic and Subtropical Convergences. In all, 245 squids, 12 benthic octopods, 6 pelagic octopods, 6 finned octopods, and 2 specimens of *Vampyromorpha* were collected. The cephalopod fauna was much more varied in the area of the Subtropical Convergence than in the area of the Antarctic Convergence. A marked concentration of *Histioteuthis* sp. was noted in the vicinity of the Albatross Cordillera. *Ommastrephes* was observed at almost all stations, frequently in large numbers.

An investigation was conducted by Texas A&M University of primary productivity and standing crop of phytoplankton. Vertical plankton hauls made from the surface to a depth of 200 meters yielded 154 samples for chlorophyll analysis and 462 samples for C^{14} analysis. In order to relate productivity to the standing crop, data were obtained on light penetration and water transparency, as well as on nutrients, pH, alkalinity, and temperature.

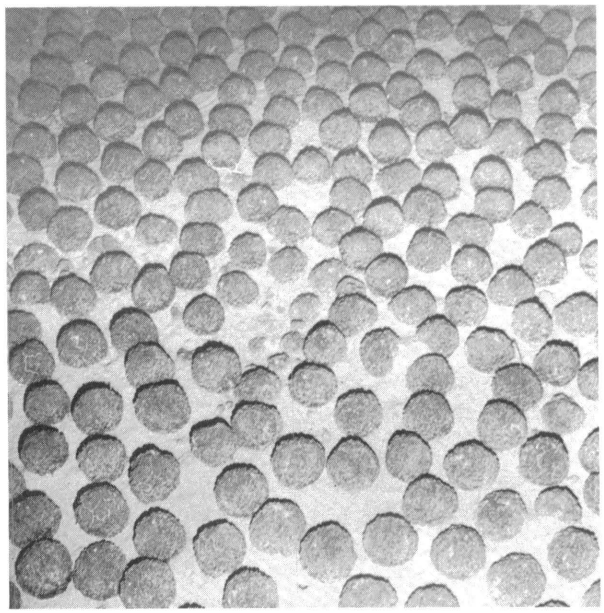
Data on aerobic and anaerobic organisms in marine sediments were gathered by the Georgia Institute of Technology from Phleger cores. Sediment samples were removed at three-inch intervals along the cores and placed in six different enrichment media for analysis in the United States. Slide counts of organisms were made aboard ship.

Twenty-two piston cores that ranged in length from 12 centimeters (4½ inches) to 25.63 meters (84 feet) were taken as part of Florida State University's marine geology program. Phleger cores were obtained at most stations. Seven rock samples were brought up by Blake trawls.

Lamont Geological Observatory's magnetometer was in continuous operation. The values recorded ranged from a low of 37,400 gammas in the area of 53°40′S. 75°30′W. to a high of 57,600 gammas in the area of 41°10′S. 170°15′W.; several anomalies were recorded in the area of 55°25′S. 135°13′W.

Lamont's seismic profiling program was hampered by problems with the air gun. Six crossings of the Southeast Pacific Basin's northern boundary between 59°25′S. 77°49′W. and 61°06′S. 114°56′W. were recorded. The average depth of the basin was found to be 2,400 fathoms. Multiple reflections were obtained, indicating that the underlying material consists of layered sediments. The records obtained north of the basin indicated that the topography is rugged; only about 0.2-0.3 second of signal penetration was obtained there.

Stanford University recorded whistlers and other very-low-frequency phenomena. The program included broadband (2.5 to 30 kc/s) recording for two minutes of each hour and recording of signals from two VLF stations for a total of six minutes each hour. During periods of particularly interesting VLF activity, recordings were made for as long as 45 minutes at a time. Noteworthy activity was observed on 17 days. On 11 consecutive days, recordings were made of signals from Byrd Station. The VLF program, which has been in operation for several years, was discontinued at the end of this cruise.



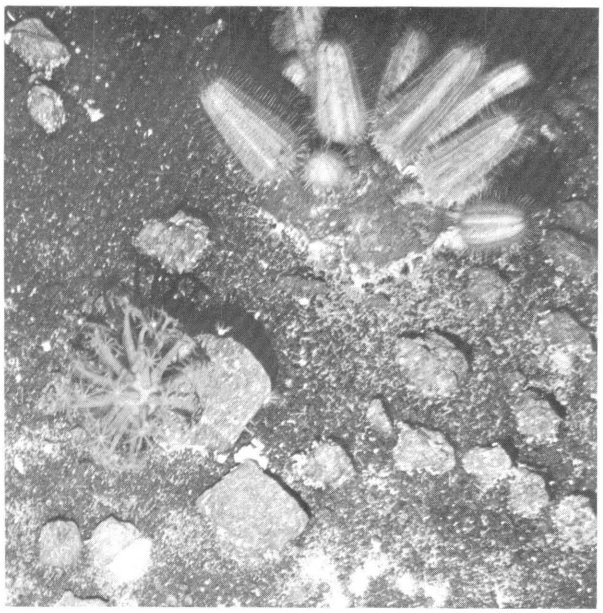
(NSF photo)

Eltanin *Cruise-24 bottom photograph showing manganese nodules at a depth of about 2,880 fathoms at 42°31′S. 145°04′W.*

Meteorological observations were made by the U.S. Weather Bureau, ESSA, during 35 successful radiosonde balloon flights (of a total of 45 attempted) to an average altitude of 26,120 meters and a maximum of 34,761 meters, and during 34 rawinsonde flights (of 44 attempted) to an average altitude of 10,529 meters and a maximum altitude of 15,130 meters. Two hundred surface observations were made. Fourteen carbon dioxide samples were obtained for the Scripps Institution of Oceanography.

Two foreign exchange scientists participated in the cruise: Peter C. Harper of the Dominion Museum, New Zealand, and Hugo Mery of Santa Maria University, Chile. Mr. Harper, who continued ornithological investigations he had conducted previously aboard *Eltanin,* observed 34 species of birds at sea and collected about a dozen species at the Chatham Islands. Mr. Mery, who was interested in the effect of solar energy on phytoplankton growth, measured global radiation and recorded the hours of effective sunlight.

Bottom photographs were obtained at all but five stations. In general, the quality of the 179 black-and-white and 85 color photos was excellent.



(NSF photo)

Eltanin *Cruise-25 bottom photograph showing plant life at a depth of about 200 fathoms at 46°02'S. 83°57'W.*

Cruise 24

This transpacific cruise, which involved investigations by 32 scientists and technicians, began at Auckland, New Zealand, on July 7 and ended at Valparaíso, Chile, on September 17. Ten crossings were made of the Subtropical Convergence. On each of nine crossings, four stations were occupied between 2 and 3 latitude degrees apart, and on one crossing, four stations were occupied between 2.5 and 4.5 degrees apart. Toward the end of the voyage, *Eltanin* entered dry dock at Talcahuano, Chile, for one week. She then steamed to Valparaíso, where tours of the vessel were arranged for participants in the Symposium on Antarctic Oceanography, then being held in Santiago, and other interested parties.

Seven scientific programs were conducted, three in biology and the others in marine geology, seismic profiling, hydrography, and meteorology. As usual, bottom photographs were obtained. The satellite navigation system functioned well throughout the cruise.

The hydrographic program of Lamont Geological Observatory and the study of fungal populations conducted by the University of Miami were coordinated once again to obtain physical, chemical, and biological data simultaneously. At 22 stations, both shallow- and deep-water casts were made; Phleger cores obtained on the deep casts were given to Florida State University and the University of Southern California. Temperature and salinity profiles were prepared for all crossings of the Convergence. Bathythermograph readings were taken at 151 sites. About 300 yeast and mold cultures were selected for physiological and systematic analysis, and material was gathered for a study of bacterial populations.

Collections for the University of Southern California's study of the relationships of marine fauna to water types were augmented by the following successful operations: 5 Blake trawls, 58 mid-water trawls, and 5 dip-net hauls. Bottom trawling yielded little biological material, but mid-water trawling was highly productive. A record was kept of the amounts of luminescence exhibited by fish according to the depth of their occurrence and their phyletic classification.

At 50 stations, Texas A&M University biologists obtained water samples for the measurement of primary productivity, standing crop of phytoplankton, and dissolved and particulate organic carbon. Plankton was collected with various types of gear. For the first time, radioactivity counts were completed aboard ship of all samples obtained for the C^{14} uptake analysis, which is made as part of the study of primary productivity. In the past, such counting has been delayed until the samples reached the University.

Owing to the failure of a gear in the deep-coring winch, only 16 piston cores were taken for geological analysis by Florida State University. Averaging 9.46 meters in length, they were composed primarily of silty clay and clay containing manganese oxide. Phleger cores were obtained with the piston-coring rig. Manganese nodules and basalt fragments comprised most of the geologic specimens gathered by Blake trawls. At the first station, located over a seamount, living coral was obtained at a depth of 150 fathoms.

The seismic operations conducted by Lamont Geological Observatory were delayed until July 16 because of equipment failure. During the following two weeks, no subsurface reflections were recorded. Afterward, however, the record often suggested that the seismic energy was being scattered through the subbottom material to depths as great as 400 fathoms.

The meteorological program of the U.S. Weather Bureau, ESSA, included 52 radiosonde, 17 rawinsonde, and 11 radiometersonde flights. Maximum and average heights attained by the balloons were 38,893 and 28,629 meters (radiosonde) and 11,590 and 8,733 meters (rawinsonde). In addition, 213 observations were made of 14 GHOST (Global Horizontal Sounding Technique) balloons.

Cruise 25

Upon departing Valparaíso, Chile, on September 24, 1966, *Eltanin* steamed to the Chile Rise, thence directly westward over the Albatross Cordillera to 56°S. 127°30′W., where she turned southward and crossed the Antarctic Convergence to 63°S. The course then lay northwestward over the Chatham Rise to Wellington, New Zealand, where the ship docked on November 21. Twenty-eight stations were occupied. A total of 35 scientists and technicians, including four women, conducted nine scientific programs—four in marine biology and one each in marine geology, hydrography, seismic profiling, meteorology, and magnetics.

Lamont Geological Observatory's hydrographic program was devoted primarily to the testing of the Salinity-Temperature-Depth (STD) recorder and the Surface Activated Multiple Sampling unit (SAMS). SAMS consists of combined water-sampling bottles and reversing thermometers that are attached to the STD line; the bottles are closed and the thermometers reversed upon command from the surface. Standard casts were made at six stations and STD casts at 12 stations. Five hundred bathythermograph casts were made. Phleger cores were obtained for the Georgia Institute of Technology and Florida State University. Eighteen stations were occupied before winch failures forced cancellation of the program.

Seismic profiling carried out by Lamont revealed a significant body of sediments averaging 200-300 meters in thickness northwest of that part of the Albatross Cordillera crossed first by *Eltanin* on Cruise 25. The sediments in a small basin at 45°30′S. 83°30′W. measured one kilometer in thickness and about six kilometers in width along the line of *Eltanin*'s crossing. Between 45°30′S. 83°30′W. and 50°S. 123°30′W., the sediments appeared to be thin but persistent. No sediment was recorded on the Chile Rise or the central part of the Albatross Cordillera. Thick, contorted, gullied sedimentary layers were noted on the southern flank of the Cordillera. On the floor of a 200-mile-wide abyssal plain east of Bounty Basin, the sedimentary material measured at least one kilometer in thickness. The towed magnetometer, also operated by Lamont, functioned well during the entire cruise.

Florida State University obtained 22 piston cores, six of which were taken on the basis of seismic recordings made over the Chatham Rise. The average length of the cores was 5.11 meters. Phleger cores were obtained from the piston-coring rig. Foraminifera were identified in many of the sediments; clays and silty clays were common. Most of the rock samples collected from bottom trawls were manganese nodules and volcanic material.

The meteorological program, conducted by the U.S. Weather Bureau, ESSA, included 44 successful radiosonde flights to an average altitude of 30,770 meters and a maximum altitude of 41,950 meters, and 17 successful radiometersonde flights. Rawinsonde measurements were not made. Eleven hundred observations were made of 20 GHOST balloons. Surface observations were made on 221 occasions, and carbon dioxide samples were taken at eight locations.

At eight stations, Texas A&M University biologists made determinations of the quantity and types of lipids of major antarctic marine organisms found at depths of 30, 1,000, 2,000, and 3,000 meters. Samples of carbonaceous particulate matter were prepared. Three stations were occupied to obtain samples of trace metals from depths of 750 and 1,500 meters and levels near the bottom.

Texas A&M University's study of primary productivity, dissolved and particulate organic carbon, and plankton involved sampling at 22 stations and 100 other localities. In conjunction with Lamont's STD casts, collections were made at three stations near the Antarctic Convergence. A total of 210 analyses for each of three types of chlorophyll were run. Radioactivity counts of all samples obtained for C^{14} uptake analysis were made again aboard ship.

Phleger cores were obtained at 10 stations for the Georgia Institute of Technology as part of a study of the kinds of anaerobic microorganisms occurring in marine sediments. Water samples were taken on the hydrographic line at 10 depths between the surface and bottom to determine the variation of kinds of bacteria as a function of depth.

In cooperation with other Cruise 25 programs, the Smithsonian Oceanographic Sorting Center collected biologic material at 21 stations from 48 mid-water trawls and 14 bottom trawls. Color photographs were taken of most specimens. The collections were prepared for shipment to the Center for processing.

A. P. Crary Assumes New Position

Dr. A. P. Crary, since 1960 Chief Scientist, Office of Antarctic Programs, National Science Foundation, was appointed Deputy Division Director, Environmental Sciences, on January 15. For the time being, he will continue to serve as Chief Scientist for the U.S. Antarctic Research Program.

The Office of Antarctic Programs is an integral part of the Division of Environmental Sciences, of which Dr. T. O. Jones is Director. The Division was established on November 26, 1965.

The U.S.-U.S.S.R. Exchange Scientist Program in Antarctica is Ten Years Old

I. A. ZOTIKOV *
Institute of Geography
Academy of Sciences, U.S.S.R.

In 1959, 12 countries signed the Antarctic Treaty to designate Antarctica a continent of peace. Under this Treaty, scientists from different countries, including the Soviet Union and the United States, are working together to unravel the mysteries of the frozen continent. Thus, the coldest of all continents has become the site of warm human relationships and fruitful scientific cooperation between citizens of our countries.

The exchange scientist program has been of major significance in furthering mutual understanding between our countries in Antarctica. Such arrangements between national expeditions are recommended in the Antarctic Treaty, but even before the Treaty was signed the United States and the U.S.S.R. had begun to exchange scientists between their antarctic expeditions. During 1956-1957, an American scientist, Gordon Cartwright, spent a year at the Soviet antarctic base Mirnyy. At the same time, Soviet scientist Vladimir Rastorguev wintered over at Little America V.

Since then, the United States and the U.S.S.R. have exchanged scientists as members of wintering-over parties during all years except one. Meteorologists, glaciologists, physicists, biologists, and oceanographers from the United States have joined Soviet expeditions, and Soviet scientists have been members of U.S. expeditions. Last winter, John Taylor from the United States conducted studies in upper atmosphere physics at the Soviet station Vostok, while Lev Klimov, a geologist, wintered over at the U.S. station McMurdo.

On the tenth anniversary of this exchange program, I should like to relate some lasting impressions formed while spending the 1965 winter and the 1965-1966 summer doing research in glaciology at McMurdo and other U.S. stations. I believe these impressions are typical of the relationships formed by U.S. scientists at Soviet stations and by Soviet scientists at U.S. stations.

(NSF photo)
Drs. I. A. Zotikov and A. P. Crary at South Pole (cf. article, page 44).

Foremost among my impressions was a sense of continuous, friendly attention on the part of all the foreign colleagues with whom I lived and worked. During my first month at McMurdo, Dr. A. P. Crary and Morton Rubin helped to familiarize me with the area and facilitated commencement of my work. When it turned out that I lacked some instruments to carry out my investigations, the equipment was kindly provided by R. A. Paige of the U.S. Naval Civil Engineering Laboratory and Guenther Frankenstein of the Cold Regions Research and Engineering Laboratory. Later, as winter set in, Art DeVries, George Somero, David Cook, and other members of the U.S. Antarctic Research Program became my friends. We discussed scientific problems and means for solving them; we helped each other to drill holes through the sea ice; and we encouraged each other when the polar night seemed to have no end. Together, we listened to Russian and American songs reminiscent of our homelands.

Life at McMurdo seemed strikingly similar to that at Mirnyy, where I had spent an earlier winter. Working conditions, and even the humor which helps to carry one through the long antarctic winter, seemed to be the same, an observation confirmed by Dr. George Meyer who lived and worked at Mirnyy at the same time that I was at McMurdo. Though we never met, we conversed by radio and got acquainted; I was not surprised to learn that his impressions of life at Mirnyy were in many respects similar to mine of McMurdo.

My relationships with the men of Antarctic Support Activities and Air Development Squadron Six and their leaders—Comdr. Jehu Blades, Chaplain Donald Weir, and Lt. Comdr. Bert Johnson—were

* Dr. Zotikov wintered over at McMurdo Station in 1965 as the U.S.S.R. exchange scientist. His studies encompassed the growth of sea ice in McMurdo Sound, the regime of the Erebus Glacier Tongue, the mechanism of ice growth in the vicinity of the Dailey Islands, and temperature profiles in Lake Vanda.

equally warm. They provided me with both technical and manpower support.

When I needed assistance in my work away from the station, the helpers were usually volunteers from the ASA complement. In fact, there were so many volunteers, all willing to exchange the warmth of the station for the cold of a tent, that the main problem was how to tactfully turn down some of the offers. Lieutenants John Dittmar, Phillip Dwyer, and George Gould lived with me for days in tents at Lake Vanda and near the Dailey Islands, working hard to help me complete my research.

While working on the sea ice, we were in close contact with Chief Grimes and his men. When I had to ask for help from the workshop, Chiefs Gabryluk, Voigt, and McCartney and their men could be counted on for quick and efficient service.

When spring arrived and the old crew departed, one of the first persons of the replacement group to offer his assistance was Rear Admiral Fred Bakutis. As time for my departure drew near, Kendall Moulton and Philip Smith, of the USARP administrative staff, and Comdr. Morris and his VX-6 pilots did much to enable me to complete my investigations. On my arrival at Christchurch, I was warmly received by Edward Goodale. I should like to thank all of these people and many others; to name them all would entail listing almost the entire winter and summer complements.

I earnestly hope that the exchange program continues so that other scientists will enjoy the distinct advantages of conducting research at foreign stations, while exchanging ideas on all aspects of antarctic research and establishing the close personal contacts that lead to better understanding between people and nations.

Visit to Vostok

The landing of a Navy Hercules at Vostok Station on December 12 ended 10 months of isolation for 15 members of the Soviet Antarctic Expedition and their winter guest, USARP scientist John H. Taylor. Aboard the aircraft were 20 visitors and a crew of 9, plus Dr. Victor P. Hessler, another U.S. scientist, who joined Mr. Taylor for a month's work at the Soviet station on the polar plateau.

The visitors received a warm welcome in a scene symbolic of the international cooperation that Antarctica fosters: flags of the U.S.A. and the U.S.S.R. flew together from the station's towers and over its entrance, and Soviets and Americans joined their efforts to unload scientific supplies and fresh produce from the LC-130.

(U.S. Navy photo)

Soviet station leader Artem'ev welcomes the visitors. Dr. Hessler is at left, Capt. Kosciusko at right, and Lt. Comdr. Timoney and Mr. Huffman are behind.

The international theme was emphasized by the presence of Mr. Colin M. Clark, leader of New Zealand's Scott Base, and two members of a group of eight foreign representatives observing U.S. antarctic activities: Mr. John Grierson of Great Britain and Mr. Bruce Harry Stinear of Australia. Mr. Grierson is an author, aeronautical engineer, former test pilot, and pioneer of polar aviation. Mr. Stinear is a geologist with the Australian Bureau of Mineral Resources and an antarctic veteran. Thus, five of the nations signatory to the Antarctic Treaty were briefly represented at Vostok.

Greetings from Rear Admiral Fred E. Bakutis were presented to Soviet station leader Aleksandr Artem'ev by Captain Henry M. Kosciusko, the commander of Antarctic Support Activities. On the Admiral's behalf, the Captain also invited Soviet personnel to visit McMurdo. As USARP Representative in Antarctica, Mr. Jerry W. Huffman voiced the desire for continued Soviet-American scientific cooperation. This was Mr. Huffman's second visit to Vostok (he had accompanied Mr. Taylor on last summer's deployment flight), but it was the first for Dr. Albert P. Crary, USARP Chief Scientist, and Dr. Jay T. Shurley of the University of Oklahoma Medical Center.

In his welcoming speech, station leader Artem'ev praised the exchange concept and the work accomplished under the program. He noted that Mr. Taylor's counterpart, Soviet geologist Lev V. Klimov, had spent the past winter at McMurdo Station and was currently extending his geologic investigations as a member of the Byrd Land coastal survey team. (Bad weather at the survey camp prevented Dr. Klimov from joining the Vostok flight.)

The United States exchange projects at Vostok are conducted for the Institute for Telecommunication Sciences and Aeronomy of ESSA, the University of Alaska, Dartmouth College, and the

Bartol Research Foundation. The program includes observations of extremely-low- and very-low-frequency emissions, cosmic rays, and ionospheric absorption. Dr. Hessler made his third trip to Vostok primarily to check and calibrate his ELF recording equipment and a system for measuring earth currents through the ice cap. The forward-scatter link that Mr. Taylor maintained between Vostok and McMurdo is one of three operated by the Bartol Research Foundation; together with the Byrd—South Pole and Byrd—McMurdo links, it provides a means of observing electron precipitation in the upper atmosphere. Mr. Taylor described his winter at Vostok as scientifically profitable and personally rewarding, thanks to excellent cooperation and a genial atmosphere.

A little less than two hours after their arrival, the visitors boarded the Hercules again for the 819-mile return trip. Dr. Hessler and Mr. Taylor remained at the station to service their equipment and, since there will not be an American exchange scientist at Vostok this winter, to train their Soviet colleagues in its operation. In mid-January, the U.S. scientists departed for Australia via Mirnyy Station.

Penguins Demonstrate Homing Ability on Three-Thousand-Mile Journey

Three of a group of 40 Adélie penguins captured on November 5, 1964, on the coast of East Antarctica and transported 1,500 miles to a central location on the Ross Ice Shelf were recaptured at their home rookery near Mirnyy Station during the 1966-1967 breeding season. Since the penguins had to make their return journey along the periphery of the Continent (presumably in the pack ice), they must have covered a distance of some 3,000 miles, swimming, walking, and tobogganing on their bellies. The Soviet scientists who discovered and examined the birds found them to be in good condition.

The 40 penguins were captured by Soviet and U.S. scientists as subjects of orientation-navigation experiments conducted by Richard L. Penney of Johns Hopkins University and John T. Emlen of the University of Wisconsin. From their home rookery, located on Fulmar Island of the Haswell Islands, the birds were flown to 80°S. on the 180° meridian, where the two U.S. biologists banded and released them.

Dr. Penney, who is now with the New York Zoological Society and Rockefeller University, has continued his investigations of the behavioral and physiological aspects of the sun-azimuth orientation exhibited by Adélie penguins. He is now studying captive penguins in specially designed environmental control rooms at the New York Zoological Park.

More Russian Translations Available from CFSTI

Vol. II, No. 1 of the *Antarctic Journal* lists five Russian monographs on polar research available in English translation from the Clearinghouse for Federal Scientific and Technical Information, U.S. Department of Commerce, Springfield, Virginia 22151. The following works, also translated for the National Science Foundation by the Israel Program for Scientific Translations, are available from CFSTI at $3.00 a copy:

Academy of Sciences of the U.S.S.R. Interdepartmental Commission on Antarctic Research. Antarctica: Commission Reports, 1963. 1964. 187 p. (TT 65-50143).

Academy of Sciences of the U.S.S.R. Zoological Institute. Biological Reports of the Soviet Antarctic Expedition, 1955-1958, Vol. I. Edited by A. P. Andriiashev and P. V. Ushakov. 1962. 315 p. (TT 66-51061).

Academy of Sciences of the U.S.S.R. Zoological Institute. Biological Reports of the Soviet Antarctic Expedition, 1955-1958, Vol. II. Edited by A. P. Andriiashev and P. V. Ushakov. 1964. 448 p. (TT 66-51062).

Arctic and Antarctic Scientific-Research Institute, Leningrad. Contributions to Long-Range Weather Forecasting in the Arctic. Edited by A. A. Girs and L. A. Dydina. 1963. 240 p. (TT 66-51059).

Kotliakov, V. M. The Snow Cover of the Antarctic and its Role in the Present-Day Glaciation of the Continent. Edited by G. A. Avsiuk. 1961. 255 p. (TT 65-50144).

Kozlova, O. G. Diatoms of the Indian and Pacific Sectors of the Antarctic. Edited by A. P. Lisitsyn. 1964. 191 p. (TT 66-51154).

Rusin, N. P. Meteorological and Radiational Regime of Antarctica. 1961. 355 p. (OTS 64-11097).

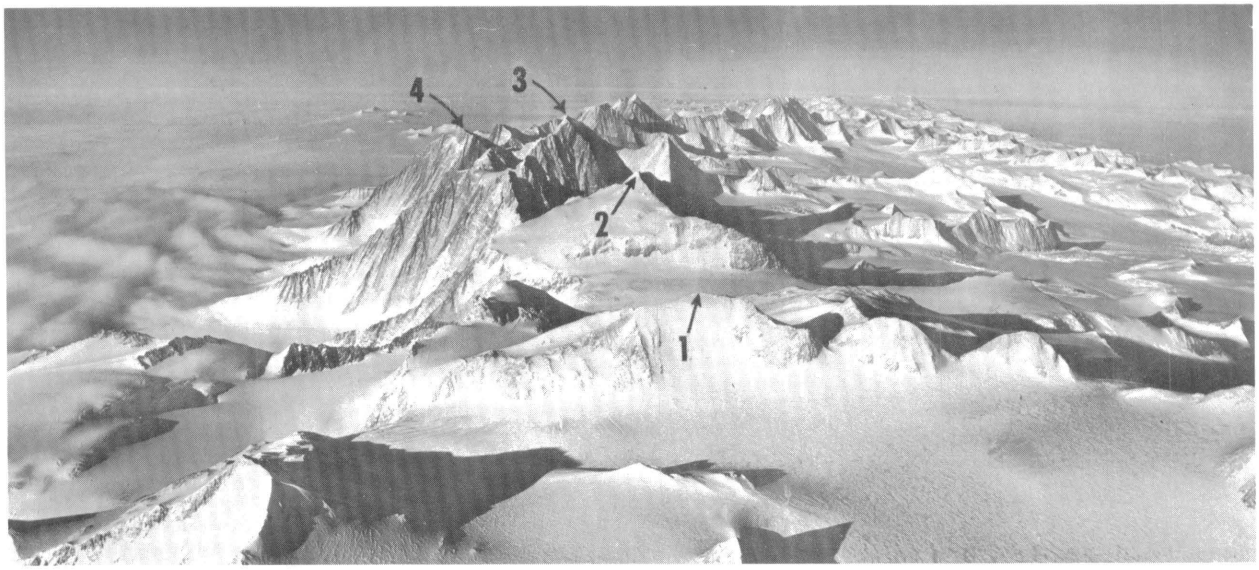
The following monographs have been submitted for translation and are expected to be available in English during 1967:

Arctic and Antarctic Scientific-Research Institute, Leningrad. Hydrometeorological Problems of the Polar Regions. Edited by G. IA. Vangengeim and A. F. Laktionov. 1963.

Gaigerov, S. S. Aerology of the Polar Regions. 1964. 304 p.

Nudel'man, A. V. Soviet Antarctic Expeditions 1961-1963. 1965. 272 p.

Ravich, M. G., L. V. Klimov, and D. S. Solov'ev. Precambrian of East Antarctica. 1965. 470 p.



(Photo U.S. Navy for U.S. Geological Survey)

Oblique aerial photographic view of part of the Sentinel Range. Four of the mountains climbed by the American Antarctic Mountaineering Expedition are Vinson Massif (1), Mount Shinn (2), Mount Tyree (3), and Mount Gardner (4). Mount Ostenso and Long Gables, also climbed, are among the peaks farther north.

The American Antarctic Mountaineering Expedition

SAMUEL C. SILVERSTEIN*
Rockefeller University
New York, N.Y.

A Navy LC-130 Hercules circled over the lower slopes of the Sentinel Range, then descended, touched its skis to the snow, and glided to a stop near 10 waiting mountaineers and their equipment. Twenty-five miles to the east, the 16,860-foot-high summit of Vinson Massif, highest mountain in Antarctica, glistened above a wreath of gray cloud. Nearby were Mount Tyree, 16,250 feet, second highest mountain on the Continent; Mount Shinn, about 16,000 feet; Mount Gardner, 15,800 feet; and Mount Ostenso and Long Gables, both over 13,000 feet high. As the men loaded their equipment into the plane and then clambered aboard for the return trip to McMurdo, a fascinating mountain-climbing experience, involving first ascents of all of those peaks, was coming to an end.

That experience had begun in the United States three years earlier when it occurred to members of the American Alpine Club that a major mountaineering challenge, heretofore ignored, waited in Antarctica. Although tentative plans were made to answer the challenge, it was not until 1966 that those plans began to materialize. In November of that year, the National Geographic Society agreed to provide major financial support for the undertaking, and the Office of Antarctic Programs of the National Science Foundation, in view of the proven capability, national representation, and scientific aims of the group, arranged with the Department of Defense for the U.S. Naval Support Force, Antarctica, to provide the logistics required. On December 3, the climbing party, called the American Antarctic Mountaineering Expedition, assembled in Los Angeles to prepare for the unprecedented undertaking.

The Members

The expedition consisted of 10 members selected by the American Alpine Club. Nicholas Clinch, a Los Angeles lawyer, was expedition leader; he had successfully led two previous American mountaineering expeditions to the Himalayas. Dr. William E. Long of Alaska Methodist University, John P. Evans of the University of Minnesota, and Charles D. Hollister of the Lamont Geological Observatory of Columbia University comprised the geologic group. Long and Evans had explored antarctic mountains previously, Long with the 1958 traverse party which first saw the Sentinel Range from the ground, and Evans with the 1963-1964 University of Minnesota party that visited the Heritage and Ellsworth Mountains. The radio operator was Eiichi Fukushima, a

* Member, American Antarctic Mountaineering Expedition.

doctoral candidate in physics at the University of Washington. Peter Schoening of Seattle, Washington, Richard Wahlstrom of Edmonds, Washington, Brian Marts of Estes Park, Colorado, and Barry Corbet of Jackson Hole, Wyoming, were all mountaineers of considerable experience (Corbet was a member of the 1963 American Mount Everest Expedition). Physician's services were provided by the author.

The party flew by commercial airliner to Christchurch, New Zealand, and thence, on December 6,* by military aircraft to McMurdo Station. The following day, the mountaineers and their two tons of equipment, including a motor toboggan, were transferred to a ski-equipped Hercules LC-130, which took them the remaining 1,300 miles to the Sentinel Range and a landing site only 25 miles from Vinson Massif.

At the landing site, the motor toboggan was loaded with all of the equipment and supplies needed to sustain the group for at least 60 days. The ascent of Vinson Massif, the first and primary objective of the expedition, began on December 9 with a toboggan trip to the head of a deep cirque two miles northwest of the mountain at an altitude of 8,500 feet. Here, a base camp was set up for the ascents of both Vinson Massif and its next neighbor to the north, Mount Shinn.

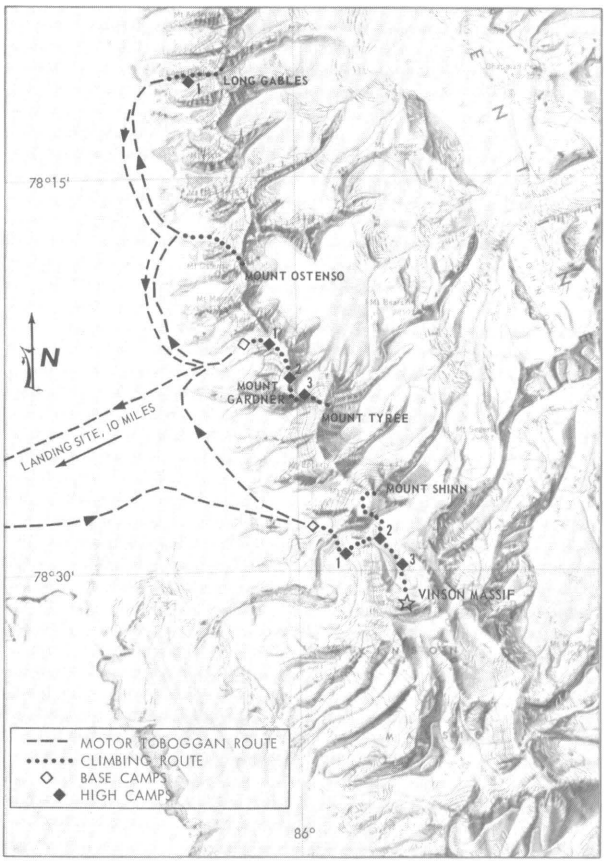
Vinson Massif and Mount Shinn

Vinson Massif is a 10-mile-long block-shaped prominence that stands 9,000 feet above the surrounding ice. The expedition's route to the highest of its numerous rocky summits led up a steep snow slope at the head of the cirque in which the base camp had been placed and over a pass into a glacial basin on the other side. In this basin, at an altitude of 10,500 feet, camp 1 was set up on December 11. On the following day, a route was found through the upper icefall of the basin, at the head of which, on the rolling summit plateau, camp 2 was established at 12,500 feet. A severe windstorm, gusting to 60 knots, immobilized the expedition for the next four days. On December 16, Barry Corbet, Peter Schoening, John Evans, and William Long placed camp 3 at 14,500 feet, and on the following day this group went on to the summit. The rest of the expedition, which had divided into two three-man teams, reached the summit on the 18th and 19th. In a gesture symbolic of the international cooperation that exists in Antarctica, the first group to reach the top of Vinson Massif planted there the flags of the 12 nations that signed the Antarctic Treaty.

* All times given are local for the areas concerned.

(Photo courtesy National Geographic Society)

The flags of the 12 Antarctic Treaty nations fly at the summit of Vinson Massif.



Route and camp locations of American Antarctic Mountaineering Expedition portrayed on a portion of U.S. Geological Survey 1:250,000 Reconnaissance Series map "Vinson Massif" (compiled 1961).

After returning to camp 2, the expedition again divided itself into three climbing parties, and on the 20th, 21st, and 24th climbed to Mount Shinn's conical, heavily snow-corniced summit. By Christmas Day, all expedition members had returned to the base camp.

Mounts Gardner and Tyree

The expedition then headed northward by motor toboggan along the western flank of the range to the foot of Mount Gardner, where it set up a base camp at 8,500 feet and planned its climbs of Mounts Gardner and Tyree. Mount Gardner, a fortress-like mountain capped by a rolling plateau, was a worthy objective in itself. But because it was situated beside the second highest mountain in Antarctica, Mount Tyree—a forbidding pyramid of steep rock and ice that gave only fleeting hints of feasible climbing routes—the expedition, quite understandably, gave its full attention to the larger objective. As it turned out, Mount Gardner became a stepping stone to the ascent of Mount Tyree, for the route finally chosen lay over the lower summit.

The climb began December 27 on Mount Gardner's northwestern flank with the ascent of a steep, narrow, mile-long couloir, at the top of which, on the gently rolling, snow-covered plateau, camp 1 was established. The party then traversed the plateau, establishing camp 2 at about 14,000 feet and reaching the summit on December 31.

A 1,500-foot descent that involved fastening 1,000 feet of climbing rope to steep ice and rock was then made to a narrow saddle between Mounts Gardner and Tyree. Because of the difficulties in reaching the saddle and setting up camp 3 there, it was decided that only two men would attempt the final ascent of Mount Tyree. They were Barry Corbet and John Evans.

These men lived in the saddle for five days, during which they made two attempts to reach Mount Tyree's summit. First, they tried to climb the ridge directly, but were turned back by steep rock pinnacles 500 feet above camp. On the second try, they climbed mostly along the northern slope of the ridge, avoiding the pinnacles. They reached the summit at about 1800 on January 4. The climb to the top of Mount Tyree and back to the saddle lasted 20 hours, all spent at altitudes above 14,000 feet.

During this period, two climbers stood by at camp 2, and the others waited to assist, if necessary, at lower levels. Help was not needed, however, and by January 6, the entire expedition had reassembled at the Mount Gardner base camp.

Mount Ostenso and Long Gables

On January 11, after a period of rest and forced rest while waiting out a storm, the expedition continued northward for quick ascents of Mount Ostenso and Long Gables. Simultaneously, four men went up each mountain. The remaining two men operated the motor toboggan between the bases of the mountains.

By noon on the 12th, the entire group had returned to the base camp at Mount Gardner, and by late the following day it had reached the Hercules landing site. Four days later, on January 17, the Navy aircraft arrived to transport the party back to McMurdo Station.

As the plane took off and circled in front of the Sentinels before setting course for McMurdo Station, the climbers wondered, as they had on many occasions during their 40 days in this remote mountain range, how they might have fared in their undertaking without Navy logistic support. As the expedition leader, Nicholas Clinch, noted during an interview in Washington, "A big psychological factor was the knowledge that the U.S. Navy was standing by."

The American Antarctic Mountaineering Expedition had achieved all of its goals. In addition to climbing six mountains, including the four highest in Antarctica, it had contributed to the objectives of the United States Antarctic Research Program by making a geological reconnaissance of upper levels of the Sentinels which had not been visited previously.

Geologic Observations

The geologic program included the sampling of Crashsite Quartzite on ridges between the base camps and summits of all of the mountains climbed and on the flanks of some that were not climbed. Only one exposure of pre-Crashsite rock was found —near the head of the Nimitz Glacier northwest of the summit of Vinson Massif. A sequence of rhythmic flysch-like bedding was noted in the Crashsite Quartzite at an altitude of about 9,000 feet on the west ridge of Mount Shinn. On the west ridge of Mount Shear, glacial striations were observed as high as 10,200 feet (from 1,200 to 1,500 feet above the present ice level). Between 1200 and 2100 (local time) on December 26, 27, and 28, running meltwater was observed on the darkest rocks on this ridge below an altitude of 9,500 feet. This water began to freeze at about 2200 hours, causing visible rock breakage.

The rock samples collected by the expedition are now being analyzed. The results will be published this spring by the New York Academy of Sciences.

Command of Naval Support Force is Transferred

Ceremonies at McMurdo Station on February 25* marked the transfer of command of the U.S. Naval Support Force, Antarctica, from Rear Admiral Fred E. Bakutis to Rear Admiral J. Lloyd Abbot, Jr., the fifth commander in the organization's 12-year history. The ceremony coincided with the closing of the summer support season and the beginning of the austral winter. When the two admirals departed Antarctica that day, they left behind about 200 Navy and scientific personnel who will remain there until next austral summer.

(U.S. Navy photo)

Rear Admiral Bakutis congratulates Rear Admiral Abbot after change of command ceremonies at McMurdo Station. Behind them is the Byrd memorial.

Admiral Bakutis, who has been appointed Commander, Fleet Air Alameda, at the U.S. Naval Air Station, Alameda, California, held his antarctic command since April 27, 1965. His tour was highlighted by the construction of Plateau Station and Byrd Station's VLF substation, major redevelopment of McMurdo Station, extensive photomapping of Antarctica, the beginning of a new Palmer Station, and the first landing in Antarctica of a pure-jet transport.

The new commander is a native of Alabama and a 1939 graduate of the U.S. Naval Academy. Admiral Abbot also graduated from the Armed Forces Staff College and the National War College, and he received a master's degree in business administration from George Washington University in 1964.

Admiral Abbot is a veteran of many sea assignments. He first served afloat in 1939 aboard the carrier USS *Enterprise* (CV-6). In September 1939, he was transferred to the destroyer USS *Gilmer* (DD-233), aboard which he served until 1941, when he was detached for flight training. On August 18, 1941, he was designated a naval aviator. In 1942 he was a flight officer with an air antisubmarine squadron (VS-1-D14), and in March 1943 he became the commander of another such squadron (VS-66). While commanding that squadron, he was cited for achievements in combat in the vicinity of the Gilbert and Marshall Islands. Later he assumed command of two other naval aviation squadrons: in 1946, of a fighter squadron (VF-42) aboard USS *Franklin D. Roosevelt*; and in 1951, of a utility squadron (VU-4). In 1955, he reported to USS *Lake Champlain* and served as operations officer and executive officer. In 1956, he joined the staff of the commander of Carrier Division Two as operations officer; during this tour, he embarked in the carriers USS *Coral Sea,* USS *Franklin D. Roosevelt*, and USS *Randolph*. In 1960, he was assigned command of the seaplane tender USS *Valcour,* and in 1961 of the aircraft carrier USS *Intrepid*. Under his command, *Intrepid* recovered astronaut Scott Carpenter after his three-orbit flight in May 1962 and won the Naval Air Force, U.S. Atlantic Fleet Battle Efficiency Award. One year later, he became chief of staff of Carrier Division Five.

Admiral Abbot's shore duty includes two tours on naval aviation training staffs and one as executive officer of the U.S. Naval Academy's Bancroft Hall. In August 1964, he returned to the Office of the Chief of Naval Operations, this time as director of Naval Warfare Analyses. From that assignment he came to his present command.

Soviet Exchange Scientist Named

P. G. Astakhov of the Arctic and Antarctic Scientific-Research Institute in Leningrad has been named U.S.S.R. exchange scientist with the U.S. Antarctic Research Program for 1967. Mr. Astakhov, an upper atmosphere physicist, will work at Pole Station. It will be his second year in Antarctica: he wintered over at Mirnyy Station in 1963 as a member of the Eighth Soviet Antarctic Expedition.

Erratum in Vol. II, No. 1, p. 8: That part of the caption for the map that reads "Alexander Island is now called Alexander I Island" is incorrect. The correct name is Alexander Island.

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* February 24 in Greenwich time; changes of command are effected in local time.

(U.S. Navy photo)

NASA officials and their NSF host in Antarctica. Left to right: Drs. Faget, Gilruth, and von Braun; Mr. Smith (NSF); and Dr. Stuhlinger.

NASA Officials Visit Antarctica

During January 3-10, four high officials of the National Aeronautics and Space Administration visited Antarctica as guests of the National Science Foundation. They were Dr. Wernher von Braun, Director of the George C. Marshall Space Flight Center, Huntsville, Alabama; Dr. Ernst Stuhlinger, Director of the Research Projects Division, George C. Marshall Space Flight Center; Dr. Robert Gilruth, Director of the Manned Space Flight Center, Houston, Texas; and Dr. Maxime Faget, Assistant Director for Engineering and Development, Manned Space Flight Center. Mr. Philip M. Smith, Program Director for Field Requirements and Coordination, Office of Antarctic Programs, prepared the program for the visit and accompanied the group to Antarctica.

Of principal interest to the NASA officials were management procedures of the U.S. antarctic program. Dr. Gilruth observed after the visit that, although the environmental conditions of Antarctica and the moon are quite dissimilar, the problems of support operations and scientific exploration in the two realms may parallel each other. "In each case," he noted, "scientific investigations must be conducted at the end of a long and complex logistic chain. The concept of conducting a variety of scientific missions from a remote field base, such as the camp in Byrd Land, is similar to that of exploring the moon after the first lunar landings have been achieved. In both cases, the operational activities required to enable scientific investigations to be pursued are so massive that they tend to overshadow the efforts which they support. In coping with the problems that arise in coordinating such missions, an analysis of the past ten years of antarctic experience may be of assistance to NASA."

From McMurdo Station, which served as headquarters for the visitors, trips were made to the dry valleys, New Zealand's Scott Base, the Byrd Land camp, the Byrd VLF substation, and Byrd, Plateau, and Pole Stations. At all of these sites, scientific and military personnel explained the research and support activities in progress. The NASA group also visited Shackleton's and Scott's huts at Capes Royds and Evans. Trips between stations were made in Navy Hercules aircraft, whereas short trips were made in Navy LH-34D helicopters or surface vehicles.

At McMurdo Station, the group inspected the nuclear power plant, the saltwater distillation system, the backup diesel-electric power plant, the new medical facility, and the scientific laboratories. Special attention was given to the USARP biological laboratory, where work related to projects underway in the dry valleys was in progress.

During their visit to the dry valleys, the NASA officials inquired primarily about the problems of detecting and observing plant and animal life. Their interest was motivated by problems NASA encounters in designing life-detection systems for installation in spacecraft. USARP project scientists Roy E. Cameron of the Jet Propulsion Laboratory, Robert E. Benoit of Virginia Polytechnic Institute, and Russell W. Strandtmann of Texas Technological College discussed their studies of microorganisms and insects. These studies relate particularly to the confinement of life to rigidly defined ecological zones, such as might occur on other planets.

(U.S. Navy photo)

Drs. von Braun and Gilruth visit one of the dry valleys of Victoria Land. At left is Mr. Smith.

At Byrd Station, the visiting scientists saw how living and working quarters had been constructed beneath the snow surface. They also examined the small modular facility installed at Byrd substation to support the long-wire VLF antenna program. "Conditions encountered in living below the surface of the moon," Dr. von Braun said, "could be very similar to those encountered in living below the snow in Antarctica. Beneath-the-snow structures at Byrd Station permit USARP and Navy personnel to live and work in a relatively stable thermal environment and without concern for the effects of storms. If structures were to be placed a few feet beneath the lunar surface, the temperature could be kept at about 12°C. and protection could be provided from the damaging effects of solar flares."

The Navy's antarctic air operations aroused much interest among the group. At Williams Field, methods of servicing and repairing large aircraft, such as the C-130, and an air-cushioning device that supports aircraft fuselages were demonstrated by Air Development Squadron Six.

The visitors examined a variety of surface transport equipment, including the motor toboggan, which is used by geological field parties; the "Gnat," a New Zealand vehicle that transports personnel on Hut Point Peninsula; the "Trackmaster," which the group drove from the Byrd substation to Byrd; and the "Power Wagon," which is used at McMurdo to carry personnel and freight.

At McMurdo, Pole, and Byrd Stations, Drs. Gilruth and von Braun gave illustrated lectures on the Gemini and Apollo programs. About 300 scientific and support personnel attended the McMurdo lecture, which was given in the helicopter hangar.

Before leaving Antarctica, the visitors held a briefing with Rear Admiral Fred E. Bakutis, commander of the U.S. Naval Support Force, Antarctica.

Antarctic Museum a Growing Success

ROBERT F. BLAND II
Lieutenant (jg.), USNR
Air Development Squadron Six

A small but successful museum devoted entirely to Antarctica is operated by Air Development Squadron Six (VX-6) at the squadron's home station in Quonset Point, Rhode Island. Since May 1966, when renovations were completed, it has attracted over 8,000 visitors, including many groups from educational institutions.

VX-6 established the museum in 1960 to acquaint local residents with the region in which the squadron has been providing aerial logistic support for 11 years. During 1965 and 1966, the museum was completely remodeled. Volunteers from the squadron, assisted by Seabees from nearby Davisville, worked almost a year to equip the one-room gallery with new showcases, flooring, recessed lighting, wall panelling, and a light box for displaying color transparencies.

The museum's displays describe the antarctic history of the squadron and the activities and progress of the U.S. Antarctic Research Program. The antarctic aviation exhibit includes models of the squadron's LC-130F Hercules and C-121J Super Constellation and of the Ford Tri-Motor in which Admiral Richard E. Byrd flew over the South Pole. Also on display is an album of photographs from Admiral Byrd's 1939 expedition to the Antarctic aboard the *Bear*.

Geological research in Antarctica is represented by a collection of rocks from various parts of the continent. This collection was recently classified by a geologist who has worked in Antarctica, Dr. Wakefield Dort, Jr., of the University of Kansas.

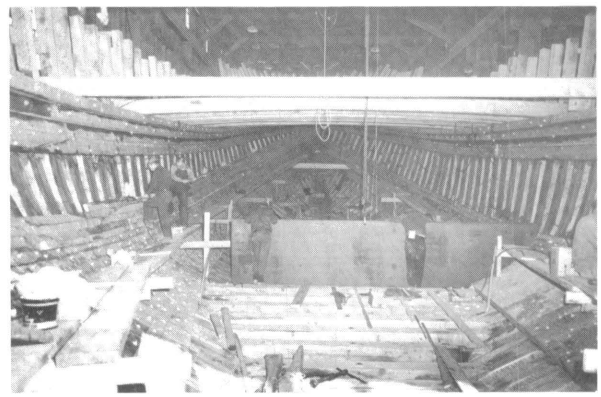
Biological exhibits include stuffed specimens of the Adélie and emperor penguins and a mummified seal found in Taylor Valley, one of the snow-free valleys near McMurdo Station. Marine life from the Ross Sea is displayed in settings that depict the natural environment. One of the museum's highlights is a small display, donated by New Zealand's Scott Base, of tinned foods cached by Captain Robert Scott's party during its tragic traverse to the South Pole in 1911. The starker side of Antarctica is also portrayed by a mannequin dressed in cold-weather clothing and by a survival tent like those constantly carried by the squadron's aircraft.

In January, the displays were flown to St. Paul, Minnesota, to be exhibited during the city's annual winter carnival. Because of the museum's success, its present curator, Lt. Comdr. Frederick A. Prehn, plans to double its size by adding another room which will be constructed in the style of a Jamesway hut. Besides accommodating many more displays, the proposed addition will serve as a lecture hall and theater for slide shows.

[*Requests for tours and other correspondence concerning the museum should be addressed to Historical Officer, Antarctic Museum, Air Development Squadron Six, U.S. Naval Air Station, Quonset Point, Rhode Island 02819.*]

Antarctic Trawler Progress Report

Construction of the National Science Foundation's antarctic research trawler (cf. *Antarctic Journal,* Vol. I, No. 5), whose keel was laid early in October 1966, was about 15-20 percent complete on March 15. As seen in the photo, most of the framing and deck beams had been fastened in place, the beams forming the engine bed (in foreground) had been bolted down, and work was progressing on the interior sheathing, exterior planking, and installation of a watertight bulkhead. The trawler is scheduled to be made available to NSF late in January 1968. She will accommodate a permanent scientific party of 6 persons plus a temporary party of 10 persons.



(U.S. Maritime Administration photo)

Aft view of interior of antarctic trawler.

Antarctic Chronology

December 1, 1966—January 31, 1967

Time in Greenwich Mean Time

December

1—USCGC *Westwind* departed Davisville, R. I., for Palmer Station, via Punta Arenas, with 96 measurement tons of construction material.

3—University of Massachusetts geological party transferred from Olympus Range to Mount Fleming.
University of Wisconsin geophysical party aboard an LC-117D returned to Byrd Station from the coast of Byrd Land.

6—British Antarctic Survey aircraft landed near Palmer Station on Anvers Island.

Additions to "Antarctic Chronology," *Antarctic Journal,* Vol. II, No. 1. The following events are to be included on page 25:

September 14—SS *Australian Gem* arrived Port Lyttelton.

15—SS *African Grove* departed Davisville for Port Lyttelton with 337 and 453 measurement tons of cargo for McMurdo and Christchurch, respectively.

October 16—SS *African Grove* arrived Port Lyttelton.

McMurdo Station sewer system and outfall completed and operational.
The Honorable Edward Clark, U. S. Ambassador to Australia, arrived at McMurdo for a visit.

7—USNS *Alatna* departed Port Lyttelton at 0754 for McMurdo.
James B. Pranke relieved Robert B. Flint, Jr., as Station Scientific Leader of Pole Station.
American Antarctic Mountaineering Expedition placed near Vinson Massif.

8—USCGC *Staten Island* departed Port Lyttleton at 1315 for McMurdo.
USS *Mills* departed Dunedin at 2116 for ocean station.

9—USCGC *Eastwind* departed McMurdo channel at 1200 to meet and escort USNS *Alatna* to McMurdo, and activated TU 43.2.2 at 2200.
HMNZS *Endeavour* departed Port Lyttelton at 2000 for McMurdo.

10—Ohio State University glaciological party airlifted to Meserve Glacier.
Ambassador Clark departed McMurdo for New Zealand.

11—USS *Mills* relieved USS *Thomas J. Gary* on ocean station.

12—RRS *John Biscoe* called at Palmer Station.
LC-130F departed McMurdo at 0001 for Vostok Station, arrived at 0302; departed for McMurdo at 0455, arrived at 0737.
USCGC *Glacier* arrived Winter Quarters Bay.

15—USS *Thomas J. Gary* arrived Dunedin via Port Lyttelton.
USCGC *Staten Island* met HMNZS *Endeavour* at 1155 to escort her to McMurdo.
USCGCs *Glacier* and *Eastwind* met USNS *Alatna* at 2300 to escort her to McMurdo.

17—USNS *Alatna* arrived McMurdo.
American Antarctic Mountaineering Expedition reached summit of Vinson Massif.

19—USNS *Alatna* departed McMurdo for Port Lyttelton.

20—USNS *Eltanin* arrived Wellington, terminus of Cruise 26.

21—Replacement Army UH-1D assembled and ready for flight.
HMNZS *Endeavour* arrived McMurdo at 0500.

22—HMNZS *Endeavour* departed McMurdo for Dunedin at 1400; escort and tow provided by USCGC *Glacier* (departing for Port Lyttelton) and USCGC *Staten Island*.
VX-6 Warehouse No. 1 completed and accepted by CASA.

23—First parachute descent at the South Pole by a Navyman made by AEM2C Henry B. Thomann, Jr., of VX-6.
Rossman W. Smith, Jr., new Station Scientific Leader, arrived at Byrd Station.
National Center for Atmospheric Research trace-gas study completed and party departed Antarctica.

24—USCGC *Staten Island* returned to McMurdo from escorting HMNZS *Endeavour*.
USNS *Pvt. John R. Towle* arrived Port Lyttelton and reported to control of CTF-43 at 1900.
Lt. E. M. Cranton, MC, USN, relieved Lt. J. L. Archambault, MC, USNR, as Byrd Station physician.

25—University of Massachusetts geological research project in Victoria Land completed.
Ohio State University glaciological party returned from Meserve Glacier.
Texas Technological College and University of South Dakota biological parties returned from Cape Royds.

26—USNS *Pvt. John R. Towle* departed Port Lyttelton at 0430 for McMurdo.
USCGC *Glacier* released HMNZS *Endeavour* from tow at 1230.
The University of California, Wichita State University, and the U.S. Geological Survey parties airlifted to Polarstar Formation.
New Mexico State University satellite tracking operations at McMurdo Station ceased at 1900 and preparations began for closing down the facility until October 1967.

27—*Project Santop* C-121J made final flight over Palmer Land, accomplishing 1,022 miles of photographic flight lines.
Captain George A. Wright, CHC, USN, Fleet Chaplain, CINCLANTFLT, departed McMurdo after 12-day visit to Antarctica.

28—USNS *Alatna* diverted to Dunedin for survey and repair of hull damage; arrived at 1600.
C-121J departed Punta Arenas at 1652 for McMurdo; arrived on the 29th.
LC-130F completed 1,408 miles of photographic flight lines, including all of Bryan and Eights Coasts.

29—Desalination plant started supplying fresh water to McMurdo Station.
USS *Thomas J. Gary* departed Dunedin for ocean station.
Season's first decrease (approximately 5-10 inches) in the thickness of the annual ice runway recorded.
University of Wisconsin party visited Byrd Land Camp No. 1 and Meserve Glacier.

30—USS *Mills* departed ocean station at 1500.
USNS *Eltanin* departed Wellington at 2300 on Cruise 27, with Dr. George A. Llano as USARP Representative.
USCGC *Glacier* arrived Port Lyttelton at 2124.
USNS *Wyandot* arrived Davisville.
LC-130F completed 764 miles of photographic flight lines in the Roosevelt Island area.
Site reconnaissance for Byrd Land Camp No. 2 completed. Site selected at 75°12′S. 113°50′W.

31—USCGC *Staten Island* departed McMurdo at 0045 to meet USNS *Pvt. John R. Towle*.
LC-130F completed aerial photographic coverage of Roosevelt Island with 1,239 miles of photographic flight lines.

January

1—USS *Thomas J. Gary* arrived on ocean station.
USCGC *Eastwind* departed McMurdo at 0152 for Wellington.
USNS *Pvt. John R. Towle* arrived McMurdo at 0155 escorted by USCGC *Staten Island*.
Texas Technological College and University of California biologists placed at Skelton Glacier.
LC-130F completed 891 miles of photographic flight lines in Kohler Range.

2—USS *Mills* arrived Dunedin at 2213.
USCGC *Westwind* arrived Punta Arenas at 0152.
Texas Technological College and University of California biological parties returned to McMurdo from Skelton Glacier.

3—HMNZS *Endeavour* arrived Port Chalmers, New Zealand.
Four officials of the National Aeronautics and Space Administration arrived at McMurdo Station for one-week visit.

4—USNS *Alatna* transferred from Dunedin to Port Lyttelton.

5—USCGC *Westwind* departed Punta Arenas at 1300 for Palmer Station.

6—USNS *Alatna* departed Port Lyttelton at 0448 on her second voyage of the season to McMurdo.
USNS *Wyandot* departed Davisville, R. I., for Antarctica with 4,963 measurement tons of cargo.

7—USCGC *Eastwind* arrived Wellington at 2212.
USCGC *Westwind* arrived in Arthur Harbor and reported to the control of CTF-43 at 1900.

8—USCGC *Staten Island* departed McMurdo at 0037 for Hallett Station.
RNZAF C-130H in support of *Deep Freeze* 67 arrived McMurdo from New Zealand at 0117 and departed at 0548.
Ohio State University glaciological party at Meserve Glacier resupplied.

9—USCGC *Staten Island* arrived Hallett Station at 1450.
USNS *Pvt. John R. Towle* departed McMurdo at 0830 for Port Lyttelton.

10—USCGC *Staten Island* departed Hallett Station at 0510 for McMurdo.
Second RNZAF C-130H flight departed Christchurch at 1815.
NASA party departed McMurdo for Christchurch.

11—Helicopters from USCGC *Eastwind* recovered the crew of the explosives ship *Tuvalu* grounded 35 miles northeast of Wellington.
RNZAF C-130H arrived McMurdo at 0040 and departed at 0355; arrived Christchurch at 1145 to conclude RNZAF participation in *Deep Freeze* 67.

13—USNS *Alatna* arrived Winter Quarters Bay at 2200.
USCGC *Staten Island* arrived McMurdo.

14—USCGC *Glacier* departed Port Lyttelton at 0358 for Hallett Station.

15—USNS *Alatna* departed McMurdo Station at 0902 for Port Lyttelton.
USNS *Pvt. John R. Towle* arrived Port Lyttelton at 1815.

16—USS *Mills* departed Dunedin for ocean station.
USCGC *Staten Island* departed McMurdo at 0345 for Hallett Station.
Desalination plant started using nuclear-generated power.

17—American Antarctic Mountaineering Expedition returned to McMurdo from Sentinel Range.
Polarstar party (University of California, Wichita State University, and U. S. Geological Survey) returned to McMurdo.

18—USS *Thomas J. Gary* departed ocean station at 1200.
USCGC *Staten Island* arrived Hallett Station at 1500 and departed at 1550 for Wellington.
American Antarctic Mountaineering Expedition departed McMurdo for Christchurch.
Tourists from the Argentine cruise vessel *Lapataia* visited Palmer Station.

19—USCGC *Glacier* arrived Hallett Station at 2300.
USS *Mills* arrived on ocean station at 0830.

20—USCGC *Glacier* departed Hallett at 0949 for McMurdo.

21—USCGC *Glacier* arrived McMurdo at 1500 and departed at 1545 for Hallett Station via Coulman Island.

22—USNS *Alatna* arrived Port Lyttelton at 1900.
USNS *Eltanin* arrived McMurdo at 0100.
UH-13P (BUNO 143135) of HC-1 Det. 55, operating off USCGC *Glacier,* crashed at 1540 on glacier tongue near 73°21′S. 169°03′E. Pilot, Lt. Comdr. Callison, USNR, and passenger Sterling uninjured; helicopter abandoned.

23—USNS *Eltanin* departed McMurdo at 0125.
USS *Thomas J. Gary* arrived Dunedin at 2150.
USCGC *Glacier* arrived Hallett Station at 0350 and departed at 0636 for McMurdo.

24—USNS *Alatna* departed Port Lyttelton on her third voyage of the season to McMurdo.
USCGC *Eastwind* departed Wellington at 2150 on Weddell Sea reconnaissance.
USCGC *Glacier* arrived McMurdo at 1919.

25—USCGC *Staten Island* arrived Wellington.

26—USCGC *Glacier* departed McMurdo at 0359 on bathymetric program.
Prevailing-wind runway on the annual ice closed because of ice deterioration; all material removed without incident.
Lt. E. M. Cranton, MC, USN, relieved Lt. J. K. Williams, CEC, USN, as Officer-in-Charge of Byrd Station.
Backloading of Byrd Land Camp No. 1 to McMurdo completed.
Virginia Polytechnic Institute and Johns Hopkins University biological parties placed at Cape Crozier.

27—Deep-core drill installed at Byrd Station.
USCGC *Eastwind* diverted to aid of *Nella Dan* and *Thala Dan.*

28—USNS *Wyandot* arrived Palmer Station.

29—USCGC *Glacier* arrived McMurdo at 0812 and departed at 2305 for Cape Hallett.

31—USCGC *Eastwind* hove to off Dumont d'Urville Station.

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